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Edited by
Andrés Tremante
Freddy Malpica
Angel Oropeza
Friedrich Welsch
J. V. Carrasqueño
Hui Fang Su

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Foreword

The relationship between education/training and Information and Communication Technologies (ICT) is intensifying quickly and appears sometimes in unexpected forms, and in combination with original ideas, innovative tools, methodologies and synergies. Accordingly, the primary purpose of the 5th International Conference on Education and Information Systems, Technologies and Applications: EISTA 2007 has been to bring researchers and practitioners from both areas together to support the emerging bridge between education/training and ICT communities.

The 3rd International Conference on Social and Organizational Informatics and Cybernetics: SOIC 2007 and The 5th International Conference on Politics and Information Systems, Technologies and Applications: PISTA 2007 have been organized and collocated with EISTA 2007 and the proceedings of the three conferences have been collected in the same volumes under the general title of Society, Cybernetics and Informatics because significant relationships were found among the three of them.

In the context of EISTA 2007, practitioners and consultants were invited to present case studies and innovative solutions. Corporations were invited to present education/training information systems and software-based solutions. Teachers and professors were invited to present case studies, specifically developed information systems and innovative ideas and designs. Educational scientists and technologists were invited to present research or position papers on the impact and the future possibilities of ICT in educational systems, training processes and methodologies. Managers of educational organizations and training consultants were invited to present problems that might be solved by ICT or solutions that might be improved by different approaches and designs in ICT.

EISTA 2007 provides a forum for the presentation of solutions and problems in the application of ICT in the fields of education/ training. Authors of the proceeding's papers provided varied answers to the following questions:

- What is the impact of ICT in education and training?
- How are ICTs effecting and improving education and training? What networks and models are emerging?
- How are universities, schools, corporations and other educational/training organizations making use of ICT?
- What electronic tools are there to facilitate e-learning, distance education and co-operative training?

In the context of PISTA 2007 / SOIC 2007, Information and Communication Technologies (ICT) are transforming our societies and our governments at a remarkable speed.

Government departments are seeing the importance of delivering services electronically. Political parties have begun using ICT in their processes. Yet despite this increased need, we find, as John Harvey-Jones calls it, a Dialogue of the Deaf between politicians and the ICT community. Politicians need to understand the potential role of the Internet in politics and the ICT community needs a better understanding of politics if this Dialogue of the Deaf is to be transformed into a mutually comprehensive dialogue and a synergic relationship. The purpose of The International Conference on Politics and Information systems, Technologies and Applications: PISTA 2007 is to contribute to this emerging dialogue and aid in bridging the gap between the two communities.

In order to contribute to the creation of relationships between ICT and Sociopolitical communities, ICT researchers and professionals were invited to present their experience and research as it pertains to the application of ICT in politics, governmental action and political science. Practitioners and consultants were invited to present case studies and innovative solutions. Corporations were invited to present political information systems and software-based solutions for political issues. Public servants were invited to present case studies requiring technology; information systems, innovative ideas and designs that were developed with political purposes in mind. Political and social scientists were invited to present research or position papers on the impact and the future possibilities of ICT in social systems and political processes. Politicians and political consultants were invited to present problems that might be solved by means of ICT or solutions that might be improved by different approaches and design in ICT.

The main objective of PISTA 2007 has been to provide a forum for the presentation of both the solutions and problems of ICT applications in politics and society. The following questions need answers from a variety of different perspectives:

How do ICTs impact society?

How are ICTs affecting democracy and the potential to make joint and collective decisions in government?

What networks and models are emerging to provide support for political decision systems?

How are political parties, governments and campaign groups using IT systems and electronic communications in particular?

What electronic tools already exist to facilitate democratic discussions and decision-making?

What ethical and legal issues will be a part of the social transformation produced by the ICTs?

Approximately 233 papers and abstracts were submitted to EISTA 2007. These pre-conference proceedings include about 120 papers that were accepted for presentation. Invited sessions organizers accepted about 11 papers from the papers/abstracts submitted directly to them by the respective authors. We extend our thanks to the invited sessions' organizers for collecting, reviewing and selecting the papers that will be presented in their respective sessions.

Approximately 101 papers and extended abstracts were submitted to PISTA 2007 / SOIC 2007 (57 to PISTA and 44 to SOIC). These pre-conference proceedings include about 35 papers that were accepted for presentation. Invited sessions organizers accepted about 15 papers from the papers/abstracts submitted directly to them by the respective authors. We extend our thanks to the invited sessions' organizers for collecting, reviewing and selecting the papers that will be presented in their respective sessions.

A total of approximately 334 submissions were made to 2nd International conference of Society, Cybernetics and Informatics (Which include the three conferences mentioned above), from about 80 countries. We extend our gratefulness to the authors who submitted these papers/abstracts for their support.

The submissions were reviewed as carefully as time permitted, but they were not formally refereed (at the level of a journal reviewing), it is expected that most of them will appear in a more polished and complete form in scientific journals.

On behalf of the Organizing Committees, we extend our heartfelt thanks to the 143 members of the Program Committees, from 42 countries; the 249 additional reviewers, from 62 countries, and the 293 scholars and researchers who made the non-blind reviews, from 45 countries, for their reviewing efforts which made possible the quality achieved in EISTA 2007, PISTA 2007 and SOIC 2007.

We also would like to thank Professor Freddy Malpica for distinguishing this conference by accepting the position of EISTA 2007's General Chair and for accepting the position of Honorary President of PISTA 2007, to Professor Friedrich Welsch for serving as its Program Chair. We also extend our gratitude to Professor Belkis Sanchez, for her relentless support of the organizing process and to Maria Sanchez for her hard work in creating the hard copy version of the proceedings. We extend our thanks to Juan Manuel Pineda, Sheyla Lecue, Juan Pinto, Michel Naranjo, Miguel Bustamante, Danny Da Silva, and Heriberto Díaz for the support they provided for the conference Web site and for developing the CD containing the conference proceedings. We would also like to thank the support staff and the secretariat that helped in the troubleshooting activities.

Professor Andrés Tremante
EISTA 2007 Organizing committee Chair

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EXPLORING THE NANOWORLD:

Development of an Online Course to Introduce Nanotechnology to High School Students Through Diversified EducationalResources

By: Marc Dudas
Teacher at the High School at Donna Klein Jewish Academy
Science Department
Boca Raton, Florida 33428

Co-Author:
Dr. Tsung-chow (Joe) Su
Professor Mechanical Engineering Department
Florida Atlantic University
Boca Raton, Florida 33431

Abstract:

Nanotechnology stems from the fundamental principles, on the molecular level, of biology, chemistry and physics; the fundamental sciences taught to high school students across the nation. Through the use of differentiated and cooperative learning across cyberspace, it is the goal to develop an online high school course focused on teaching the fundamental principles of nanotechnology to future scientists, engineers and entrepreneurs. As the educators involved are from many disciplines of science, this program emphasizes utilizing their expertise and experience with regard to specific subject matters. This course aims to create and promote investigative learning across cyberspace, while developing new partnerships amongst schools both local and distant. Utilizing current educational technology, both hardware and software, allows for easy implementation along with rapid initiation and growth. Examples of technology include Smart Boards® and webcams for video conferencing. Demonstrations and interactive materials currently available online from as the University of Wisconsin's Interdisciplinary Education Group, for example, provide the backbone for online facilitated learning. As designed for high school students with strong understanding of fundamentals in chemistry, biology, and physics, this course aims primarily at juniors and seniors. Students will focus not only on understanding the concepts and relationships, but move towards application and product design whereby principles of nanotechnology are implemented, thus preparing for future scientific and engineering endeavors. Furthermore, educators from both neighboring and distant schools will collaborate and focus their expertise and experiences, so as to increase the effectiveness of teaching the students. Student directed learning will also be promoted through the afore mentioned application and design portion of the class. Since most of the tools and resources are based online, costs of implementing this program are minimal. As is in the case of Florida Atlantic University's success of their Explore Nanotechnology course, which is designed for high school students, this program seeks to expand upon this example and deliver similar success on a larger scale.

Introduction:

It has been almost half a century since Dr. Richard Feynman ignited the scientific community in his historic lecture "There's Plenty of Room at the Bottom." This revolutionary vision was so large that it was almost impossibly too big to imagine a world on a scale smaller than the head of a pin. Today, Dr. Feynman's legacy of nanotechnology represents a critical paradigm shift such that many, not only those in the scientific community, but those outside it, refer to nanotechnology as the Second Industrial Revolution. As was the case of the Industrial Revolution in the eighteenth and nineteenth centuries, nanotechnology today is uniting the scientific community in a noncompetitive manner. Contrary to a Darwinian model for scientific advancement, members of the scientific community are creating a mutually symbiotic relationship with members of the global community. As researchers, investors, and politicians collaborate across the globe with an open-door policy; advancements in fields of medicine, computers, botany, and structural engineering to name a few; no longer will they require immense time prior to application and implementation. As this paradigm shift continues, knowledge, experience, and development will continue to grow exponentially. Consequently, our students today find themselves in a unique and dynamic environment. Therefore, it is our duty as educators to prepare and provide students with the fundamental knowledge and tools at the core of nanotechnology.

Course Development:

Today the world is at one's fingertips. In order to ensure the success in developing this course, it is essential to utilize the most current resource materials. With new developments occurring rapidly, the Internet replaces the tradition of textbook learning. Although many texts are available, the dynamic nature of nanotechnology demands alternative resources. Several high schools across the country aware of the need to educate students in nanotechnology began teaching their own constructed courses.

Unlike traditional subject matters such as mathematics, history, and literature, these subjects have seen less change compared to nanotechnology. The consistency of such classes aids those teachers in obtaining high levels of respective mastery. Unfortunately, the exponential growth in nanotechnology challenges not only the students, but teachers alike to remain informed on current developments. As new discoveries and laws of the nanoworld are tested and observed, exceptions to macroworld laws arise, creating an interesting paradox.

In order to resolve such a paradox it is essential to provide the necessary tools through collaboration on a macroscale, thus ensuring success in educating students in the nanoscale. As part of the development of this course, an online resource website will be provide educators a blog forum to collaborate and discuss developing material. Furthermore, such a site allows for easy access to literature, laboratory materials, activities, collegiate courses, and virtual media that are fundamental to the success of this course in the twenty-first century classroom experience.

The following are several key online resources to be incorporated in this course's development, all of which contain links to further online resources.

Web Address	Material and Significance
http://mrsec.wisc.edu/Edetc/IPSE/educators/	Professional development, communication, lesson plans

http://www.thenanotechnologygroup.org/index.cfm?content=75&Menu=27	Global educational resource for students and educators, including literature, products, and events
http://www.mrsec.wisc.edu/Edetc/index.html	Multimedia resources and virtual labs
http://www.nanoscience.com/education/index.html	Nanoscience education
http://thenanotechnologygroup.org/docs/Teaching%20Nanotechnology%20in%20the%20High%20School%20Curriculum.pdf	Example high school curriculum
http://www.mrsec.wisc.edu/Edetc/LEGO/PDFfiles/nanobook.PDF	LEGO® resources for hands on instruction
http://www.nano.gov/html/edu/home_edu.html	National Nanotechnology Initiative; material for educators, researchers, and news events

The above resources represent a miniscule fraction of resource material available. The directory of resources will include but is not limited to current research developments, fundamental principles, virtual labs to demonstrate said principles, educational instructional materials, current high school courses, and links to government and private corporations. Again, collaboration amongst educators will continually enhance, refine, and provide new resource material in the development of this course.

In addition to the resource material online, students and educators today can collaborate beyond the classroom through the use of video chat conferencing and podcasts. These tools allow teachers and school the ability of utilizing faculty from multiple disciplines so as to increase the effective instruction for students. With the diversity of nanotechnology spanning across many disciplines, the design of the course is topic based. Unlike classes such as mathematics where there is a consistent building upon previous material, this course will focus on several small units independent of each other, while connected by the theme of nanotechnology. Examples of some units are light emitting diodes (LED), smart materials including shape memory alloys, carbon nanotubes, and microfluidics.

The diversity of faculty participants brings a dynamic element to students not seen before, thus allowing students to expand their educational growth and experience. Similar to guest speakers, Exploring the Nanoworld provides the communication database for educators to seek out colleagues experienced in specific subject matters and bring their expertise into the classroom. In universities across the globe, each professor has a level of expertise, which lends to specific research and in-depth course offerings. Today with the technology, we can now bring this level of organization to the high school level. Educational institutions mostly on the collegiate level and some on the high school level readily make available recorded class sessions and live courses to allow for easy access to essential materials. Examples of this can be seen with the recently created iTunes U from Apple Inc. Interaction is essential to promoting active learning. Smart Board®, which many schools are familiar using, allow for greater interaction between students and faculty. Although not essential to the program, schools and teachers familiar with this resource already see the benefits of this technology.

Collectively utilizing the technology and resources at hand, not only are students actively participating in a dynamic science environment; they are additionally gaining critical skills for future endeavors. Independent of career choice, teamwork is a staple of occupational responsibility. Albeit a lawyer, engineer or teacher later in life, students must continually refine their teamwork skills to ensure desired outcomes. As such, pulling together the tools of the program, not only will active learning and research be for educators, but also students will focus on active and cooperative investigative learning. Nanotechnology does require previous scientific understanding and as such this course aims at juniors and seniors who have completed high school chemistry and biology. Participating students will now draw upon their previous knowledge to focus their class participation and investigation on moving from concept to application of nanotechnology principles discussed in each previously noted small unit.

As cost is an ever-increasing concern amongst schools, the benefit of this program is in its design and implementation exists in cyberspace. Because the tools are currently available, there is a minimal cost to implement this course, while subsequently providing an effective ease of implementation.

Previous Work:

In the fall of 2003, Dr. Tsung-chow (Joe) Su, a professor of mechanical engineering at Florida Atlantic University, offered the first nanotechnology elective aimed to introduce engineering students to Dr. Feynman 's "World at the Bottom." The elective provided the foundation for future coursework development. Subsequently in a proposal to the National Science Foundation, Dr. Su sought to expand upon the success of this course so as to offer further nanotechnology education at the graduate and undergraduate levels.

Following the success of this course, Dr. Su has offered a course entitled Discoveries in Engineering to high school students in the local community in Boca Raton, Florida. Incorporating the online materials previously mentioned, Dr. Su emphasizes teamwork through student directed investigative learning, where students learn to move from concept of principles to applications in industries such as medicine, automotive, robotics, and electronics. The ease of implementation and success of this course lend support towards the development of exploring the Nanoworld cyber course discussed above.

Conclusion:

Stemming from current developments in the global scientific community, it is evident from the dynamic environment caused by nanotechnology that students are in need of education to effectively prepare them for their nano-future. By creating a collaborative virtual course, greater numbers of students can be involved while actively participating in this second Industrial Revolution. Drawing on expertise of faculty around the country and the world, schools can develop partnerships, promoting teamwork and communication that are essential skills for high school graduates. Additionally, by initiating programs such as this now during the early stages of the nanotechnology evolution, the benefits of educating students today will ensure the continual progression and beneficial development already seen today.

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Use Mathematics and Computer to Predict Boat's Drift for Search and Rescue

Jim Han, Ph.D., Dept. of Computer Engineering & Computer Science
Florida Atlantic University, Boca Raton, FL 33431

Hui Fang Huang Su, Ed.D. Graduate Teacher Education Program
Nova Southeastern University, 1750 NE 167th St. North Miami Beach, FL 33162

Tsung-Chow Joe Su, Eng.Sc.D. P.E., Dept. of Mechanical Engineering
Florida Atlantic University, Boca Raton, FL 33431

ABSTRACT

Finding a boat in wind and current is an age old problem that puzzled many people throughout history. It is only until recently a simple theory is developed to allow efficient and accurate prediction of the boat's drift trajectory. Such theory could be developed using simple physics and algebra. In this paper, we will describe the derivation of the theory that would give the boat's trajectory in terms of different types of boat condition under given wind field and current field. We will show that the relationship is versatile, and could be used for practical application. We will further implement the results in computer animation setting so that the results can be obtained easily for a given application. The paper demonstrates the power of mathematics and technology to solve problem of boat drift of search and rescue.

Keywords: Boat Drift, Daft Drift, Vessel Searching, Modeling, and Computer Simulation.

1. BOAT DRIFT AND VESSEL SEARCHING

Search and rescue of persons and vessels in distress on the high seas requires the capability to accurately predict the position of the survivors. The vital importance of search and rescue calls for continuing effort to improve this capability to the extent developing technologies will support. The current approaches on drift prediction are based on an empirical correlation between wind speed and life raft motion from limited field data. These results are not sufficient for accurate prediction, and thus have limited applications.

The sea surface is a complex and dynamic environment. Many factors affect the drift of life rafts and disabled boats so that successful search-and-rescue missions depend on human intelligence, on the intuition and insight gained from many years at sea, and on the engineering tools developed for that task. With the interest in providing better data for the computation of drift in search planning, numerous efforts have been made to determine the effects of the surface current on a drifting object [1][2][3] and the effect of the wind on a drifting object[4]-[11]. Leeway is defined as the movement of an object through the water caused by wind acting on the object. Previous studies on leeway prediction were reviewed in the reports by Hufford and Broda[6] and Nash and Willcox[11].

While extensive field tests were conducted over decades to obtain these empirical relationships between leeway and wind speed, these relationships were found to be of limited validity and applications. Several questions still remain. As was pointed out by Osmer, Edwards and Breitler[10], these problems associated with leeway prediction are:

1. each type of craft displays different leeway characteristics;
2. a complex relationship exists between leeway motion and wind speed for wind speeds less than 5 knots;
3. the adequacy of the present leeway factors of 0.03 to 0.07 remains unknown; and
4. the leeway angle is difficult to predict.

The vital importance of search and rescue calls for continuing efforts to improve these tools to the extent developing technologies will support. With recent progress in oceanography, meteorology and environmental monitoring, as well as computers simulation and animation we will be able to integrate those technologies to provide a real time system to forecast the position of an object drifting at sea.

In this paper we present a mathematical model which models small boat/raft drift for a given environmental condition. The essential effects of environmental forces, vehicle characteristics, and load conditions were properly accounted for through analysis rather than through correlation. The study is intended to provide a theoretical framework and better understanding of the dynamics of drift and will thus lead to a reliable model of drift prediction and improved efficiency in search and rescue missions.

2. PRELIMINARY ANALYSIS

Simplified Formulation

A preliminary analysis was presented which confirmed the validity of linear leeway formula in high wind applications, while pointing out the constant term in the leeway formula was dependent on the current speed. This explained the limited applicability of the leeway formula in its present form. For the general wind speed case, a suitable formula was derived. Wave effect was examined and found to be of significance in some cases. We present a model of steady drift with boats drifting in a linear translation mode in this paper. A model for general drift problem will be discussed in following up papers.

Elementary Leeway Formulas

There is nothing more practical than a simple theory. The intention here is to derive one as such. Forces exerted on a solid body when fluid flows by it or when it moves through a fluid are termed the drag and the lift, depending on whether the force is parallel to the motion or at right angles to it. The general expression of the drag force D is

$$D = \frac{1}{2} C \rho A V^2 \tag{1}$$

in which C is the shape dependent drag coefficient ρ is the density of fluid (air or water), A is a frontal area and V is the velocity of fluid over the object. The boat is subjected to both wind and current action. The two actions balance out, and the net force on the boat is zero: the boat is drifting at a constant velocity, V_b. We shall use the subscript "1" for the quantity above the waterline and "2" for the quantity beneath the waterline. The wind velocity is V_1, the current velocity is V_2, the air density ρ_1, water density ρ_2, etc. The equation of motion is:

$$\frac{1}{2} C_1 \rho_1 A_1 (V_1 - V_b)^2 = \frac{1}{2} C_2 \rho_2 A_2 (V_b - V_2)^2 \tag{2}$$

Let

$$(C_1 \rho_1 A_1)/(C_2 \rho_2 A_2) = \lambda^2$$

Then,

$$\lambda^2 (V_1 - V_b)^2 = (V_b - V_2)^2 \tag{3}$$

Take the square root on both sides, we obtain

$$\lambda (V_1 - V_b) = V_b - V_2 \tag{4}$$

We could then obtain

$$V_b = \frac{1}{1+\lambda} V_2 + \frac{\lambda}{1+\lambda} V_1 \tag{5}$$

Therefore, given the wind speed V_1 and the constant λ (which involves air-water density ratio and ship geometry), the velocity of the boat can be obtained.

Using additional physics, namely Bernoulli's Principle, one could show that the boat will turn its broadside into the wind; therefore the velocities cited here are vector quantities.

$$\vec{V_b} = \frac{1}{1+\lambda} \vec{V_2} + \frac{\lambda}{1+\lambda} \vec{V_1}$$

The leeway is defined as the movement of an object through the water caused by wind acting on the object. The leeway speed V_L can be obtained by subtracting current speed from the drift velocity, i.e.

$$\begin{aligned} V_L &= V_b - V_2 \\ &= \left(\frac{\lambda}{1+\lambda}\right) V_1 - \left(\frac{\lambda}{1+\lambda}\right) V_2 = \left(\frac{\lambda}{1+\lambda}\right)(V_1 - V_2) \end{aligned} \tag{6}$$

3. SOLUTION SIGNIFICANCE

We note the following:

1. The expression is in agreement with the important finding of Chapline[5] that the leeway speed of the small craft without a drogue is directly proportional to the wind velocity (at least for moderate to fresh winds). For a boat of 8 ft. or larger, with a wind speed of 5 knots (8.44 ft/s) or higher, the standard atmosphere air kinematical viscosity of 1.57×10^{-4} ft^2/s leads to the Reynolds No. $N_{R1} > 4.3 \times 10^5$. The corresponding N_{R2} is expected to remain of the same order of magnitude. This is because while current speed is typically one order of magnitude smaller than the wind speed, the water's kinematical viscosity is also one order of magnitude smaller than that of air. Thus the applicability of equation (6) for small craft drift for wind speed of 5 knots or above is justified.
2. The leeway factor "a_1", in the typical leeway formula of $V_L = a_0 + a_1 V_1$ can be understood as

   $$a_1 = \frac{\lambda}{1+\lambda} \quad \text{with} \quad \lambda = \sqrt{\frac{C_1 \rho_1 A_1}{C_2 \rho_2 A_2}}$$

   In which $C_1 \cong C_2$ as $N_{R1} \cong N_{R2}$ and the dependence of C to N_R is weak. Therefore:

   $$a_1 \cong \lambda \cong \sqrt{\frac{\rho_1 A_1}{\rho_2 A_2}} \cong 0.035 \sqrt{\frac{A_1}{A_2}} \tag{7}$$

   This may account for the variation of the present leeway factor from 0.03 to 0.07 for various types of search targets.

3. Furthermore, in light of this simple derivation, the constant term "a_0" in the typical field data fitted leeway formula, is related to the current speed as

$$a_0 = -\frac{\lambda}{1+\lambda}V_2 = -a_1 V_2$$

From the leeway formula in SAR manual, a reasonable V_2 value ranging from -0.3 to 2.4 knots can be inferred. It is obvious that these field data fitted formula will be of limited applicability as they will be suitable only to those areas where the current field is the same as the site of field test through which the leeway formula was derived in the first place. Nash and Willcox[13] suggested that the apparent wind $(V_1\text{-}V_2)$ be used in the leeway formula. This is in consistence with the above observation.

4. There are circumstances where N_{R1} and/or N_{R2} are not large enough to justify full turbulence behavior of constants C_1 and C_2. This may happen if the wind is of 5 knots or less. For a more general treatment, the following functional dependence may be assumed

$$C_1 = C_1^{'}\left|V_1 - V_b\right|^{-n_1}$$

with a similar expression for C_2. For full turbulent conditions $n_1 = 0$, for the case of laminar boundary layer flow, $n_1 = 1/2$ and as $N_R << 1, n_1 \to 1$ [15]. Consider again the steady drift with co-flowing wind and current. The force balance leads to

$$\frac{1}{2}\lambda_1^{'2}(V_1 - V_b)^{2-n_1} = \frac{1}{2}\lambda_2^{'2}(V_2 - V_b)^{2-n_2}$$

or

$$\lambda^{'}(V_1 - V_b)^{1+n^{'}} = V_b - V_2 \qquad (8)$$

In which

$\lambda_1^{'2} = \rho_1 A_1 C_1^{'}$ and $\lambda_2^{'2} = \rho_2 A_2 C_2^{'}$.

While

$$\lambda^{'} = \left(\frac{\lambda_1^{'}}{\lambda_2^{'}}\right)^{\frac{2}{2-n_2}} \text{ and } n^{'} = \frac{n_2 - n_1}{2 - n_2} \qquad (9)$$

Following the usual definition of leeway, letting $V_b = V_2 + V_L$, equation (8) can then be written as

$$V_L = \lambda^{'}[V_1 - (V_2 + V_L)]^{1-n^{'}} \qquad (10)$$

AS the wind speed is typically much larger than the ship drift (V_2+V_L) the following expansion is valid

$$V_L = \lambda^{'} V_1^{1+n^{'}}\left[1 - \frac{V_2 + V_L}{V_1}\right]^{1+n^{'}}$$
$$\cong \lambda^{'} V_1^{1+n^{'}}\left[1 - (1+n^{'})\frac{V_2 + V_L}{V_1}\right]$$

Therefore

$$V_L = \left[\frac{\lambda^{'}}{1 + \lambda^{'}(1+n^{'})V_1^{n^{'}}}\right]V_1^{1+n^{'}} - \left[\frac{\lambda^{'}(1+n^{'})V_1^{n^{'}}}{1 + \lambda^{'}(1+n^{'})V_1^{n^{'}}}\right]V_2 \qquad (11)$$

Aside from the transition range, N_{R1} and N_{R2} are generally of the same order, $n_1 = n_2$. Therefore $n^{'}=0$. Hence, equation (11) can be reduced to

$$V_L = \left(\frac{\lambda^{'}}{1+\lambda^{'}}\right)V_1 - \left(\frac{\lambda^{'}}{1+\lambda^{'}}\right)V_2 = \left(\frac{\lambda^{'}}{1+\lambda^{'}}\right)(V_1 - V_2) \qquad (12)$$

with $\lambda^{'}$ is defined according to (9). For complete turbulent flow or high Reynolds Number flow as typically occur in moderate to fresh wind, $n_2=0$ and as discussed before

$$\lambda^{'} = \left(\frac{\rho_1 A_1}{\rho_2 A_2}\right)^{1/2} \approx 3.5\times10^{-2}\left(\frac{A_1}{A_2}\right)^{1/2} \qquad (13)$$

For laminar flow with moderate N_R, n_2=1/2 and

$$\lambda^{'} = \left(\frac{\rho_1 A_1}{\rho_2 A_2}\right)^{2/3} \approx 1.1\times10^{-2}\left(\frac{A_1}{A_2}\right)^{2/3} \qquad (14)$$

For very low Reynolds Number flow, $n_2=1$ and

$$\lambda^{'} = \left(\frac{\rho_1 A_1}{\rho_2 A_2}\right) \approx 1.2\times10^{-3}\left(\frac{A_1}{A_2}\right) \qquad (15)$$

We note that the basic solution (6) can be generalized to deal with low wind speed case, provided that the leeway factor λ' is used instead of λ.

Wave Effect

Hufford and Broida[6] reported that small craft leeway appears to increase up to about 15% with increasing sea state. However, the relationship has not been quantitatively established. Included in this section is a simple derivation to account for the wave effect on drift and to assess its significance.

The wave drift force can be expressed by

$$F = \frac{1}{2}\rho_2 g L C_{2w} a^2 \tag{15}$$

with g representing acceleration due to gravity, a, the wave amplitude (which is one-half of the wave height) and C_{2w} denoting the wave drift coefficient in a regular wave which is a function of the frequency of the incoming waves and may reach a value of order of one in some cases. Including the wave drift force in the force balance equation (2), and assuming the wave, wind and current are along the same direction, we obtained

$$\frac{1}{2}C_1\rho_1 A_1(V_1 - V_b)^2 = \frac{1}{2}C_2\rho_2 A_2(V_b - V_2)^2 + \frac{1}{2}\rho_2 g L C_{2w} a^2 = 0 \tag{16}$$

This equation can be solved to yield

$$V = V_o - \frac{V_o - V_2}{1-\lambda} + \sqrt{\left(\frac{V_o - V_2}{1-\lambda}\right)^2 + \frac{\alpha}{1-\lambda^2}} \tag{17}$$

Where V_o is the solution of equation (16) when $a=0$, thus

$$V_o = \frac{\lambda}{1+\lambda}V_1 + \frac{1}{1+\lambda}V_2 \tag{18}$$

and

$$\alpha \cong \frac{gLC_{2w}a^2}{A_2 C_2} \tag{19}$$

For large α, wave effect is considerable as indicated in equation (17). While for small α assuming $\alpha << |V_o - V_2|$, equation (17) can be reduced to yield

$$V = V_o + \frac{1}{2}\frac{\alpha}{(1+\lambda)(V_o - V_1)}$$

So that

$$V_L = \frac{\lambda}{1+\lambda}(V_1 - V_2) + \frac{1}{2}\frac{\alpha}{\lambda(V_1 - V_2)} \tag{20}$$

For zero α equation (20) reduces to equation (6), as expected. From (20) it is obvious that the wave effect on leeway is negligible if

$$\frac{\lambda}{1+\lambda}(V_1 - V_2) + \frac{1}{2}\frac{\alpha}{\lambda(V_1 - V_2)} << 1 \tag{21}$$

i.e.

$$\frac{1}{2}\left(\frac{1+\lambda}{\lambda^2}\right)\frac{1}{(V_1 - V_2)^2}\frac{gLC_{2w}a^2}{A_2 C_2} << 1$$

Since $\lambda<<1$, $V_1>>V_2$ and $A_2 \sim L^2$, for wave drift to be neglected

$$\frac{a}{L} << \left(\frac{2C_2}{C_{2w}}\right)^{1/2}\frac{|V_1 - V_2|}{\sqrt{gL}} \tag{22}$$

This condition may not generally be satisfied. It is therefore concluded that wave drift needs to be included in the drift prediction model.

4. IMPLEMENTATION

In general, the boat will turn its broadside into the wind. The fluid dynamics explanation is as follows. As shown in Figure 1(a), a boat is exposed to wind with its broadside turned to the wind, relative current drag counteracts and an equilibrium condition results. The "S" in the figure denotes the stagnation point at which point velocity is zero and the maximum pressure occurs. The Figure 1(b) shows a small perturbation of the previous condition. The stream pattern was altered and the location of maximum pressure shifted, which tends to bring the boat back with its broadside turned into the wind again.

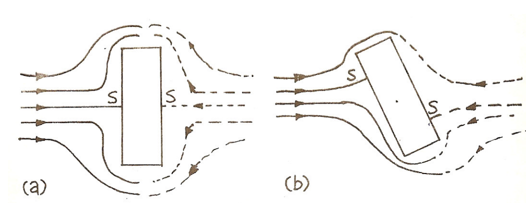

Figure 1 Flow Pattern and Fluid Forcing

Figure 2(a) shows a condition of ship with its bow facing the wind. Figure 2(b) shows that a small perturbation will have a destabilizing effect which will turn the ship further away from its original undisturbed position. Thus the boat will turn its broadside into the wind provided a steady wind prevails.

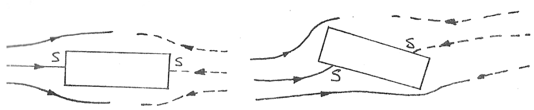

Figure 2 Flow Pattern and Fluid Forcing

With the above elucidation, the sail area A_1, and the keel plane area A_2 can be defined. With equations (12) to (15) leeway speed can be expressed in terms of wind speed and current speed.

However, in practical situations, winds and currents are neither steady, nor collinear. Current drag contains several components, such as drags from drogue, propellers, etc. Waves are irregular. These complications and other effects need to be accounted for to achieve a workable model.

A more theoretical framework of the drift prediction model will be discussed in our forthcoming paper.

A computer simulation model for this mathematical model was developed with a Java Applet. It is used to demonstrate the different variables of constant λ (which mainly reflects the ship geometry) on the drift direction.

5. SUMMARY

A simplified leeway formula was obtained which offers insight and understanding into the correct interpretation of empirical correlation formulas currently available in the National Search and Rescue Manual. A computer simulation model was developed to demonstrate this model.

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Design of an In-Home Defrosting Device by Numerical Simulation

Maria Reimann
Department of Mechanical Engineering
Florida Atlantic University
Boca Raton, FL 33431
Email: mreimann@fau.edu

***Abstract*—Anyone who has ever purchased frozen meat with the intent to keep it frozen and eventually thaw it for future use understands the time that goes into thawing the meat naturally.**

In this paper, a novel product, DefrEase, is proposed. DefrEase is a defrosting plate with a unique design that can be used to greatly decrease the amount of time it will take to defrost a flat, frozen food item, such as a steak. DefrEase is compared to similar products that are currently available for common household use.

Such factors as durability, maintainability, ease of cleaning, affordability, and manufacturability will be examined. Analyses are conducted to determine the effectiveness of the proprosed product.

***Index Terms*—Defrosting, cookware, DefrEase, heat transfer, finite deference, food safety.**

I. Introduction

This paper is based on a design problem assigned in an undergraduate heat transfer course. The problem involves the design of a defrosting plate that will be used to speed up the defrosting time of flat food items such as frozen steaks.

The performance of the design will be evaluated using the numerical technique called the finite deference method. Laws of heat conduction, convection and radiation are used, and are incorporated into the overall equation for energy conservation. From there, the design is compared to defrosting plates that are currently available on the market.

The product must theoretically perform up to high standards of common-household-use suitability. These factors include durability, cleanability, manufacturability, safety, and affordability.

The remainder of this paper is organized as follows. In Section II, a formal definition of the problem is discussed, along with the assumptions made when addressing the problem. In Section III, material analyses and product competitors are outlined and defined. Section IV outlines the solutions for the problem. In Section V, an analysis of the solution is presented, along with the results of the analysis. This paper is concluded in Section VI, with directions for future work.

II. Formal Problem Definition

The basic background theory of this problem deals with the concept that the process of defrosting flat, frozen food items can be sped up considerably for items such as steaks by placing them on a large piece of a highly conductive material known as a defrosting plate.

The increased surface area for the process that is granted by the plate enhances heat transfer, thereby reducing the overall defrosting time.

In this paper, DefrEase - an efficient device for in-home defrosting - is proposed. DefrEase is composed of copper with a stainless steel lining for the perfect combination of high thermal diffusivity and low reactivity by combining the non-reactive properties of stainless steel with the exceptional thermal properties of copper.

The parameters for this assignment are as follows:

1) The plate must perform well, it must be suitable for purchase and use as a household utensil, and it must be durable, safe to use, easy to clean, easy to manufacture, and affordable.
2) The frozen food is assumed to be at an initial temperature of -18 degrees Celsius at the beginning of the thawing process and 0 degrees Celsius at the end, with all of the ice melted.

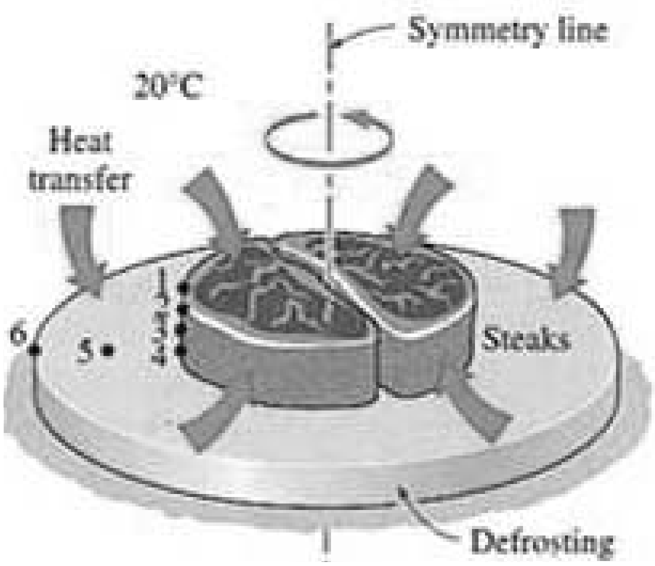

Fig. 1. Problem definition image. This is a graphical representation of the problem addressed in this paper. The dots with the numbers represent the various nodes at which measurements will be made regarding heat transfer.

3) The materials, shape, size, and thickness of the proposed plate must be specified and justified via calculations.
4) The ambient and surrounding surface temperature is set to 20 degrees Celsius, and the convection heat transfer coefficient is set to $15W/m^2 * C$ in the analysis.
5) For a typical case, the defrosting time with and without the plate are determined.

III. Product Analyses

A. Material Selection

Choosing materials was one of the more time-consuming and educational aspects of this design project. Not only did a lot of time go into learning a great deal about specific materials, such as copper, silver, aluminum, stainless steel and iron; much in the way of determining which materials were specifically capable of being used for food preparation was also involved.

There are many factors that go into the selection of a material when said material will be used in food preparation due to the issue of *reactivity* - where a food will take on the characteristics of the material used, which can result in altered flavor, or more seriously, health issues including liver failure and kidney problems.

The most effective materials as far as heat transfer properties were concerned wound up being the most reactive, so not did this project involve determining which materials would be the most effective; it also involved using a safe material. For DefrEase, a combination that incorporated the best aspects of both was designed.

Thusly, this project enables students to delve into deeper matters of engineering ethics, where our number one duty as engineers is to "hold paramount the safety, health, and welfare of the public" [7].

Now, I will include my findings as far as materials are concerned. The information listed in the following items was obtained from the following sources: [3], [4], [5], [6].

- ***SILVER***
  Although silver has the best heat conduction of any cookware material out there (thermal conductivity is 7 percent better than copper and 82 percent better than aluminum), its exceedingly high cost makes it impossible to incorporate into the average family's cookware collection. Since cost is a major factor in deciding the material to use for this project, silver will not be considered.
- ***COPPER***
  Copper is a soft (scratches easily) but durable (will last a lifetime) material that has great thermal properties. The material is prone to oxidation but with proper care, it will retain its beauty indefinitely. Pros of coppper include: 1) High thermal diffusivity, 2) with decent thickness, pans heat extremely evenly, and 3) extremely responsive. Cons of copper include: 1) Heavy, 2) can be expensive, 3) can tarnish or scratch, and 4) cooking directly on copper may result in undesirable levels of copper intake.
- ***ALUMINUM***
  Aluminum is low-cost, light-weight, and thermally responsive but reactive. Teflon-coated aluminum is low-cost and both non-stick and non-reactive. Anodized aluminum has been treated to develop an aluminum oxide (extremely hard and non-reactive) coating. Pros of aluminum include: 1) Extremely low cost if plain or Teflon-lined; moderately-priced when anodized and 2) great thermal properties. Cons of aluminum include: 1) Highly reactive to acid ingredients, 2) lower density may require thicker construction to increase heat capacity,

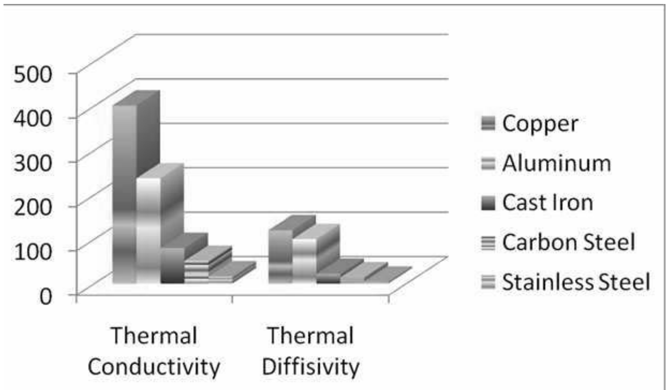

Fig. 2. A comparison of the thermal properties of the materials. Thermal conductivity is the intensive property of a material that indicates its ability to conduct heat. Thermal diffusivity is the ratio of thermal conductivity to volumetric heat capacity. Substances with high thermal diffusivity rapidly adjust their temperature to that of their surroundings, because they conduct heat quickly in comparison to their thermal 'bulk'.

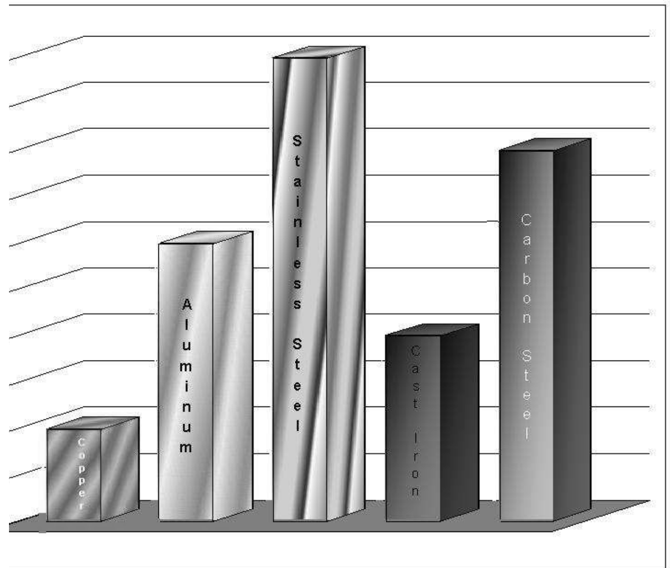

Fig. 3. A comparison of the durability levels of the materials discussed. It is clear that stainless steel is the most durable and copper is the least.

3) unless anodized (or lined/clad) may warp under high heat and scratch, and 4) very expensive if stainless steel lined or clad.

- ***STAINLESS STEEL***
  Mixing steel with chromium and nickel produces a corrosion-resistant steel called stainless steel (S.S.)that is both hard and shiny. Disks of copper or aluminum can be fused to the stainless steel cookware to enhance its thermal properties. Stainless steel can also be used to line or clad copper or aluminum utensils. Pros of S.S. include: 1) Tends to be relatively inexpensive, 2)corrosion resistant and easy to clean, and 3) when fused with thick aluminum or copper, stainless steel becomes one of the best materials to cook in (insofar as thermal properties, durability, ease of care, and visual control of cooking). Cons of S.S. include: 1) Plain stainless steel makes for a terrible cooking utensil (in terms of thermal properties).
- ***CAST IRON***
  Cast iron is composed of iron, carbon, and trace elements found in common clays. The iron is melted down and poured into a sand or clay mold to form the utensil. Pros of cast iron include: 1) Plain cast iron is low cost and 2) manufacturing process results in thick and dense cookware for great heat capacity and very even heating. Cons of cast iron include: 1) Enameled cast iron can be expensive, 2) high heat capacity means the utensil takes longer to heat up, and 3) can crack or fracture if dropped or thermally shocked (highly-heated material being placed in an ice bath, for instance).
- ***CARBON STEEL***
  Carbon steel contains less carbon than cast iron and is formed and pressed from sheets instead of being casted. It can be annealed (heating the metal until its molecular structure realigns to alleviate internal stresses and then specially cooled to preserve the new structure) to form blue/black steel; a harder and less reactive material. Carbon steel can also be enamel coated. Pros of carbon steel include: 1) All variations are usually low cost and 2) fast seasoning process for carbon steel; enameled carbon steel and blue or black steel does not need seasoning. Cons of carbon steel include: 1) Poor thermal properties; slow heat up and uneven temperature and 2) thin and light, which results in very little heat capacity.

Based on these findings, it is clear that copper fully clad by stainless steel is an optimal choice for the material selection for DefrEase. The copper layer will be quite thin, lowering the cost, and the exterior and interior will be durable and easy to maintain. Additionally, the item will have the capacity to be moderately-priced, thereby allowing

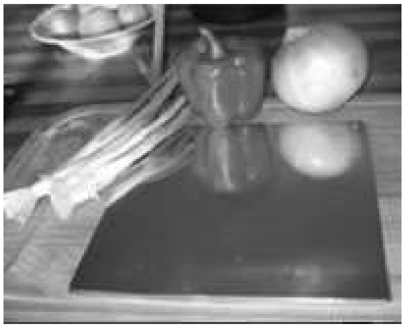

Fig. 4. Bella Copper's copper plate.

it to become a common household product.

B. Product Comparison

The main competitor for DefrEase is a product designed by a company called BellaCopper[2]. BellaCopper makes high-quality silver and copper defrosting plates. Since their silver defrosting plates are extremely high-priced, they are not eligible for comparison to DefrEase. They do not comply with the design parameter that the product must be inexpensive and available for common household use.

That being the case, it is more suitable to look at BellaCopper's copper defrosting plates. Their copper plates are extremely effective in terms of efficient defrosting and ease-of-use. They are also moderately-priced. However, the product in this comparison is composed of pure copper. This means there is the issue of high reactivity.

Since safety and health-risks must be taken into consideration, BellaCopper's lack of a non-reactive material to encase the copper implies that their product does not meet all of the necessary specifications for this design problem.

There is another aspect of BellaCopper's design that conflicts with the design parameter. Pure copper tends to scratch easily and requires a good deal of care. This violates the terms that the product must be durable and easy to maintain.

Since BellaCopper's copper defrosting plates fail to comply with the design parameters, DefrEase is the superior product. That being so, DefrEase will not be further compared to BellaCopper, and the calculations in section IVB will determine how effective DefrEase is compared to normal, unaided thawing at room temperature.

IV. Problem Solution

A. Problem Statement and Assumptions

We begin to solve this problem with a clearer statement of the problem, its assumptions, and its variable definitions. Extending upon the problem statements listed in Sections 1 and 2, the following information is detailed:

The ambient and surrounding surface temperatures are set to 20 degrees C, and the convection heat transfer coefficient is set to $15W/m^2 * C$ in this analysis.

We make the following assumptions:

1) Heat transfer in the steaks and the defrosting plate is one-dimensional since heat transfer from lateral surfaces is negligible.
2) Thermal properties, heat transfer coefficients, and the surrounding air and surface temperatures remain constant during the defrosting process.
3) Heat transfer through the bottom surface of the plate is to be neglected.
4) The thermal contact resistance between the steaks and the plate is to be neglected.
5) Evaporation from the steaks and thus evaporative cooling are to be neglected.
6) The heat storage capacity of the plate is small relative to the total heat transferred to the steaks, and thus the heat transferred to the plate can be assumed to be transferred to the steaks.

We may now continue on to the calculations, wherein DefrEase's superiority over standard, unaided thawing at room temperature is determined.

B. Calculations

We will begin with calculations involving each independent part of the problem: the steaks, the plate, and the general calculations.

- General Equations
  Δt = 5s
  Tambient = T = 20 degrees C
  δ = 0.01 m
  r4 = 0.075 m
  r5 = 0.1125 m
  r6 = 0.15 m
  r45 = (0.075+0.1125)/2 m = 0.09375 m
  r56 = (0.1125+0.15)/2 m = 0.13125 m
- Steak Equations

Definition of Variables	
Δt = time step	N = number of time steps
$T_{ambient}$ = ambient temp.	C_p = heat capacity
T_∞ = final temp.	α = thermal diffusivity
r = radius	h = convection heat transfer coefficient
ρ = density	Q = heat transfer
k = thermal conductivity	ε = emmisivity
Δx & Δr = Nodal Spacing	
$m_{steak} = \rho V$ = The total amount of heat transfer needed to defrost the steaks	
ρC_p = volumetric specific heat	
$\tau = \frac{\alpha \Delta t}{\Delta x^2}$ = Fourier Number	

Fig. 5. A table of variable definitions.

ρ = 970 kg/m3
Cp = 1.55 kJ/kg.*C
k = 1.40 W/m.*C
α = 0.93 x 10-6 m^2/s = 0.95
hif = 187 kJ/kg
ε = 0.95
ρCp = 1505.38 kW/m^3* C
Δx = 0.005 m
τsteak = 0.186
$m$steak = 0.257 kg
Qtotal = Qsensible + Qlatent = 55.2 kJ

- Plate Equations
  k = 362.5 W/m*C
  α = 87.39 x 10-6 m^2/s = 0.58
  ρCp = 4148.07 kW/m^3* C
  Δr = 0.0375 m

Now that basic equations necessary to solve this problem have been detailed, we will proceed to the remainder of the solution. This problem involves 6 unknown nodal temperatures, and thus we need to have 6 equations. Nodes 2 and 3 are interior nodes in a plain wall. For them we can use the general explicit finite deference relation, which is detailed in Fig. 6.

The finite deference equations for the other nodes are obtained from an energy balance by taking the direction of all heat transfers to be towards the node under consideration. These equations may be found in Fig. 6.

The heat transfer to the steak during a time step i is the sum of the heat transferred to the steak directly from its top surface, and indirectly through the plate. This process is detailed in the equations found in Fig. 6.

The general finite deference relation used for nodes 2 and 3.

$$T_{m-1}^i - 2T_m^i + T_{m+1}^i + \frac{\dot{g}_m^i \Delta x^2}{k} = \frac{T_m^{i+1} - T_m^i}{\tau} \quad \rightarrow \quad T_m^{i+1} = \tau(T_{m-1}^i + T_{m+1}^i) - (1-2\tau)T_m^i$$

The finite difference equations for other nodes are obtained from an energy balance by taking the direction of all heat transfers to be towards the node under consideration:

Node 1: $$h(T_\infty - T_1^i) + \varepsilon_{steak}\sigma[(T_\infty + 273)^4 - (T_1^i + 273)^4] + k_{steak}\frac{T_2^i - T_1^i}{\Delta x} = (\rho C)_{steak}\frac{\Delta x}{2}\frac{T_1^{i+1} - T_1^i}{\Delta t}$$

Node 2: $$T_2^{i+1} = \tau_{steak}(T_1^i + T_3^i) + (1 - 2\tau_{steak})T_2^i$$

Node 3: $$T_3^{i+1} = \tau_{steak}(T_2^i + T_4^i) + (1 - 2\tau_{steak})T_3^i$$

Node 4: $$\pi(r_{45}^2 - r_4^2)\{h(T_\infty - T_4^i) + \varepsilon_{plate}\sigma[(T_\infty + 273)^4 - (T_4^i + 273)^4]\} + k_{steak}(\pi r_4^2)\frac{T_3^i - T_4^i}{\Delta x} + k_{plate}(2\pi r_{45}\delta)\frac{T_5^i - T_4^i}{\Delta r} = [(\rho C)_{steak}(\pi r_4^2 \Delta x/2) + (\rho C)_{plate}(\pi r_{45}^2\delta)]\frac{T_4^{i+1} - T_4^i}{\Delta t}$$

Node 5: $$2\pi r_5 \Delta r\{h(T_\infty - T_5^i) + \varepsilon_{plate}\sigma[(T_\infty + 273)^4 - (T_5^i + 273)^4]\} + k_{plate}(2\pi r_{56}\delta)\frac{T_6^i - T_5^i}{\Delta r} = (\rho C)_{plate}(\pi r_5^2\delta)]\frac{T_5^{i+1} - T_5^i}{\Delta t}$$

Node 6: $$2\pi[(r_{56} + r_6)/2](\Delta r/2)\{h(T_\infty - T_6^i) + \varepsilon_{plate}\sigma[(T_\infty + 273)^4 - (T_6^i + 273)^4]\} + k_{plate}(2\pi r_{56}\delta)\frac{T_5^i - T_6^i}{\Delta r} = (\rho C)_{plate}[2\pi(r_{56} + r_6)/2](\Delta r/2)\delta\frac{T_6^{i+1} - T_6^i}{\Delta t}$$

The heat transfer to the steak during a time step i is the sum of the heat transferred to the steak directly from its top surface, and indirectly through the plate, and can be expressed as:

$$\begin{aligned} Q_{steak}^i = {} & 2\pi r_5 \Delta r\{h(T_\infty - T_5^i) + \varepsilon_{plate}\sigma[(T_\infty + 273)^4 - (T_5^i + 273)^4]\} \\ & + 2\pi[(r_{56} + r_6)/2](\Delta r/2)\{h(T_\infty - T_6^i) + \varepsilon_{plate}\sigma[(T_\infty + 273)^4 - (T_6^i + 273)^4]\} \\ & + \pi(r_{45}^2 - r_4^2)\{h(T_\infty - T_4^i) + \varepsilon_{plate}\sigma[(T_\infty + 273)^4 - (T_4^i + 273)^4]\} \\ & + \pi r_1^2\{h(T_\infty - T_1^i) + \varepsilon_{steak}\sigma[(T_\infty + 273)^4 - (T_1^i + 273)^4]\} \end{aligned}$$

Fig. 6. Finite Deference Method Equations.

To determine the defrosting time, we must find the amount of heat transfer during each time step, and add them up until we obtain 55.2 kJ (a figure obtained from the earlier equation where the Qtotal for the steaks was determined). Multiplying the number of time steps N by the time step Δt = 5s will yield the defrosting time. In this case it is determined to be 245 s. This means that the total defrosting time, using the DefrEase plate, is 245 seconds, or just over 4 minutes.

V. Analysis and Results

Based on the results obtained via solving this problem using the finite deference method, it can be seen that DefrEase takes just over 4 minutes to completely thaw the frozen steaks.

Comparing this result to the time it takes to thaw frozen steaks to room temperature if the steaks are merely placed on a countertop (no thermally-reactive properties), we can determine just how

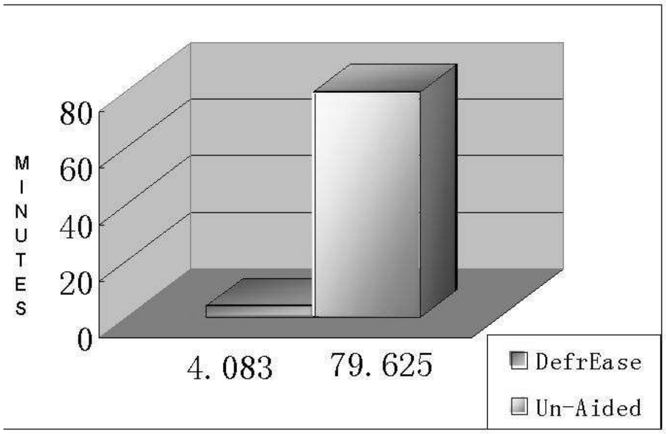

Fig. 7. A visual comparison of the defrosting times for DefrEase vs. un-aided thawing.

effective DefrEase is.

Based on a series of independent studies conducted at home, the average defrosting time for the same size steaks at room temperature was just under 80 minutes. That is 20 times as long as it takes DefrEase to defrost the steaks.

Moreover, going back to engineering ethics, leaving meat out to defrost at room temperature for an extended period of time allows for the rapid growth of harmful bacteria. Although 80 minutes is not scientifically a long enough time to allow for a full-blown bacterial infestation, thawing meat at room temperature still opposes food safety guidelines and health regulations. Standard food safety regulations state that you should thaw meats only in the refrigerator, microwave, or under cool, running water[8]. Thusly, thawing at room temperature does not fall within the safety parameters of this design problem. Thawing the steaks in the refrigerator would take much longer, as would thawing them under cool, running water. Many people are opposed to thawing meat in the microwave because even though it is fast, it tends to cook the meat more than desired, negatively effecting the consistency of the meat.

It is obvious that DefrEase offers a vast improvement in defrosting time and overall consumer health according to standard food regulations.

VI. Conclusion and Future Work

In this paper we have presented DefrEase, a novel product for the defrosting of flat, frozen food items such as steak. We have evaluated the plate using the numerical technique called the finite deference method, and further incorporated the laws of heat conduction, convection and radiation into the overall equation for energy conservation.

From there, the design was compared to BellaCopper's defrosting plate; the best plate on the market today, and also to defrosting meats unaided at room temperature.

It was sufficiently proven that the proposed product, DefrEase, meets all of the necessary requirements, and can be easily integrated for use in the modern-day kitchen. Further, DefrEase proved to be the superior product in terms of durability, maintainability, reactivity, and overall safety with regard to human use.

Future work could examine more complex material combinations in an attempt to find an even more home-friendly, cost-effective, reliable defrosting plate.

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Online Learning Modules with Diagnostic Tools for K – 12 Educators

Hui Fang Huang Su, Ed.D. Fischler School of Education and Human Services
Nova Southeastern University, 1750 NE 167th St. North Miami Beach, FL 33162

Shelley Green, Ed.D. Fischler School of Education and Human Services
Nova Southeastern University, 1750 NE 167th St. North Miami Beach, FL 33162

Dr. John Sico, Fischler School of Education and Human Services
Nova Southeastern University, 1750 NE 167th St. North Miami Beach, FL 33162

Naveed Peerani, Fischler School of Education and Human Services
Nova Southeastern University, 1750 NE 167th St. North Miami Beach, FL 33162

Khitam Azaiza, Fischler School of Education and Human Services
Nova Southeastern University, 1750 NE 167th St. North Miami Beach, FL 33162

Abstract

One of the largest schools of Education, located in the southeastern region of the United States, in partnership with five private and state universities and school districts, has developed and disseminated research-based online modules to enhance teacher professional development and student achievement in mathematics. The project is designed to increase teacher access to mathematics' best practices through cutting edge technologies and to establish new 21st century partnerships between universities and school districts.

The university used one of its partner's online learning environments to provide online modules in both mathematical content and pedagogy. These modules will help thousands of users teach mathematics more effectively. Delivered through the school district's Virtual University and coupled with the statewide (and national) dissemination capabilities of private university partnership, and the mathematics expertise available at regional university hubs, this project can ensure wide dissemination of best practices in mathematics.

The mathematics abilities of teachers entering the program will vary widely, therefore an **online diagnostic Pre-Test** was developed under this project. Based on the pre-test results, teachers will receive an online prescription as to which modules they will need to complete in order to reach proficiency. In this way teachers will complete the modules that specifically address their deficiencies. A participating teacher will be able to complete as many modules as they want, however, they need not complete any modules that cover areas where they are proficient. In this way the program will react to individual teacher professional development needs in mathematics, making the online professional development of this project time sensitive, individualized, and standards aligned.

The online learning modules will enhance the competencies of mathematics teachers by:

- targeting teachers in low performing schools where the need for skilled teachers is most critical;
- actively engaging higher education institutions in improving mathematics education and its online delivery;
- disseminating the latest research on mathematics teaching and learning;
- bringing K-12 teachers together online with mathematicians and mathematics educators to increase teachers' subject matter knowledge and interest;
- linking universities to provide online professional development, communications, community building, instructional resources, mentoring, and technical assistance to the schools and districts;
- improving teacher skills through the use of on-demand professional development;
- working proactively with school district personnel to refine and utilize online delivery and use;
- establishing new supports for teachers by establishing a partnership of mathematics and mathematics education faculty statewide; and,
- offering numerous and varied professional development opportunities including follow-up trainings; and interactive online university courses.

Simultaneously, the academic achievement of students in mathematics will be closely evaluated and the data will be used to continuously target improved ways to disseminate information and the professional development needs of teachers.

Initially, a secondary-level algebra course mapped to the new mathematics standards was developed to help mathematics teachers review and reinforce their basic skills. A forty-question pretest was designed with the purpose of benchmarking the teachers' mathematical skill level. In order to enforce test security, a website was designed to host the pretest. The teachers were given one hour to complete the forty-question test. Eighteen out of twenty-two teachers took the pretest and of those about 16% scored 70% or higher. 0% of the teachers scored between 60% and 70%, and the remaining 84% scored 60% or lower.

The course is designed to take place online. Lecture notes were posted in advance so students had a chance to review topics and work out problems if needed. Students attended weekly "chats" (classes) for eight weeks in which the instructor solved and instructed Algebra topics "live." The instructor of the course was carefully selected and had incredible credentials in both mathematics and education.

At the end of the course, modules will be developed and designed to accommodate participants with specific skills in Algebra. Participants will take a diagnostic test that will help identify the needed skill areas. In this way a well-rounded mathematics teacher will emerge. The modules are designed for individuals who either want to improve their mathematics skills, both basic and advanced, with topics ranging from basic arithmetic skills and computation to algebra, geometry, and trigonometry, or review topics in preparation for new teaching assignments. The modules are designed to be taken at an individual pace with many opportunities for practice in the form of exercises and practical applications with instant feedback. Each module contains a Pretest, the content, and a Posttest. Some modules also include separate practice exercises in addition to the practice presented within the content. Upon successful completion, participants will be able to: understand and connect specific key ideas regarding mathematics operations and applications; the potential for introducing interdisciplinary mathematics scenarios to enhance student learning; and, understand and be able to teach mathematics applications with confidence.

Depending on the outcome, this successful model will be disseminated in school districts throughout Florida.

The purpose of the Mathematics Content modules is to provide participants with a practical, hands-on, systematic approach to the teaching and learning of mathematics. Using an applied problem solving approach, these self-paced modules is designed to enable the participant to learn, re-learn, practice, and review a wide range of algebra topics. Additional courses will be designed and modules will be developed based on the initial Algebra course. These modules will help increase teachers' understanding and content knowledge related to the new Body of Knowledge for secondary mathematics in the state of Florida. They also improve teachers' understanding of current mathematics applications by allowing them to solve real-world problems. Upon successful completion, the teacher will be able to identify strategies for implementing the Florida Department of Education's "12 Accomplished Competencies for Teachers of the 21st Century" in his/her classroom.

Use Physics and Mathematics to Design an Impact Protection Device

Hui Fang Huang Su, Ed.D. Graduate Teacher Education Program
Nova Southeastern University, 1750 NE 167th St. North Miami Beach, FL 33162

Tsung-Chow Joe Su, Eng.Sc.D. P.E., Dept. of Mechanical Engineering
Florida Atlantic University, Boca Raton, FL 33431

This paper will describe an engineering design project in which we trained students to use simple physics and mathematics to create an impact protection device. The task is to drop an egg down a two or three story building onto a concrete floor/ground with at most two full pieces of newspaper to protect the egg. No other materials, such as tapes, and other types of adhesives are allowed.

When you drop an egg from a two or three story building to a concrete ground, the egg will crack. Why? The reason is that during its fall, it gains speed (at 9.81 m/s per second). But while it may take a second or two for the egg to reach the ground, the speed it gains will be abruptly halt to zero in a tiny fraction of a second. Such a sudden change of speed means large force acting on the egg and cracks the egg. The Newton's second law of motion states that:

$$Force = mass \bullet \left[\frac{instantaneous\ change\ of\ velocity}{time}\right]$$

So that to reduce the force on the egg, we need to either reduce the speed that the egg approaches the ground or also increases the time of impact during which the egg slowing down to a halt. We may want to do both.

The students were asked to drop an egg down a two or three story building onto a concrete floor using at most two full pieces of newspaper. They were not allowed to use any additional materials. Materials such as adhesive tapes and other types of bonding agents were forbidden. Extra credit was awarded for using less amount of newspaper, at the increment of a quarter of piece of newspaper.

One successful design was to use a cone shape container around the egg. As the pointed end of the cone reached the ground, the impact buckled (or crumbled) the cone in time before it reached the egg. Thus, it increased the impact time to soften the blow to the egg. Various types of parachutes were make from the newspaper and attached to the egg to reduce speed of descent.

Students worked in teams to design the egg packaging to prevent drop damage. Team competitions were held with three students in each group. Teams were rewarded with additional points as lesser pieces of newspaper were used and when the egg impacted the ground without slightest sign of crack. When teams dropped an egg using their creative device from a third floor window using only two pieces of newspaper, each team member received a grade of 80 points. With each reduction of half amount of paper used, the grade was increased by 10 points. Some students came out with designs that allowed an egg to drop from a 3-story building onto a concrete floor without any crack using only a quarter piece of newspaper.

This design problem is an open-ended challenge to student's creativity and ability to work as a team. Students learned the techniques of brainstorming and conceptual development of their design. The project led the design process from a conceptual phase to an actual prototype testing situation. Individual design reports were submitted by each student that described the design process and their participation as well as what they have learned from this project.

Students were pleased with their creations and realized the value of physics, mathematics and engineering process in achieving their design objectives. The project increased their confidence and their interest in engineering.

Following this project, students will be asked to design a protection device for a laptop and a car bumper using the cone impact absorber concept. They will also be designing a high rise escape capsule using the concept they have learned in this lesson. Additional assignments included conceptual design of a light-weight protection device for the air-drop of radios and how to safely return soil samples from Mars.

Using Mathematics to Help Improve the Quality of Life of the Special Needs Population
by
Hui Fang Huang "Angie" Su, Ed.D. Nova Southeastern University

The field of community research includes problem areas such as violence and abuse, juvenile delinquency, gang warfare, teenage pregnancy, academic underachievement, school dropout, drug abuse, homelessness, and poverty. Historically these complex social problems have posed serious problems for thnd to be extremely volatile (Criswell 1998). The researchers frequently are seen as outsiders who are more interested in their project than in the problems of the study's participants.

To deal with these complex social problems, community researchers have turned increasingly toward qualitative research methods. In this study, we have used multiple methodologies. We have combined Participatory Action Research with the standard pre and posttest that is the hallmark of traditional quantitative research. By combining these very different research tools, we hoped to develop a much richer picture of the needs of the homeless and the types of interventions that would best meet their needs.

The research project was conducted at a second largest county-based homeless shelter located in a southeastern state of the United States of America. The shelter serves homeless adults and children in the southeastern region of the state. The goal of the center is to assist individuals who are tired of living a life on the streets. Clients at the center are taught life skills that they can use to become productive and successful citizens.

At the time of the study the center housed 33 women who were referred to the center by community-based agencies. The education level of the women varied considerably: 6 had college degrees, 3 had a GED, 21 had dropped out after the 10^{th} grade, 2 had completed the 8^{th} grade, and 1 had finished the sixth grade. Over 90% of the women were single parents.

Twenty-eight women began the program. However, not all of the twenty-eight completed all of the training sessions because many of the women found work or left the shelter after eight weeks. As might be expected, the extreme volatility and rapid turnover of residents made data collection a very difficult and demanding task.

An initial focus group meeting was set up to determine the areas of need. The responses indicated that this group of women suffered some form of memory impairment due to a variety of factors. This leads to our research question: *Can mathematics activities designed for memory recall be used to compensate memory loss in homeless women who have suffered various types of abuse?*

The clients attended a second one-hour focus group session in which personal views and information were shared among the participants. The researchers gathered the information needed and designed the activities specific to individual needs utilizing research based successful mathematical techniques. The clients also filled out a needs assessment survey after the session. The survey contained 10 items with the following questions:

✓ Have you ever been to a homeless shelter before?
✓ I am here because of alcohol dependency
✓ I am here because of substance abuse
✓ I am here because of physical abuse
✓ I am between the ages of (18-25, 26-33, 34-41, 42-49, 50 and above)
✓ Are you currently employed?
✓ The highest grade that I have completed is:
✓ How many hours per week do you work?
✓ Is English your first language?
✓ Have you ever had involvement in the criminal justice system?

The group sessions allowed the clients to express feelings regarding the areas of need relating to memory loss. The clients discussed how memory loss has affected their ability to function on every day tasks and how it hindered their job performance. The researchers arranged the focus groups to accommodate the clients' schedule. The research based mathematics activities were used as the intervention strategies in the study. The clients participated in the activities one hour per day for a minimum of 7 days and a maximum of 60 days.

The project design utilized an integrated approach that combines formal instruction, skills-building exercises, psychosocial assistance, social networking, and empowerment into a unified program that strengthened the memory functions of this group of women (Weiss, 2000). A confidential needs assessment survey was administered to each client; a profile was created based on the results of the survey. Individualized assistance plan in the areas of need in reference to memory recall techniques was assigned to each client.

A comprehensive mathematics memory recall plan that helped enhance the client's short term and long term memory was put into action based on Jensen's (2000) research on memory. A variety of mathematics games utilizing research-based teaching techniques (Su, 1995) and real world scenarios were refined to fit the needs of the clients in our study.

Sample Activities:

Materials: texture boxes, blocks and descriptions, decks of cards, and pencil and paper for each participant

Long Term Recall Exercise:

Each session will start with a dance step, and succeeding sessions will build upon the preceding dance steps, so that clients will have to recall the previous session's dance steps.

Session 1: Starting with the **right** foot on each of the following:

- 3 -steps forward, feet together
- 3- steps backward, feet together
- Grapevine right and back
- 3-steps backward, feet together
- 3-steps forward, feet together
- Grapevine left and back (You will end up where you started)

Short Term memory exercises:

Activity 1: ***What's My Number***, page 46 (Su, p.46 Some Ways Book)

Give each client a deck with all jokers, picture cards and 10s removed, only 1-9 will be in the deck. Read which place value is associated with each suit of cards (example: hearts= thousands place. Upon hearing the problem, each client will place the cards face down in front of them. When everyone has completed this exercise, they will all turn over their cards and say the number their cards represent.

- Show any multiple of 10 between 10 and 90, example would be 70. (Show 7 of spades)
- Show any multiple of 1000 between 1000 and 9000. (Example: show 3 of hearts)
- Show any multiple of 100 between 100 and 900. (Example: show 5 of clubs)
- Show any unit number between 1 and 9. (Example: show ace of diamonds)
  These exercises have gotten them familiar with the place value associated with each suit. Now the problems will have 1, 2, 3 or 4 digits, so multiple cards may have to be laid down.
- Show 72, 8, 469, 3311, 7846

Long Term Memory Recall Exercises:

Activity 1: ***Finish the nursery rhyme.*** Clients will do this in unison.

Jack and Jill went up the hill ________________________________

(To fetch a pail of water)

Old King Cole was ____________________________

(A merry old soul and a merry old soul was he)

Little Miss Muffet sat on a tuffet ____________________________

(Eating her curds and whey)

Activity 2: ***Number sequencing*** (Su, p. 47 Some Ways)

The teacher will call out a problem and client will answer, next client will get a different problem. Teacher will give appropriate problems, examples below:

1. The number before AND after (or one more than and one less than) 5, 28, 89, 123, 199, 3029.
2. Two more than AND two less than 7, 33, 82, 179, 3028, 1000
3. Ten more than AND ten less than 15, 28, 119, 196, 3028, 1000, 2000

Activity 3: ***Real Life Geometry***

Draw a picture of a Stop sign, draw a picture of a pentagon (can think of the building in Wash. D.C.)

<u>Sensory Memory: Exercises:</u>

Activity 1: Read Story **"The Cookie Caper"** on p 65 of Su's Strategies book

Ask the questions following the story to enhance memory recall skills.l

Activity 2: Texture box

On a paper have an example of the following items with their names:

Note: all lengths are approximate

(red tower=2"; short green stick=4";long green stick=9";short purple log with cutout=1 ½"; long Purple log with cutout=7 1/2")

Clients study items for about 1 minute, then paper and items are taken out of view. Put one of each item in texture box. Client puts hand into texture box, picks an item and describes it with its shape, color and whether it is long or short, big or little. Then object is taken from texture box and checks whether it was the correct description. A small token is given for each correct description.

Findings

The clients were involved in follow-up interviews and also participated in a summative evaluation focus group. During the final focus group several themes emerged as key findings of the study. In addition to the educational aspects of the program, the development of social networks among the participants, the building of self-esteem, and the opportunity for self-improvement were cited by most of the participants as being among the most important results of the program.

The Center's staff reviewed and evaluated the program by observing the use and progress of the clients at the shelter on a weekly basis. During quarterly staff meetings the center's education specialist reviewed the intervention with the other staff members and then, as part of the ongoing collaborative process, she and her assistant shared their findings and experiences with the researchers. The clients (or residents) were involved in follow-up interviews and also participated in a summative evaluation focus group. During the final focus group several themes emerged as key findings of the study. In addition to the educational aspects of the program, the development of social networks among the participants, the building of self-esteem, and the opportunity for self-improvement were cited by most of the participants as being among the most important results of the program.

Focus Groups: Finding

By the end of the program several themes had emerged from the study. In the following section, we have selected representative comments from the program's participants that summarize the residents's reactions to the research project.

The most frequently cited response was that the class projects let them do "real life fun things." By the third week the participants mentioned that the highlight of the week was the math class. We "couldn't wait to go to class," and "this is the first time I have ever liked going to class." And for the first time the ladies commented that the program had helped them to make friends in the class. They stated that they valued the friendships of women who understand their problems and situation. They enjoyed the relaxed atmosphere that had "no men, all women." In many cases the friendships had blossomed because they were practicing the mathematical memory games with each other or simply "hanging out together."A nearly universal comment was that they loved learning in a non-threatening environment. Non-threatening included a wide range of factors, such as: fear of failure, non-judgemental setting, early success in the program, and "liked their classmates." The social setting encouraged learning and reduced fear of failure. For many of the women the mathematics memory classes were the first time that they had experienced success in the classroom. Feelings of inadequacy were almost paralyzing in the beginning. Many not only stated that they felt more confident, but demonstrated this by volunteering or working,

The education specialist stated, "the program was more than successful: it was spectacular. Women were willing to go with the flow. They talked freely after the second or third class. The learning strategies and the ways to remember made for successful learning. It helped them succeed despite their expectations.She also noted that the program contributed to the class becoming more cohesive. Within a class or two, the class veterans would help each other and new arrivals. Working together in the classroom has also created an environment that led the residents to help each other with problems or tasks outside of class.

Many of the ladies commented on the importance of what they learned. "It will help me when I leave." The one area that received unanimous praise was the section on managing money basics. This was a topic of enormous interest because very few of the ladies ever had control of the family finances. In fact, the whole issue of being in control was a key theme that emerged early in the study. A major part of the project's success was that it allowed them to be in control. Learning was fun; they were successful; and they were doing something they wanted to do.

An essential component of the program was the emphasis on building a climate that fostered trust and collaboration. During the final session one of the residents captured the spirit of the project when she said that the instructor "was one of the gang, not superior." To reduce the likelihood that the women would feel that the classes were simply one more burden, they participated in the plans for outings. They calculated the total cost of the trip, including tickets, lunch, and transportation. They also estimated the total time needed for the entire trip. Of course, practical concerns about transportation limited the options, but the women were able to decide to attend a play. For many of them, this would the first live production that they had ever seen. They were equally involved in the trip to IMAX. To make the outing less formal, the movie was preceded by a picnic. By including the residents in these decisions, all of the people involved in the project were able to share their academic and social successes and celebrate their achievements with a social event. In fact, it is a widely accepted tenet of community research that when the participants are encouraged to articulate their issues and concerns and assist in the development of activities, the community members are "more likely to develop a sense of ownership" for the program (Jenson, 2000).

The following list contains verbatim comments that were made at the summative meeting:

- *"Lot of things that women need to know."*
- *"It was the most fantastic experience."*
- *"This is the best program that is happening at the shelter."*
- *"It has completely changed my expectations and thinking."*
- *"It has absolutely helped to improve my memory."*

- *"You can have a good time learning."*
- *"We made friends in the class, and I can now remember the names of everyone in the class."*
- *"This is an awesome program; even the teachers look forward to teaching the session."*

Major Theme

1. Feelings of inadequacy
2. Lack of control
3. Social isolation (no social network)
4. Totally dependent on others and completely powerless
5. Empowerment (nonexistent
6. Discovered it was fun to lear
7. Discovered that they could learn mat
8. Impressed with their progress in improving their memory
9. They were successful
10. First time many had attended a play ("First play Lisa had ever seen.")
11. Important that they have some control.
12. Allowed them to modify the program
13. They were not treated as mindless subjects or research objects
14. Appreciated by both staff and residents

Qualitative Findings

Although we realized that it would be very difficult to collect data because the participants were likely to leave the program before they completed the class session, the study used a pre- and posttest to measure the participant's sensory memory, short-term memory, and long-term memory. A paired *t*-test (Fig. 1) was used to test the hypothesis that the sensory, short-term, and long-term memories of the participants would improve significantly on the posttest compared to their pretest scores. The study found that the *t* value obtained for sensory memory exceeded the critical value for p=.01. The *t* for the long-term memory and the short-term memory, however, did not show a significant difference, so the null hypothesis could not be rejected. According to these data, the memory program did improve sensory memory, but it had no measurable effect on either long-term or short-term memory (Fig. 2).

Paired Smaples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pair Pretest Long Term	3.14	14	1.027	.275
1 Post Long Term	3.36	14	.745	.199
Pair Pre Sensory Test	3.36	14	.929	.248
2 Post Sensory Test	4.43	14	.756	.202
Pair Pre Short Memory	4.64	14	.633	.169
3 Post Short Memory	3.93	14	1.269	.339

Fig. 1

	Paried Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair Pretest Long Term	-.214	1.188	.318	-.900	.472	-.675	13	.512
1 Post Long Term								
Pair Pre Sensory Test	-1.071	1.328	.355	-1.838	-.305	-3.019	13	.010
2 Post Sensory Test								
Pair Pre Short Memory	.714	1.437	.384	-.116	1.544	1.859	13	.086
3 Post Short Memory								

Fig. 2

In this case the findings from the pretests and the posttests are not supported by the responses of the participants or the instructors. Despite the lack of statistical corroboration, the program was felt to be so valuable that the program continues at the Broward Outreach Center even though the study ended six months ago. The program is taught by volunteers who participated in the original study.

It should also be noted that because of the difficulty in collecting data, only 14 of the participants were included in the statistical test. In addition, the study did not monitor how many classes that each participant had completed. As a result, the statistical part of the study treated participants who had completed six classes exactly the same as the participants who had completed only one class.

One obvious recommendation would be to tighten the administrative procedures so that each student could be tracked by class attendance. The obvious trade-off is that such tracking would require a major effort by the staff of the Broward Outreach Center. It would also require a more regimented environment, the very type of environment that the original research project wanted to avoid.

Conclusions & Suggestions for Future Research

Domestic violence is one of the many reasons why a woman ends up in a shelter. For many women, domestic violence is the catalyst to a downward spiral and the shelter provides a support system for them. And, without valuable community programs that help build self-sufficiency these victims often have a tough time recovering (Binford 1997).

Our research focused on building a better community by providing individuals with the tools they need to succeed. Programs such as ours, when collaborate with other community partners can help develop systems that combat our community's greatest issues such as homelessness.

The information gained from this study may some day be helpful to educators and to other health care professionals to develop appropriate educational programs for homeless families in shelters throughout the country.

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Online Dialogue Journaling in Graduate Literacy Teacher Education: Identity and Knowledge Construction

Nadine Bryce
School of Education,
Hunter College of the City University of New York
New York, NY 10021, USA

ABSTRACT

While teaching several sections of a graduate literacy teacher education course, I grappled with the issue of how to engage candidates more deeply with the content of the course, and how to foster wider communication among classmates. Further, I was interested in how candidates expressed their developing sense of teacher identity, as they constructed notions of literacy pedagogy for elementary level students. I supplemented in-class sessions with online dialogue journal writing about course readings, and studied how candidates wrote about the course content, and themselves as developing teachers. Results confirmed asynchronous online discussion: fosters deeper thinking; increases candidates' participation and critical thinking; provides candidates with opportunities to connect with classmates who are physically separated; and provides opportunities for candidates to use and learn how to teach with technology. Surprisingly, candidates wrote using situated identity roles, such as learners, teachers, or parents, as they made sense of literacy pedagogy for elementary students, signaling the importance of identity formation in knowledge construction.

Keywords: asynchronous online communication, dialogue journaling, literacy pedagogy, teacher education, teacher identity construction

INTRODUCTION

Graduate elementary literacy teacher educators are faced with the bold task of rigorously preparing teacher candidates for work with learners in grades 1 – 6, addressing issues such as increasing reading and writing proficiency, while fostering lifelong learning. Doing this in the context of a typical class that meets once a week for 2.5 hours is not always sufficient, as face-to-face meetings are limited in opportunities for deep exploration of course content, and provide limited opportunities for teacher candidates to share ideas amongst themselves. Lecture, small-group activities and discussion provide some opportunities for exchange, but are influenced by time constraints, the instructor's ability to create and capitalize on meaningful discussions, and candidates' willingness to participate in the activities. More active and talkative candidates often vie for talk-time, while quieter participants listen. As such, it is not always possible to informally measure the degree of candidates' engagement with course content. In addition, course assignments are often individually prepared, specifically with the instructor as the sole audience, thereby also limiting communicative possibilities, and reducing the potential for demonstration of knowledge to teacher-evaluation of student work.

Faced with this conundrum while teaching four sections of an introductory literacy teacher education course for 92 candidates enrolled in the Childhood Education program at my university, I decided to implement an online component that supplemented face-to-face class meetings, so candidates would have more time to engage with and reflect on course readings, and communicate more often with classmates about the course content. I implemented dialogue journaling using Blackboard, an electronic learning software program designed to provide: online storage and access to course related materials; communication with classmates and course instructors; and electronic storage and access to grades. To complete the online dialogue journals, teacher candidates constructed an initial response to the assigned readings, addressing their reflection and analysis of the content of the readings, connections to professional experiences working with, or observing children in a concurrent or past fieldwork site placement, and posted them on Group Pages in Blackboard. Group members read each other's initial postings, then, constructed a feedback response, addressed to each member, to reflect on ideas shared.

Two exchanges were required of each individual for each posting, and at the end of the 10th dialogue journal experience, candidates wrote a reflective paper on the content and processes of using the online dialogue journal format to explore literacy instruction. Each was asked to self-evaluate his or her learning throughout the dialogue journaling process, and make recommendations for using this online format in the reflection paper. The dialogue journals and final reflection paper were assessment tools, in addition to four other course assignments.

LITERATURE REVIEW

In a review of research on online courses, Tallent-Runnels, Thomas, Lan, Cooper, Ahern, Shaw, and Liu [1] stated asynchronous participation in an online medium appeared to foster "in-depth communication" (p. 93) because of its nature of providing learners with opportunities to move at their own pace. Rovai [2] studied a 5-week completely online graduate course in education in which students engaged in asynchronous dialogue journaling, and reported Internet-based asynchronous learning through Blackboard's Discussion Board facilitated a sense of community in learners that were physically separated. Teng and Allen [3] documented pre-service teachers' use of Blackboard in an educational psychology course, integration of technology in their teaching, and how the use of Blackboard affected teachers' confidence in creating technology-based lessons. Pre-service teachers benefited from seeing technology use modeled by their instructor, and their confidence increased when preparing lessons with technology. Asynchronous dialogue journaling using the Discussion Board extended class discussions, while supporting reflection and collaboration.

In a related study of technology-based communication in a higher education setting, Resnyansky [4] used discourse analysis to critique the common-sense and neutral positioning of computer-mediated communication. Instead, she implored educators to: recognize technology as a discursive practice, non-neutral and political; be aware of assumptions about communication and its impact on subject positioning of the participants; and study communication through critical reflection and assessment. Discourse analysis can help to identify and interpret communicative problems across the fields of education and technology, specifically regarding the conceptualization of technology in education, and can be used to examine and exercise agency over technology.

METHODOLOGY

To guide the study of teacher candidates' asynchronous online dialogue journal writing, I asked, "What possibilities exist for reflecting on and constructing notions of literacy pedagogy and teacher identity through the use of an online dialogue journal format designed to foster "in-depth" communication?" Data from 400 dialogue journals (1,840 exchanges) were collected from 92 candidates enrolled in four sections of a graduate education literacy methods course (10 dialogue journal groups per class), during fall 2005, and spring 2006. Courses met once a week for 2.5 hours, and candidates completed 10 asynchronous weekly dialogue journals in partnerships or small groups to reflect on course readings.

Grounded in a social and cultural history that organizes the classroom experience with many students and an instructor, each taking on inherited [5] and potentially newly defined roles as teachers and learners, I recognized the language used during dialogue journal exchanges as situated in historical and cultural foundations [6] that privilege certain kinds of talk, interaction and ways of writing, contextualized by the physical, psychological, social and cultural contexts of our graduate education course. As such, teacher candidates' roles and identities drew on their personal histories as students, and for some, professional histories as teachers. These past subject positions intersected with current social construction of the knowledge of literacy teaching [7].

Teacher candidates were primarily female (less than 5% were male), and most were pre-service (less than 10% had prior teaching experience, or were currently teaching, or working in classrooms, part-time or full-time). As candidates engaged these knowledge-construction activities from various subject positions, based on their personal and social histories, they intersected with valued language practices of the "institution" (interpreted as the academic department to which they belonged, the School of Education) within exchanges that inherently involved power relations among other candidates, and me, the instructor. Candidates were instructed by me to be "courteous" and "mindful" of the sensitivities of online communication, which was intended to foster a sense of collegiality, and restraint from abusive language. My role as the instructor was instrumental in the design, monitoring and evaluation of the process, retaining much of the authoritative power teachers hold in classrooms, but it also challenged the traditional role of positioning the teacher as the sole, or most important, source of knowledge.

To analyze the data, the language of my pedagogical possibilities and constraints as stated in the course syllabus, and the texts candidates were asked to read for the course, were examined alongside their writings. A d/Discourse analysis framework provided theoretical grounding for investigating what realities the teacher candidates constructed in their writing. I examined candidates' language, or discourse, (small "d"), to learn if, and how, it reflected and co-constructed connections to larger social, cultural, economic, political, and institutional affiliations, revealing Discourses (capital "D"), or ways of believing, acting, seeing, speaking, reading, writing, and thinking [8], from which they were operating and building knowledge about literacy teaching and their identities as teachers of literacy.

RESULTS

My role in designing the activity, and evaluating the content of the online dialogue journals and reflective papers was pivotal in creating a successful online journaling experience. Criteria for both the journal and the reflective paper were provided in the course syllabus. I created the online journal forums into which candidates deposited their work. I read and graded each journal entry, but intervened in the journaling process minimally, so candidates could maximize their communicative potential amongst themselves. When I intervened, I complimented students' work, or redirected them to write more based on the criteria for evaluation as stated in the syllabus.

Several themes emerged when data were analyzed:

1) Online dialogue journaling fosters deeper thinking. Construction of knowledge of course content reflected the language of the texts; summarization and rephrasing of the author's language accounted for much of the reflection. This was expected because it was a part of the criteria for evaluation. But learners reported in the dialogue journals and journal reflective papers as having to think deeply about the text in order to prepare the journals, which went beyond summarization to include reflections on experiences as elementary students, or experiences teaching or working with elementary students.

2) Candidates' multiple subjectivities, or roles and identities, such as those of learner, teacher, and parent, framed the written responses. Pre-service teachers often drew on their experiences as students, and observers in classrooms, when reflecting on reading, writing, and vocabulary instruction. Historically situated experiences, reflecting on the change in literacy pedagogy over the last few decades often grounded their sense-making of the text, as they compared their experiences with basal readers and workbooks, to today's balanced literacy instructional models using literature as a basis for instruction. Pre-service teachers also drew on other roles, such as those of a parent, to illustrate how the process of motivating learners may resemble the work they have to do as parents to motivate their own children. Some in-service teachers sought to confirm current practice, while many wrote about new ideas gleaned from texts, and from their dialogue journal partners who had teaching experience; they often promised to implement these strategies with their current students.

3) Asynchronous dialogue journaling increased learner participation and critical thinking. Candidates reported that while they sometimes felt forced to write dialogue journals, to meet the assignment's deadlines, this activity held them accountable for the course readings, and provided them with access to additional ideas provided by their journal partners. This resulted in an increased sense of awareness about various methods and techniques for teaching literacy, supporting their development of practical pedagogical knowledge, but also increased the degree to which they contemplated the efficacy of teaching practice they read about and observed in current classrooms.

4) Dialogue journaling fostered relationship building. The relationship building aspect of the online dialogue journaling proved an essential one, and the aspect commented on by all candidates in their dialogue journal reflective papers. For candidates in a largely commuter school, who did not have many opportunities to get to know fellow students in their program, online dialogue journaling broadened the number of people with whom they could share ideas, pose questions, and receive feedback. Often, they reported being less afraid to share ideas and questions with each other than with the instructor, though they

were aware the instructor read and graded each assignment.

5) Dialogue journaling provided opportunities to use and learn how to teach with technology. For many candidates, using Blackboard for communication in groups was a new experience, and it provided them with a model for integrating interactive technologies in the classroom for elementary learners. They reported in the dialogue journal reflective papers that explicit attention must be provided to modeling, and demonstrating the use of this technology for elementary students, as well as providing clear criteria for evaluation so students would know how to create a product that was appropriate for the reading and writing context. Experiencing this model of interactive communication using course readings in their graduate education class provided a foundation for their future work with grade school students.

6) Dialogue journaling was viewed as a process fraught with the negotiation of power relationships among the participants, including the instructor, and other classmates. While only 1% of all candidates reported any difficulties with accessing and posting their online journals, a few groups struggled with getting all partners to post their responses on time. Negotiating an appropriate time to post for everyone took place during in-class sessions, through e-mail, and over the telephone. At times, I was asked to intervene on behalf of a consistently tardy poster, and while this process did not result in major difficulties, it created frustration for the group. As a class, we had to review the expectations for posting online journals during face-to-face meetings, and I had to address this issue individually as well. Regarding the process of grading journals, there was little challenge posed to me because the grading criteria was made explicit in the syllabus, but my intervention was necessary to increase the writing quality of journals that only met minimum requirements.

CONCLUSIONS

Initial results revealed candidates explored and expressed: their shifting personal identities as teachers, from less to more knowledgeable or experienced; ideas about their lack of, or increasing, knowledge of literacy pedagogical methods; and, notions of what counts as literacy, which shifted from their understanding of school-based literacy pedagogy from their grade-school experiences, to more process-oriented approaches in which children engaged in more challenging literacy practices. Teacher candidates reported engaging more deeply with readings due to shared responsibility for writing dialogue journals with others. Few teacher candidates struggled with electronic and online access to the communicative medium. Grounded in perspectives on literacy as socially-situated practice[9] [10] [11] [12] bound by values and attitudes of sociocultural communities and organizations in specific contexts (including the graduate teacher education program context, and my role as their teacher educator), analysis of graduate learners' online dialogue journals highlighted cultural expectations of literacy teaching and teachers, the social nature of learning, and issues of power and identity construction as negotiated through written language.

Candidates' shifting identities shaped the ways in which they wrote about themselves and their work as developing teachers of literacy. Like all people, teacher candidates are members of various sociocultural groups (e.g., school communities, families, religious groups, book clubs, recreational groups) which define themselves by the ways they behave, speak, read, write, interact, value and think. Their roles and identities, or ways of being in the world, shift according to socially-situated contexts, changes in subject positions and power relations [13]. Along with influences from personal and social histories, epistemological beliefs, experiential knowledge, attitudes, and a sense of one's efficacy as a developing teacher, teacher candidates' multiple subjectivities add to the complexity of understanding what sense they are making of their literacy teacher education work.

As a teacher educator, this information provided me with ongoing feedback about the teacher candidates' sense of their development as literacy teachers, which greatly informed course content, discussions, and a construction of what counted as effective literacy teaching.

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Teaching Elementary School Teachers Using ICT Technologies

Susan E. HIGGINS
School of Library and Information Science, University of Southern Mississippi
Hattiesburg, MS., 39406-0001, USA

ABSTRACT

The subject entitled *Literature and Related Media for Children* is a required subject for Elementary Education students enrolled at the University of Southern Mississippi. Prospective K-6 teachers learn the history of children's literature and the sociology of reading. They learn to analyze and classify literature according to genre elements. A circulating collection of children's books located within USM's School of Library and Information Science is open to them. Students tour the University's deGrummond Children's Literature Collection and observe its digitized collection. They tour the Curriculum Resource Center and are encouraged to take part in the annual Fay B. Kaigler Children's Book Festival. [1] These enrichment activities are intended to immerse students in the print world of children's books and related multimedia. Students are taught basic PowerPoint and online searching techniques by university teaching faculty bibliographic teams to prepare them to demonstrate mastery of assignment objectives. They also prepare and present an annotated bibliography of Internet Sites which will be useful as future teaching and learning tools. A media log of all selections falling within the categories of award winners and classics is required as an annotated bibliography. Students report on the illustrations used in the books, write essays and compare and contrast fairy tales. They produce a group report addressing the one of the genres of historical fiction, realistic fiction, modern fantasy, biography, poetry or multicultural literature. Questions of how and why technology creates authentic learning and how successful it is for these face to face students are discussed in this reflective essay.
Keywords: authentic learning, digitized collection, teaching children's literature, searching techniques, critical analysis, aesthetic appreciation.

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TECHNOLOGY IN THE CLASSROOM

That students' needs and wants are central to the process of learning drives the use of technology in this classroom, as a means to an end. Students use PowerPoint slides to compose three of their assignments, an internet bibliography, a fairy tale comparison-contrast analysis and a group assignment describing a genre of picture books - fiction, historical fiction, poetry, traditional literature, multicultural literature or nonfiction. Students present their findings to their colleagues, and are evaluated by one another. The evaluation score sheet covers the professional dispositions of teachers in the areas of assignment knowledge, presentation skills, requirements of the assignment, a question and answer session, professional development, interpersonal skills, organizational skills and supervisory responsibilities. Using a scale of 1-4, 4 being Exceptional, 3. Exceeds Expectations 2. Meets Expectations, and 1. Unsatisfactory, students rate the quality of the presentation. A place for written comments is also included. Students are awarded a mean score for their classroom performance. Generally, this numerical mean is very high and perhaps most tellingly, is an indication of positive peer group support. Comments are not well developed and few are negative. Suffice it to say that students desire to support one another, and this desire supports their learning. Because it requires the engagement of a peer group, group project based learning also speaks well of learning outcomes for undergraduates. In 1998 Bonnie Gratch Lindauer [2] cited Alexander Astin's longitudinal research on freshmen and undergraduates:

The single most powerful source of influence on the undergraduate student's academic and personal development is the peer group… Time spent studying and doing homework had significant effects on more than two-thirds of the eighty-two outcome measures (e.g. retention, graduating with honors, enrollment in graduate school, and standardized test scores.) The amount of interaction among peers has far-reaching effects on nearly all areas of student learning and development. In addition to the importance of time spent studying and peer group interaction are other findings highly associated with student academic development." (p. 553). "

Engaging students with technology to produce a group presentation seems to give them a sense of accomplishment. In order to effectively prepare the presentation, they had to discuss problems, negotiate solutions and apply knowledge. Through the process of teaching one another, the aesthetic appreciation of children's literature was shared, and a potential community of practice modeled. Even simple reflection on the visual product motivated high level engagement. The technology assists students to move from the affective domain to the objective domain in a socially acceptable way. Because aesthetic appreciation of children's literature is often based on a personal experience of a favorite book as a child, and is basically an emotional response to reading, students move through self-evaluation to outcomes which develop the skills, abilities, attitudes and knowledge specific to elementary school teaching.

PROBLEMS ENCOUNTERED

Students must be emotionally and psychologically mature to learn collaboratively because the affective domain is engaged. Although most students were considered young adults (18-24), according to Grams [2] reading in adolescence is essentially an emotional experience, and many of these students are still quite young and immersed in popular culture. For example, some students want to report on Walt Disney based movie versions of childhood classics with which they are familiar, so Disney based versions must be excluded from content. Classroom management can be problematic with students unaccustomed to active learning. Instructors are encouraged to ask students to read and sign a classroom civility code. It is often difficult to make sure students understand the value and importance of the class and its contents and the consequences of inappropriate behavior. However, most students are able to move from subjective understandings of the literature to observational reportage using technology as a vehicle of communication.

CONCLUSIONS

Student perceptions of the effects of technology on their academic performance might be measured, for example by a survey questionnaire. Is their experience of the quality of their learning experience enhanced? The impact of ICT in education and training is based on how it improves education through engaging learners interactively. The promise of technology in education is its use in integrating concepts and producing a measurable outcome of performance. The use of technology emphasizes student centered learning as essentially self-directed as well as group directed. It can engage the social learning world of young adults. The knowledge gained through traditional type of teaching methods cannot motivate teachers to use ICT software in the classroom, nor equip teachers to lead their own students with ICT software applications which support learning. The skills of critical analysis and interpretation can be showcased. Students also can develop an understanding of leadership within the conceptual framework of teaching others in the class. The practical applications of generating assignments and building personal teaching portfolios will assist them in the classroom. By engagement in the social milieu of the classroom, undergraduate students can design their own learning experience and come away from class with authentic learning which will benefit the children they teach.

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The Eight-vantages of Moblogging: An exploratory study on the use of Moblogging in Primary Teaching

Serene LEE Qing Yun

Si Ling Primary School, Singapore
Email: lee_qing_yun_serene@moe.edu.sg

ABSTRACT

Moblogging or mobile blogging is becoming increasing popular in the blogsphere where bloggers can now post their entries complete with a photograph via their mobile phones without having to log on to their computers to access their blogs. While blogging has taken off in the education world where many teachers use blogging as an alternative manifestation of learning, moblogging, the enhanced version of blogging, remains a fairly new educational technology.

Through the case-studies of how moblogging was incorporated into the teaching of Mathematics and Science in a Singapore primary school in activities such as "A Measure of Fun!" Mathematics Trail, the keeping of an online logbook on the growth of green bean plant and a zoo quiz n a fieldtrip to the Singapore Zoo, this paper presents eight advantages in the use of moblogging for teaching: *(1) mobility, (2) immediacy in data transfer, (3) visual documentation of learning, (4) students' work as teaching resources, (5) sharing of knowledge created, (6) continued learning at home, (7) increased motivation in learning, and (8) bridging the gap between school discourse and real world discourse.*

Key words: Moblogging, Mobile blogging, Blogging, Mobile phones, ICT, Educational Technology, Primary teaching

1. INTRODUCTION

Popularised by the ease and freedom of online publication after the hype on personal webpage creation in the 1990s, the blogging phenomenon swept through the world with an astonishing number of bloggers on blogging platforms such as Bloggers,com, My Space, Friendster, etc. For educators who managed to see the merits of blogging and are not afraid to bring in this out-of-school discourse into their classrooms, blogging takes on the form of quick online publishing such as online reflections, journal writing, composition writing, as well as peer-discussions and teacher or peer-evaluation facilitated by the comments feature in blogs.

While quick publishing and sharing of students' work through archival online storage on blogging platforms becomes a reality, the technology is still limited by the lack of mobility in learning. Students still have to access a computer in order to post their blog entries. Moblogging distinguishes itself from blogging in that it allows bloggers to post blog entries via their mobile phone. Bloggers can also attach a photograph taken with their mobile phones and attach it along with their blog message before sending the message to their blog via Multimedia Messaging Service (MMS). In the quest for real time publishing, moblogging fulfils this desire of bloggers as they are able to 'report' on their life events almost instantaneously as things happens, as long as they carry their mobile phones by their side all the time. This requirement does not seem like a limitation at all in this day and age since almost everyone owns a mobile phone, even our students.

As moblogging is a relatively new technology in blogsphere where this phenomenon is not evenly spread out even in the more IT-savvy countries, the use of moblogging in the education scene is far and few, and even less documented. This paper distinguishes itself as one of the firsts to document the use of moblogging as an educational tool in primary teaching as well as discuss the educational merits of using this ICT in the classroom. The paper will first provide the background in which the case-studies are set while the second section of the paper presents the case-studies of how moblogging was used in various subjects in Si Ling Primary School, a Singapore primary school. Based on the implementation of moblogging activities presented as case-studies, the main section discusses the eight advantages of moblogging as an educational tool. The final section will conclude with the issues related with the implementation of moblogging in the classroom.

2. BACKGROUND

Computers are changing the way we work and the way we live… We will use IT to encourage pupils to learn more independently, to learn actively.

Senior Minister, Goh Chok Tong, National Day Rally, 1996

Singapore is in the second running of her Masterplan for ICT in Education, a blueprint launched in 1997 for the integration of information technology in the education system to meet the challenges of the 21st century. The Masterplan for ICT in Education II, also referred to as mp2, was launched in 2002 with a vision to use IT more pervasively and effectively to enhanced educational processes and structures to bring about an even more engaged level of learning. With more calls for collaboration (CFC) with the IT industry, the Educational Technology Division (ETD), a division of the Ministry of Education (MOE) works closely with schools and industry partners to pilot various projects with individual schools as well as to develop a group of IT-niche schools known as FutureSchools@Singapore to "push the frontiers of teaching and learning by harnessing ICT at a school-wide level".

(Press release, "MOE Selects First Five Future Schools@Singapore", 22 May 2007) With mp2 in place, the greater support from the ministry and industry players empowers schools to experiment, optimise, contextualise and integrate at even deeper levels (Foo & Ban, 2003).

In the context of unprecedented support for ICT innovations and integration in Singapore, the pilot project of concerned in this paper is a result of one of the collaborations between the industry, ETD and individual schools. In 2006, Si Ling Primary School participated in the New Media Programme (NMP), a joint collaboration between MOE and Singtel, an internet and telecommunications service provider, to explore 3G, blogging and moblogging technologies with the use of mobile phones to enhance classroom learning experience. Student training was provided by Singtel on:

(i) Blogging (which included the use of mobile phones for moblogging)

(ii) Video Production with the use of mobile phones

The NMP also provided advisory and technical support as it assisted the school to develop a project that tailored to the curriculum and ability of the students selected.

3. PROJECT PLANNING & DESIGN

3. 1 Planning Stage

The initial stage of programme design was guided by three tenets:

(a) practicality,

(b) adherence of explicit specific instructional objectives, and

(c) adaptability

By practicality, we wanted to explore the practicality of incorporating moblogging into the curriculum, that is, how accessible is this type of learning and whether the technology was easy to use. By adherence to SIOs, we wanted to ensure that the designed activities meet the SIOs of the curriculum where moblogging enhances and complements the day-to-day classroom teaching and learning rather than deliberately fitting the technology into the activities. By adaptability, we wanted to explore the adaptability of the technology on the teaching of various subjects.

After two classes of Primary Three higher-ability students were selected for this programme, the aim of the programme was drawn up to provide the direction for the design of the activities. The aim of the programme is as follows:

> To incorporate 3G, blogging and moblogging technologies into the Primary Three curriculum to encourage multi-faceted modes of learning and stimulate higher-order, critical, creative and collaborative learning that caters to the different learning abilities of the students.

3.2 Equipment

With the intention to carry through this project for a longer term, the school purchased 18 sets of 3G handphones with mobile phone subscriptions to facilitate the programme. All blogging activities were carried out using CampusMoblog as the blogging platform (www.campusmoblog.com.sg.)

4. CASE-STUDIES OF MOBLOGGING ACTIVITIES

The NMP project implemented encompassed blogging, moblogging and video production with the use of mobile phones. The programme spanned across core subjects such as English, Mathematics and Science, and non-core subjects such as Social Studies and Character Development Programme. For the purpose of this paper, only the moblogging activities will be mentioned.

Three activities were designed with the use of moblogging technology. Of the three activities, the two activities which were implemented as part of the NMP are: (i) "A Measure of Fun!" Mathematics Trail[1], and (ii) The Keeping of an Online Logbook on the Growth of Green Bean Plants[2]. The moblogging entries for these two activities are posted to a class blog created on CampusMoblog under the blog name: 3K kids 2006.

The third moblogging activity was implemented in the following year after the NMP ended. It was carried out as part of the Primary Three Singapore Zoo Fieldtrip programme for the entire level comprising of 10 classes. Moblogging was carried out as a Zoo Quiz Moblogging Competition during the fieldtrip to Singapore Zoo.

Table 1 showing the moblogging activities implemented and the subjects involved

New Media Programme (Year 2006) Blog: 3K kids of 2006	
1. "A Measure of Fun!" Maths Trail	Mathematics
2. The Keeping of an Online Logbook on the Growth of Green Bean Plants	Science
Primary Three Fieldtrip to the Singapore Zoo (Year 2007) Blog: Si Ling's Respect and Care 2007	
3. Zoo Quiz Moblogging Competition	Science

4.1 Case-study on "A Measure of Fun!" Mathematics Trail

Moblogging as a Trigger Activity to teach Length

As a trigger activity to introduce the topic of Length, students work in groups to measure various objects around the school with measuring tapes or rulers. After measuring the designated objects, students have to take a photograph of how they measure the objects with the mobile phone and send the photograph together with the answers to the class blog. Speed and accuracy of the measuring task was added to the challenge of the activity.

Using the announcement feature of the blog, instructions for the Maths Trail was posted so students were informed how to moblog their answers to the blog.

This activity is grounded in *the Acquisition Hypothesis* which advocates the belief that students should learn facts while engaged in a process similar to the one in which they will use the facts and opportunities should be given to them to learn through incidental learning (Polanyi, 1958; Berry, 1997).

The objective of this problem-based activity was to allow students to figure out the mechanics of measuring, such as positioning the measuring tapes on objects which length exceeds the length of a single measuring tape, and reading off the measurement of the rulers of measuring tapes. Students also had to learn how to apply arithmetic operations of addition and subtraction, especially in the measuring large objects such as the basketball court. Students who managed to find a short-cut realised that they could first find out how many measuring tapes it takes to cover the length of the basketball court before multiplying the number with the length of a measuring tape.

After the Moblogging challenge, students returned back to class to review the answers and photographs posted on the class blog. The class discussed their methods of measuring the objects and the difficulties faced. In the subsequent lessons, the class revisited the task by re-measuring the objects again as the application of concepts learnt during formal classroom teaching of Length.

Figure 1 Blog announcement on "A Measure of Fun!" Mathematics Trail

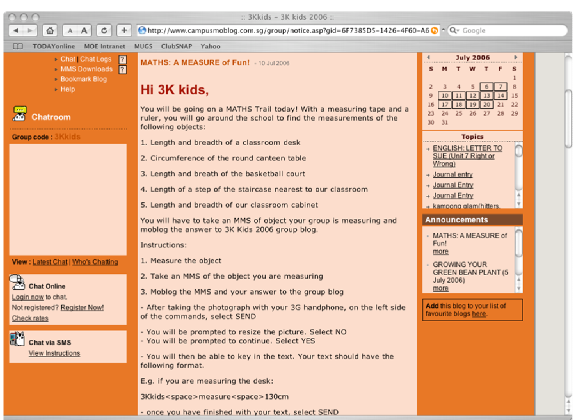
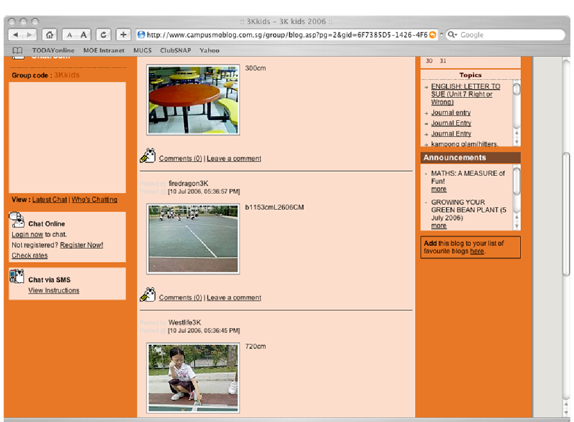


Figure 2 Moblog entries on "A Measure of Fun!" Mathematics Trail



4.2. Case-study on the Keeping of an Online Logbook on the Growth of Green Bean Plants

Moblogging as Maintain an Online Logbook

In the study on the lifecycles of plants, students grew their own green bean plant in the classroom to observe the changes that their plants underwent for a period of 16 days. To document the changes of their plants on a daily basis, students moblogged a photograph of their plants together with a short description of their observations to the class blog. The class blog thus functioned as an online logbook on the growth of their green bean plants where students could not only view their plants but also their classmates' plants.

The pedagogical basis for this activity was to encourage students to develop science process skills such as observation, prediction, comparing, generating, analysing, evaluating and communication (MOE Science Syllabus, 2001). This activity also provided opportunities to engage in inquiry and incidental learning as students had a real experience of observing the growth of a green bean plant which was not as generic as that taught in the textbooks about the descriptions of plants at different stages of growth. Students learnt that plants grow and die, even at the beginning stages of growing shoots when they did not take care of their plants. Students also learnt to make predictions about what was happening to their plants. When students noticed the growth of some 'buds' on the stem around the 5th or 6th day, some students predicted that the 'bud' would grow into leaves while others thought that it would grow into beans. The online logbook enabled the students to look at the real representation of their plants on the different days of growth to make comparison and evaluate their predictions.

The need for students to moblog their observations also provided the opportunity for them to learn lexis to describe the growth of their plants such as seed coat and germination. As compared to the direct teaching of scientific terms related to the growth of plants, students were more motivated to learn these terms to accomplish their own goals of communicating the descriptions of their plant growth.

Figure 3 Blog announcement on keeping an online logbook on the growth of green bean plants

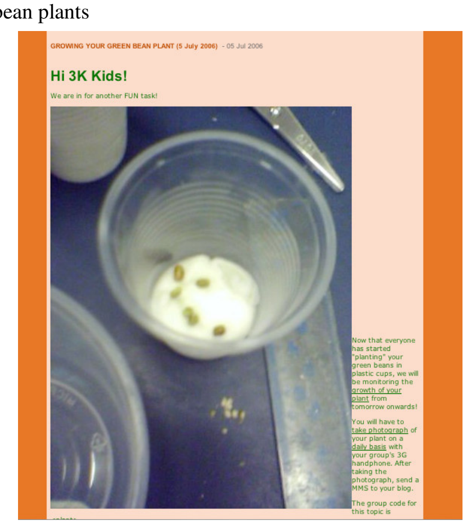
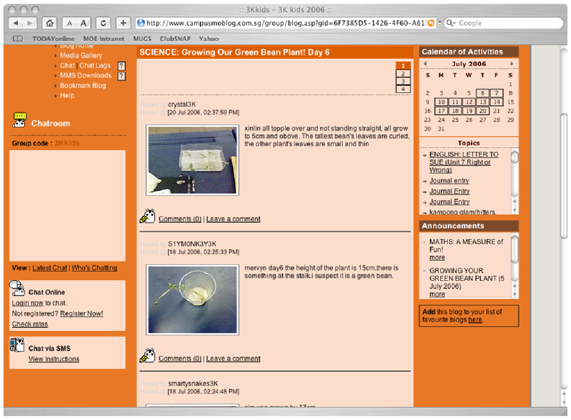


Figure 4 Moblog entries documentating the growth of students' green bean plants



4.3 Case-study on Moblogging Singapore Zoo Quiz Competition

Apart from the other two activities where moblogging was used as part of the classroom teaching and learning, moblogging was used as an interclass competition which involved all 10 classes of the Primary Three level. Based on a similar activity carried out on a class as part of NMP, this competition was implemented to create a more engaged learning at the Singapore Zoo where students learn about the characteristics of different types of animals, such as the reptiles, mammals, birds and insects. The quiz also aimed to encourage students to maximise their learning at the zoo by reading the information provided at various animals exhibits more carefully instead of merely viewing the animals.

Training was provided to teach students to use mobile phones for the moblogging competition. Every class selected a team comprising of four members to participate in this interclass competition. The zoo quiz required the groups to answer 6 questions on at four animal stations during their Singapore Zoo fieldtrip. Participating groups had to moblog their answers to the level blog. The answers also had to be accompanied by photographs taken as specified by the question. An example of a question at the giraffe station states that body part of the giraffes is liken to a human hand which is used as they feed. What body part is it? The question also required students to complete their task by taking a photograph of a giraffe and attach it to their moblog answer. Groups were taught to moblog in codes to indicate their class, the question they were answering and the answer. In Figure 2, 'r10' represents the Respect and Care 10, also referred to as the class R10. For the rest of the code, 'q6' refers to Question 6 and 'tongue' is the answer to the question.

Figure 5 An example of a Zoo Quiz question

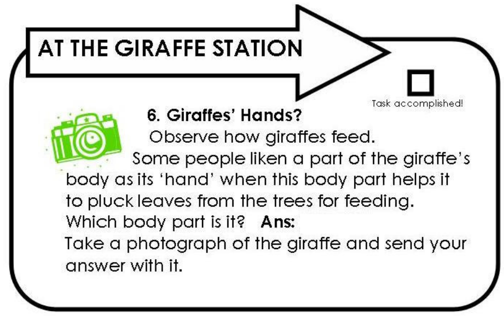


Figure 6 An example of a moblog answer to the above question

3. THE EIGHT-VANTAGES OF MOBLOGGING

Educators considering the use of moblogging in their teaching should be informed about the merits of this tehnology. The knowledge of what it can possibly bring about in pedagogy should take precedence over the mere learning of the technicalities involved in the use of moblogging. In the exploration, experimentation and conceptualisation of moblogging, the implementation of the three activities highlighted 8 advantages in the use of moblogging as an educational technology. The 8 advantages are:

(1) Mobility
(2) Immediacy in data transfer
(3) Visual documentation of learning
(4) Students' work as teaching resources
(5) Sharing of knowledge created
(6) Continued learning at home
(7) Increased motivation in learning
(8) Bridging the gap between school discourse and real world discourse

(1) Mobility

The main distinction between blogging and moblogging is that the latter allows bloggers to post entries via their mobile phones such that there is no need to access a computer to log on to their blogs. Moblogging is essentially blogging and I would like to refer to moblogging as an enhanced performance of traditional blogging. Since moblogging relies on the multimedia messaging service (MMS) capability of mobile phones, the tool required for blogging is reduced from an immobile computer to a highly portable mobile phone. As mobile phones are light and handy, they are suitable for out-of-classroom activities such as fieldtrips and excursions. From the case-studies presented, two activities are outdoor activities with one allowing students to access objects around the school and the other to learn about animals at the Singapore Zoo. Even the activity which was conducted in the confines of the classroom- the keeping of an online logbook on the growth of green bean plants, mobile phones could be easily passed on to fellow group members to take photographs of their plants and moblog their observations in the quickest time possible.

In addition, with safety issues hanging on teachers' mind when students are engaged in collaborative work requiring them to move independently around in a large area such as the zoo, mobile phones keep students connected to their teachers in cases of emergencies.

(2) Immediacy in data transfer

Apart from the advantage of mobility, the other useful attribute of moblogging is its capability of allowing a near immediate transfer of data to the online blog such that educators can almost review students' work immediately after any moblogging activities while learning is still fresh in students' mind. In the case-study of "A Measure of Fun!" Mathematics Trail, the immediacy in data transfer of students' answers to the Mathematics trail allowed the teacher to conduct a post-activity review and discussion of the mechanics of measuring different types of objects and as well as their methods of reading off the measurements to derive the length and breadth of the designated objects.

This innovation is relevant in the age where there is a growing interest in the education scene for alternative avenues of showcasing and assessing students' work. Online publishing through the creation of webpages or the development of e-portfolios on learning management systems (LMS) are such examples. However, publishing students' work online is an arduous task because students' work has to be digitalised before they can be posted online. Imagine publishing students' observations of the growth of their green bean plants online on a daily basis without moblogging, posting individual observations would seem to be a physically impossible task to achieve if the teacher is going to collect all observations from written logbooks and type them out on a word processor before posting these observations on a LMS. Furthermore, if students are keen on adding photographs of their green bean plants at their different stages of growth to their logbook entries, even if students use their own digital cameras, students themselves would have to first transfer the files from the camera to CD before passing it to the teacher to post the photographs online. Even if students were to create their own webpages to showcase their logbook, students have to be first competent in creating webpages. Students may spend more time creating and designing the webpages compared to the time spent on cognitive processes of predicting, analysing and evaluating their ideas about how plants grow. Thus moblogging helps to do away with all the levels of data transfer and free up more energy for both teachers and students to focus on real teaching and learning.

(3) Visual documentation of learning

Quick assessment of students' learning

Effective teaching is measured against whether our students have learnt successfully. However, learning is a cognitive activity which is difficult to assess yet educators are aware that it is far more important to check on the processes rather than the product of learning. In the case-study of "A Measure of Fun!" Mathematics Trail, moblogging allowed students to take a photograph of how they positioned their measuring tapes on the designated objects to measure their lengths. This visual documentation of learning goes beyond the mere inclusion of a photograph. They are in fact, evidences of students' learning which sometimes help to surface misconceptions for clarification.

In a traditional classroom setting, the quickest approach to assess students' learning is through the age old method of eliciting verbal responses from students pertaining to the concept. However, there is a limitation to how much teachers can assess accurately whether students have really mastered the concepts based on verbal responses, even if they are correct.

Removes pressure to draw when graphics are required in learning

In addition, when learning requires a visual graphics to enhance learning as in the case of the keeping of a logbook on the growth of green bean plants where graphics of the pants are important to show examples of change, moblogging provides a quick solution. As opposed to traditional paper-and-pen logbooks, students do not need to draw their plants. This benefits students who are less talented in drawing. It is also time-saving, as it takes less than a minute to take a picture of their plant and send it to the class blog. Furthemore, photographs are accurate representations of the plant observed at the specific moment as compared to sketches which may sometimes miss out on certain details or are misrepresented by the colour and proportion of the plants. Moblogging allows visual documentation of these plants without stressing on the artistic talent of students.

Facilitates teacher monitoring

Moblogging is found to be effective in facilitating teacher monitoring. In the case-study of "A Measure of Fun!" Mathematics Trail, it was physically impossible for the teacher to monitor every group as they move from one station to another. Logged on to the Internet either through the classroom computer or a PDA, the teacher is able to track which groups are actively involved in the Mathematics Trail based on the moblog entries posted to the class blog.

(4) Students' work as teaching resources

The documentation of students' work provides excellent sources of teaching resources. In the case-study of the keeping of an online logbook on the growth of green bean plants, students' moblog entries of their observations of their plants complete with corresponding photographs provided opportunities for as inquiry-based learning. For example, one student's moblog sparked off a class discussion on what was growing in the middle of stem of his green bean plant.

mervyn day 7 *the height of the plant is 17cm. 3 bean planted. 2 bean* ***germinated.*** *there is something at the middle of the stalk. i suspect that it is a flower.*

The discussion led students to make predictions and reason whether what Mervyn saw will grow into a flower, a fruit or another leaf.

In the "A Measure of Fun!" Mathematics Trail, photographs of how students measure the designated objects were used to discuss which methods were right and which would yield the most accurate measurements.

The use of students' resources for teaching not only provides opportunities for inquiry-learning, it also provides a real world context for learning which students themselves are able to identify with since it is their product of learning. According to Berry (1997), there is a danger in teaching a fixed set of facts within a chosen content area. Moblogging which captures students' work helps surface inconsistent examples of what is generally taught and opens up more opportunities for deep learning.

(5) Sharing of knowledge created

Defies the physical constraint of classroom walls for the display of students' work

As the final destination moblog entries arrive at are blogs, the nature of blogs as an online archival storage of data facilitates the sharing of knowledge learnt from moblogging activities. Knowledge created is not longer confined to the four walls of classrooms because moblog entries are not physical but rather digitalised. The display of students' work is not constrained by the availability of space the classroom walls have and this allows teachers to showcase all students' work instead of selecting only the best to display. Furthermore, there is also a time constraint to consider especially since school days are always packed with activities and there is little time for students to walk around the classroom to view their classmates' work.

A commonplace for the display of students' work

Blogs provide a virtual space to bring all students' work together in a common place at a moment in time. This is similar to e-portfolios where students work are all 'collected' in a virtual space where it makes it easy for students and teachers to access these works.

Students' work organised topically for easy access

In addition, as blogs allows information to be archived according to topics, it is easier to access to all moblog entries related to a particular topic. In the case-study of the online logbook documenting the growth of green bean plants, topics were created to organise the blog entries according days of growing the green bean plants, e.g. Day 7. Students were taught to include the code to post their moblog entries to the topics reflecting the days of growth.

Sharing of knowledge between students and with stakeholders

Moblog entries posted on blogs facilitates peer-learning because students can view their friends' work online. Class blogs also provides the opportunity for greater interaction between our stakeholders- parents and community, by keeping them informed about the learning that takes place in our classrooms.

(6) Continued learning at home

The sharing of knowledge created online meant that learning can take place outside school hours. Students can read their friends' work at home at their own time. Depending on the blog platform used, some blogs have comment features which allow visitors to the blog to leave their comments on the moblog entries. Peer-learning can be structured to maximise learning by setting students the task of evaluating, commenting or discussing about the moblog entries posted by their friends.

(7) Increased motivation in learning

In all of the case-studies, students' increased in motivation on the task and on the learning that continues after the moblogging activities can be observed. This can be attributed to a few reasons:

Joy of seeing personal work published online

Moblogging provides instant gratification of seeing work published online within minutes because of its capability of immediate transfer of data to the blog. As opposed to the other alternative of online publishing such as webpages, students have to take a longer time to view their work online as they will have to spend time handling the mechanics of transferring their work to the webpages as well as webpage design. Furthermore, as mentioned in the 5th advantage of 'sharing of knowledge created', more student work gets to be showcased rather than just the very best. This motivates students because the online publishing of their work, regardless right or wrong, is a recognition of their personal contribution to the activities. Sometimes teachers need to remember that the real issue is not whether students managed to get the final product right but whether they have experienced all the right processes of learning to value-add to their existing knowledge.

Association with outdoor learning

The mobility of this technology makes it an excellent tool for outdoor or out-of-classroom learning such as fieldtrips. Out of the three case-studies, two are out of the classroom activities- “A Measure of Fun!” Mathematics Trail and Singapore Zoo Moblogging Competition. The increased motivation in learning may be attributed to its association with outdoor learning.

Mobile phones- the forbidden fruits in school

Moblogging is associated with out-of-school practices and students are usually surprised when they are told that they will be using mobile phones for their lessons. The motivation of learning arises because of the novelty of using mobile phones as an educational tool as well as the awareness that opportunities like these do not come by very often. This is because students are not encouraged to carry mobile phones to schools due to concerns of theft or distraction. Mobile phones are very much the ‘forbidden fruits’ of school. Hence students tend to be very focused in these activities because they treasure every opportunity to ‘taste the forbidden fruits’.

(8) Bridging the gap between school discourse and real world discourse

Blogging is a popular culture in Singapore. According to statistics provided by Internet World Stats updated on 10 March 2007, 66.3% of Singapore’s population is connected to the Internet which is the fourth-highest percentage in Asia behind Japan, Korea and Hong Kong. Singaporeans are also avid bloggers on blogging websites such as Bloggers.com and social networking websites which hosts blogs such as Friendster, MSM Space, My Space, Multiply and CampusMoblog. A quick search on the number of school-related blogs in Singapore with actual school names as blog names found that there were 159 such blogs on Friendster and a total of 744 blogs on CampusMoblog, with 312 identified as primary school blogs and 432 identified as secondary school blogs. Blogs identified with schools on CampusMoblog functioned as personal blogs, class blogs as well as school blogs where some were used as part of classroom teaching and others used for the documentation of class or school events.

Blogging and moblogging made possible with websites such as CampusMoblog, is very much a way of life for our students. Snyder (2001) observes that in this age of a New Communicative Order where new technologies have altered everyday modes of communication, social practices related to work, education and entertainment are becoming increasing blurred. Negroponte’s (1996) prediction that tools which people use to work with and the toys to play with in the future will be the same, aptly describes the reality that has come true just within these few years.

Teachers need to remember that technology has become a seamless part of our students’ lives such that Pranskey (2001) terms them as Digitial Natives. Embracing popular culture like moblogging is not only a matter of only bringing the satisfaction derived from these out-of-school practices into school practices in order to increase students’ motivation and interest in learning (Hull & Schultz, 2002). A more important reason to bridge school discourse with real world discourse is the need to prepare for the New Communicative Order by equipping students with a broader range of skills taught in traditional classrooms (Street, 1998). However, this preparation does not refer to the learning of specific technological tools but rather the learning of general ICT skills. Technological tools, moblogging included, may be short-lived but learning to learn how to apply technological tools to improve learning will never end. Kennewell et. al. (2000) suggests that it is not possible for one to be fully ICT capable because there will always be some aspects of ICT that he or she has not fully embraced. It is this spirit of learning that we hope our students can grasp to be empowered in the New Communicative Order. By incorporating moblogging into teaching and learning, it provides students with the opportunity to learn how to approach and adapt to new technologies which will inevitably become a common practice in the future because of the high rate of new technologies emerging in every few years.

4. CONCLUSION

In summary, moblogging was found to be a highly mobile tool which encourages outdoor collaborative learning. It is a time-saving tool particularly because it allows immediate transfer of data to the class blog and this motivates students’ learning as it provides instant gratification of work accomplished. The ability to upload photographs taken with the mobile phones allows visual documentation of students’ learning in real representations of the objects photographed and this facilitates quick teacher assessment and evaluation of students’ learning. Moblogging also reduced the average time of monitoring students because teachers can view how involved groups are at the task based on the rate of moblogging postings on the class blog during the moblogging activities. It can be used as an e-portfolio because it is an archival online storage which makes visible what students do and what teachers teach in the classroom (Stefanakis, 2002).

The success in the use of moblogging for teaching and learning like any other ICT, depends largely on how the teacher perceives what the technology can be used for. The fundamentals of pedagogy stand even in the midst of a changing technological world.The case-studies implemented were successful because they were grounded in pedagogy right from the planning stage. The keeping of an online logbook to document the growth of green bean plants modelled after inquiry-based learning and the “A Measure of Fun!” Mathematics Trail modelled after problem-based learning. These two activities were not isolated activities but they are a part of a sequence of lessons. "A Measure of Fun!" was implemented as a trigger activity which is followed by a discussion of the mechanics of using measuring tapes and rules, and how to read off measurements. The online logbook on the growth of green beans plants allowed deeper learning and application of the concepts of the lifecycles of plants taught in formal lessons.

Successful implementation also required good classroom management and a thorough think-through of the processes involved in the activities. Proper training must be provided right from the beginning so that students can focus on the tasks ahead. The case-studies should be a comfort to many educators because they were carried out with 9 year olds and these children were found to be fast-learners even though some of them had no prior experience of MMS. It is also important to free up mechanical processes to free up energy for more cognitive processes. This can be done through proper grouping to ensure good group dynamics and involvement, providing scaffolding and ensuring that the mobile phones are prepared before the activities.

Mayes (2001) questions if there is a need for a new pedagogy for online learning, or in this case, the use of moblogging. Answering his own question, he believes that "…it is not new pedagogies that we need, but new ways of providing existing pedagogies efficiently and flexibly." The important thing that educators need to realise is that with the use of moblogging and any new technologies, it is far more important to fit the tool to pedagogy and not the pedagogy to the tool.

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Cooperative Learning and Motivation:
Students Developing Multimedia PowerPoint Presentation

J. Gordon NELSON
Educational Resources, Jacksonville State University
Jacksonville, AL 36265 USA

ABSTRACT

Although PowerPoint presentations have become a standard method of teaching, many instructors still use PowerPoint much like an overhead projector using only written text. The multimedia potential (i.e., sounds, graphics, videos, and bullet control) are under-used, and often these presentation are boring and elicit student "off task" behaviors (i.e., cell phone, talking, sleeping, etc.). This paper reports on the development of a classroom motivational and constructivist three stage model called *The Knowledge Navigator* which blends current technology with past successful teaching strategies. *The First Stage: Individual Work* consists of a more traditional approach (Teacher Centered, Direct Instruction, and Modeling). The instructor teaches/models course content using multimedia PowerPoint presentations (sounds, pictures, timing, etc.). The *Second Stage: Group Work* consists of hands-on computer instruction to help students develop multimedia PowerPoint skills (Teacher Mentoring, Student Centered, and Cooperative Learning). Students work in small groups (3-4 students) developing multimedia PowerPoint presentations to teach course content. The *Third Stage: Group Presentations* consists of students teaching course content using the above multimedia PowerPoint technology skills (Student Centered with Presentation Skills Development). Course concepts taught to the class are graded on a rubric developed by the teacher with input from the students.

Keywords: Multimedia PowerPoint Presentations, Constructivism, Motivation, Creativity, Cooperative Learning.

1. INTRODUCTION

Throughout the history of teaching there have been many methods and strategies explored, but basically teaching was *didactic* (lecturing, direct instruction), *heuristic* (discovery learning, problem solving, discussion, group work), *experiential* ("hands-on" as in art or mechanics), or some combination of the three. As the discipline of Educational Psychology began to emerge in the 19th & 20th century, more attention was directed towards pedagogical strategies. Research on teaching has developed into a smorgasbord of strategies, most useful but largely dependent on the skills, attributes, and preferences of the teacher.

New challenges are now emerging as we continue into the Information Age. Our students are changing, spending more time with TV and techno-gadgets rather than enriched, in-depth, and reflective conversation. The challenges for higher education instructors are greater now as they struggle to compete for student attention amid the ubiquitous cell phones, blackberries, sleeping, and in class talking (etc.).

2. "KNOWLEDGE NAVIGATOR" THREE STAGE MODEL

In the past few years, exploratory research has been conducted at Jacksonville State University, Alabama, on a three stage model called *"The Knowledge Navigator."* This model attempted to blend current technology with past successful teaching strategies. (Elements at this stage include the following: Direct Instruction, Cooperative Learning, and Creativity Concepts, and Constructivist Ideas.)

Stage 1: Individual Work:
Instructor taught course content with Multimedia PowerPoint (MPP) presentations, and taught/modeled basic MPP presentation skills. Skills included using (1) **research methods** to find content material (Google, etc.), (2) using **sound** - searching for and/or changing sounds to "wavs" using Accessories/Sound Recorder, saving the sound (save target as), embedding a sound in "slide transition" or "custom animation" through "other sound," (3) using **pictures** - and not thumbnails, and (4) using **timing** – inter and intra (bullet control) slide effects. (Elements at this stage include the following: Teacher Centered with Direct Instruction, at the Knowledge & Comprehension Levels.)

Stage 2: Group Work: Instructor used hands-on computer experience to teach MPP skills. Group Presentation procedures were discussed and consensus on evaluation rubrics reached. Creativity concepts were also taught, such as (1) beginning with divergent thinking (brainstorming, deferred judgment, and incubation) and ending with (2) convergent thinking (i.e., thinking – judging). Students were then assigned to work in cooperative groups (3 or 4 per group) on course content MPP presentations with instructor helping and monitoring. (Elements at this stage include the following: Teacher Mentoring, Student Centered, & Cooperative Learning at the Application, Analysis, and Synthesis Levels.)

Stage 3: Group Presentations:
Students taught course content using the above acquired technology skills. Concepts taught to the class were graded on a rubric developed by the teacher with input from the students. (Note: Students can teach several concepts throughout the semester and change or not change group configurations at the discretion of the instructor.) (Elements at this stage include the following: Student Centered with Presentation Skills Development at the Evaluation Level.)

3. PEDAGOGICAL FOUNDATION

The following teaching models were helpful in developing the *Knowledge Navigator* model.

1. **Gray's "Helping Relationship" Model [4]** (www.mentoring.ws)**:** Gray's (1984) model is based

on the progressive steps from *Teacher Directed* to *Student Directed*. It is symbolized as follows:

T > Ts > TS > tS > S

The upper case **"T"** is *teacher directed* with direct instruction. The **"Ts …TS … tS"** are *various teacher interactions* with the progression moving towards **"S"** *student centered* involvement.

2. **Johnson/Johnson Cooperative Learning [5]** (http://www.clcrc.com)**:** The Johnsons (1975) research of students working in cooperative groups is well documented. In the *Knowledge Navigator* model, students are involved in cooperative groups working on multimedia presentations.

3. **Zahorik's Four Types of Constructive Teaching [7]** (http://www.pdkintl.org) – PDK Fastback**:** Zahorik's (1995) information helps to differentiate the various types of constructivist strategies.

   Four Constructivist Teaching Methods
   - Type 1: Application
   - Type 2: Discovery
   - Type 3: Extension
   - Type 4: Invention

4. **Bloom's Taxonomy** [1] (http://faculty.washington.edu/krumme/guides/bloom.html): Bloom's (1956) model can be used to develop lesson plans and evaluation for teaching at different cognitive levels.
   - Knowledge – Knowing procedural and strategy skills by rote memory.
   - Comprehension – Being able to explain (translate) skills or concepts in "your own words."
   - Application – Being able to apply these skills and concepts to produce multimedia presentations.
   - Analysis – Being able to "break-down" the concepts into component parts.
   - Synthesis – Being able to "synthesize" the elements into creative ways of presenting the material.
   - Evaluation – Being able to evaluate your final product.

5. **Feldhusen's Three-Stage Enrichment Model [3]** (http://meltingpot.fortunecity.com/ethiopia/91/stage.html) Although Feldhusen's (1986) model is for gifted children, the idea of the 3 stages, as listed below, was helpful. This model was used as a higher education model in the 1970s with 3 useful methods of grading, as indicated below.

   Stage 1: Individual learning – Exams
   Stage 2: Group Work – Group Grade
   Stage 3: Individual Project – Final Paper

6. **Farley's Type T Personality [2]** (http://www.typet.com/custom/about_type_t.html) Farley's (1986) Type T (Thrill Seeker) psychobiological model is based on variation in individual trait arousal levels (low, moderate, high), i.e., those with chronic low arousal levels are high stimulation seekers and those with high arousal levels are low stimulation seekers. Thus, the implications indicate that high stimulation seekers assuage their appetites with *socially disapproved* stimulation (delinquency and crime) or a *socially approved* stimulation (creativity). Implications for this paper are that inattentive students would be high stimulation seekers, and that the rich stimulation in viewing and preparing MPP presentations would increase attention and time-on-task behaviors. In a past research project on "class clowns" in elementary school, the high appetite demands for stimulation among the high stimulation seekers were observed as they tried to satisfy their needs through clowning and disruption (Nelson, 1994) [6]. In higher education, these same students might not act out, but they would find it difficult to stay focused.

4. MULTIMEDIA POWERPOINT PRESENTATION SKILLS

The following *Five Basic Skills Needed to Create an Effective Multimedia PowerPoint Presentation* was taught to the students in this program:

1. **Getting Ready**
   - Toolbars: Click on *View … Toolbars …* and choose your tools by clicking on *Standard, Formatting, Drawing,* and *Picture*.
   - Slide Layout: Click on *Format … Slide Layout …* Choose *Text or Content Layouts:* You can move and change them.
   - Slide Design: Some look nice, but they can limit your creativity. I avoid them.
2. **Develop your Content**
   - Choose a subject and search the internet to get an "advanced organizer" for acquiring your material.
   - Important: Use content bulleted points, but don't be "text heavy." (Bulleted Font Size should be at least in the 20s – bigger is better.)
   - Important: Use Bullet Control by choosing *Custom Animation* for the bulleted text. This helps to focus student attention and increase on-task interaction.
3. **Select Pictures**
   - Search for Pictures (Google … Image Tab …). Three methods to acquire pictures are as follows:
   - Put your cursor on the picture and … Copy & Paste to the slide.
   - Save to Folder and Insert
   - For those who cannot "copy & paste" or "save & insert," click the "Print Screen" key on keyboard, and "Paste" on slide. You will then have to "crop" to get just the picture with "cropper" on "Picture Toolbar."
   - Important: Use pictures; don't use thumbnails! In your Google search, you will see pages of thumbnails. If you hover over the picture, your cursor will look like a hand with a "thumb." DO NOT save or copy a thumbnail as the resolution will be inferior. Left click on

the thumbnail and you will see it towards the top of the screen. That's another thumbnail, so left click on it again and you will see the real picture. You can hover over that picture and the cursor will be an arrow and not a thumb. This is the picture you want, so you can "copy & paste" or "save picture as." The most common mistake is using a "thumbnail" and not a "real picture." It essentially could ruin your presentation.

- Animated GIFS: They're like pictures but they move during the presentation.

4. **Select Sounds**
   - Search for WAV Sounds, they work best with PowerPoint. Go to Google (www.google.com) and type in the name of sound and WAV or WAVS (e.g., lion wav). Another good site is www.ilovewavs.com (notice there is no "e" in "wav").
   - Saving sounds: "Right click" on "Save Target As" -- check Name, Destination (e.g., Desktop) and type of sound (e.g., WAV).
   - Important: Always embed (not insert) a WAV (i.e., go to *Slide Transition* or *Custom Animation* … no sound … scroll down, skipping the canned sounds, to bottom … "other sound" … click and go to desktop or folder where you saved it.
   - Try to avoid MIDI, as they have to be inserted. You'll see a "horn" in the middle of your slide, and you have to carry the sound with you (i.e., you have to place the sound on the desktop so the "horn" can "find it.") If you have to use MIDI, use *Insert Sound from File* or use the Sound Recorder in Entertainment in Accessories to record the sound as a wav (you might need to go to Edit … Audio Properties … Sound recording Volume … and click on Wav Out Mix (if you are on "Microphone").
   - Sound Recorder (Accessories or *Sonic Foundry* software)
   - Play a sound from a CD: Insert Movies & Sounds … Play CD Audio Track.
5. **Movement**
   - Intra-slide movement. Go to *Custom Animation* and select the type of motion with text or objects (e.g., zoom in). Important … use Bullet Control with *Custom Animation*. Control the bulleted points for higher group interaction.
   - Inter-slide movement. Go to *Slide Transition.* Dramatic moments can be achieved by timing a selected group of slides to run automatically with music (e.g., box in, stripe down, etc.).

5. PROGRESS & CONCLUSIONS

Approximately 200 students a year take EIM 410 *Information Age in the Classroom* at Jacksonville State University, Alabama (College of Education & Professional Studies, and Department of Educational Resource). Only MPP skills are taught in the course (with other projects in Word and Excel), and the feedback has been highly positive (Business majors occasionally sit in to learn presentation skills). There have been past Educational Psychology courses that have used the *Knowledge Navigator Three Stage Model* with great success, and plans are being made to test this model more extensively.

At this point, most of the data is anecdotal (high level of interest) and observational data (higher levels of attention, motivation and "time-on-task" behaviors). The only "hard data" at this point are course evaluations. On a scale of 1 to 5 with 5 being the highest evaluation, the courses taught using the *Knowledge Navigator Three Stage Model* consistently receive averages from 4.8 to 5.0, however, to date there has only been one instructor using this model which would make this an N=1 experiment.

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From zero to hero – is the mobile phone a viable learning tool for Africa?

Merryl FORD
Meraka Institute, Building 43, CSIR, Meiring Naude St, Brummeria, Pretoria, 0001, South Africa
Tel: +27 12 841 4601, Fax: +27 12 841 4720, Email: mford@csir.co.za

Jacqueline BATCHELOR
University of Pretoria, Groenkloof Campus, Pretoria, 0001, South Africa
Tel: +27 83 616 0948, Fax: + 27 12 667 1367, Email: j.batchelor@cornwall.co.za

ABSTRACT

In many countries mobile phones are being banned from schools amidst growing concerns regarding their inappropriate use during school hours. However, the mobile phone is the de-facto most important networked knowledge exchange technology used in Africa and the most powerful universally-accessible computing device in the hands of Africans. How do we change the perception of the mobile phone as a disruptive influence in schools to one where it can be used to pragmatically support the learning process? MobilED (Mobile EDucation) is a 3-year international collaborative project aimed at creating meaningful learning environments using mobile phone technologies and services. The MobilED project was initiated in South Africa and the first two pilots consisted of exploratory research into the use of mobile phones in an advantaged private school and in a poor government school in Tshwane, South Africa. This paper examines the viability of the mobile phone as a learning tool in schools in Africa by using the MobilED project as a case study. It discusses the current anti-mobile phone situation in many schools in South Africa and suggests possible strategies to harness the potential of the mobile phone in practical ways as a pedagogically-appropriate learning tool in schools in Africa.

KEYWORDS

mobile learning, mobile phones, developing world, South Africa, Africa, learning scenarios, ICT, school, technology platform, computing device, audio-wikipedia, text, SMS, search term, Wikipedia, speech synthesizer, information society

1. INTRODUCTION

The United Nations Secretary General, Kofi Annan, on World Telecommunications Day, May 17, 2004, told the world: “Today, many people could not imagine daily life without the use of increasingly sophisticated information and communication technologies (ICTs), from television and radio to the mobile telephone and the Internet. Yet for millions of people in the world's poorest countries, there remains a digital divide excluding them from the benefits of ICTs” (United Nations, 2004).

Although South Africa is a country where there are pockets of first world environments, it is still largely a developing country with the typical problems and issues experienced in such contexts. It is an environment where affordability, accessibility, limited electricity supply and lack of infrastructure has led to a general lack of ICT-literacy amongst the majority of people. According to the School Register of Needs (Department of Education, 2000) survey, of 27 148 schools, only 58 percent had electricity, 55 percent had telephones, 30 percent had computers, and 16 percent had access to the Internet.

However, the advent of the mobile phone is set to have a major role as a catalyst for the information society as well as the narrowing of the digital divide in South Africa and the rest of Africa. According to the International Telecommunications Union, Africa’s mobile cellular growth rate has been the highest of any region over the past 5 years, averaging close to 60% year on year. The total number of mobile phone subscribers continent-wide at end 2004 was 76 million (ITU Report, 2006). The economic and social benefits of mobile phones are evident at all levels of society and the penetration rate of mobile phones is significant, especially given the fact that access is often shared (Vodafone Policy series, 2005).

Even with all the positive aspects of the rapid adoption of the mobile phone in developing countries, many of the negative issues are receiving a lot of popular media coverage in South Africa. Many schools in South Africa are either banning mobile phones from school premises, or locking them away during school hours. A popular instant messaging service, known as “MXit” which enables text chatting via mobile phones at a fraction of the cost of normal SMS messages, has taken the youth of the country by storm, with more than 3 million users, of which 45% are in the 14 – 18 year-old age-group (News24, 2007). Media reports state that this has led to inattention in class and the exposure of teens to sexual predators. In addition, mobile phones are also being used to videotape violent fights between children in schools and there are reports of children distributing pornography via their phones (Mail & Guardian Online, 2006). This is reminiscent of the early days of the internet in the 1990’s and many of the debates currently happening in South Africa about the mobile phone are similar to the debates that happened and are still happening in the developed world. The issues exposed by MXit are identical to those of the popular social networking platform, MySpace – the main difference being that mobile phones are the device of choice in the third world versus the ubiquitous networked computer in the first world.

Despite the controversy about the use of mobile phones by children, the reality is that modern mobile phones are very powerful computing devices, with built-in advanced multimedia facilities. In addition, if we have a closer look at the whole mobile phone infrastructure we will realize that the actual device can be seen as a terminal for using several computers in a network. When making a simple call or sending a SMS message we use (1) the “computer” of the mobile phone, (2) server computers of the operators and (3) the “computer” of the receiver’s mobile phone. When mobile phones are perceived as terminals for using computers we open up a new perspective for design and development of practices on how mobile phones could be used in different human operations and processes, including formal learning. Additional important considerations for using mobile phones as potential learning tools include features such as limited or no dependence on permanent electricity supply, easy maintenance, easy to use audio and text interfaces, affordability and accessibility (Masters, 2005; Mutula, 2002; Stone, Lynch, & Poole, 2003). MobilED (Mobile

EDucation) is a 3-year international collaborative project which attempts to link these features to the way mobile phones are used in informal learning contexts and builds on the advances made in the psychology of learning, which emphasize the collective nature of human intellectual achievements and the use of the mother tongue in the learning process (Ford & Leinonen, 2006).

The MobilED project was initiated in South Africa and the first two pilots consisted of exploratory research into the use of mobile phones in an advantaged private school and in a poor government school in Tshwane, South Africa. The pilots were undertaken in an increasingly hostile environment towards mobile phones in schools.

The outputs for Year 1 (2006) were a set of learning scenarios that have been successfully tested in schools and a prototype MobilED technology platform to support these scenarios. Year 2 (2007) is looking at how to build on the early successes, whilst expanding the platform and technologies. A big focus for the project is the challenge of making such an intervention sustainable in schools in South Africa (and Africa) and moving from a piloting to a mainstreaming approach.

2. RESEARCH FRAMEWORK

The approach of MobilED is to integrate research-based ideas of using mobile technologies in teaching/learning with active scenarios of real learning programs. The project includes the design, development and piloting of prototype applications where multimedia and language technologies (voice, text, images) will be used via the mobile phone as tools in the learning process.

The partnership consists of a collaboration between the Meraka Institute of the CSIR, Tshwane University of Technology, University of Pretoria (all South Africa), the Media Lab of the University of Art and Design Helsinki (Finland), Escola do Futuro Universidade de São Paulo (Brazil) and the WikiMedia Foundation (United States). For the pilots in 2006, handsets were donated by Nokia.

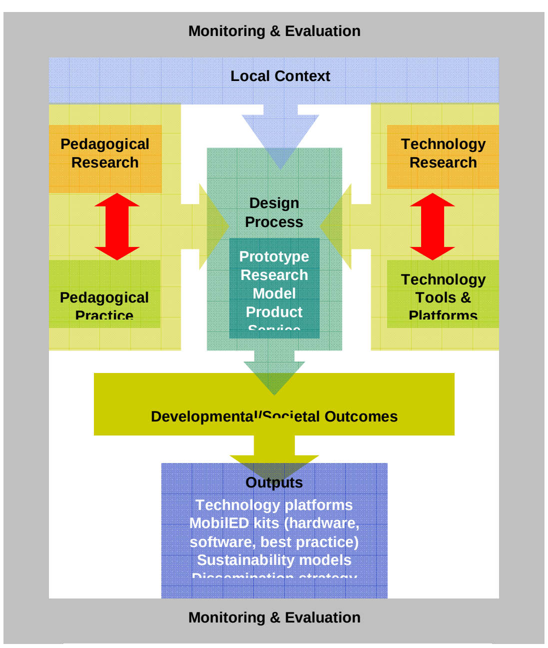

Figure1: MobilED research framework

The strength of the multi-disciplinary nature of the partnership as well as deep roots in cognitive, learning and design sciences lends a multi-pronged perspective to this initiative. In order to ensure cohesion and understanding between the different disciplines (which includes educators, educational researchers, educational psychologists, designers, software engineers and electronic engineers) a research framework was developed and is shown in Figure 1.

Each intervention needs to grounded in the local context. Central to the intervention is the design process, which is fed by both the appropriate pedagogical models and the potential of the technology itself. Since South Africa is a developing country, any intervention needs to take cognizance of the developmental and societal outcomes. (Ford & Leinonen, 2006). We are employing the *Outcome Mapping methodology* (as designed by IDRC in consultation with Dr Barry Kibel of the Pacific Institute for Research and Evaluation as an adaptation of the Outcome Engineering approach).

The research followed a mixed methods approach, making use of both quantitative and qualitative methods in collection and dissemination of the generated data.

3. MOBILED APPROACH

The approach taken in the school pilots was to build on the way mobile phones are used in informal learning contexts, by applying some of the techniques to a formal school environment. In our everyday use of mobile phones, we call our colleagues and friends to seek information and reciprocally help them in their knowledge acquisition and problem-solving situations. Simultaneously, we build up our social networks and strengthen the links that are considered very important in modern theories of learning (e.g. Senge 1990). In African traditional culture **'Umuntu ngmuntu nga bantu'** means literally, 'a person is a person because of other people'. In other words, 'you are who you are because of others'. Expressed variously as **'Botho'** in Sotho and Tswana and **'Umbabtu'** in the Nguni languages, this concept is about a strong sense of community where people co-exist in a mutual supportive life-style. This approach of using community-based knowledge systems is particularly applicable in the African context.

MobilED thus seeks to create technology that supports existing social infrastructures and increases the potential of current practices with mobile phones by introducing new opportunities for knowledge sharing, community-building and shared creation of knowledge in the authentic context of studying and learning. With this technology the participants may be encouraged to increase the value of their current practices through knowledge sharing and collaboration across boundaries of time and place. Freedom from the constraints of time and place enable the timely use of technology wherever knowledge acquisition and problem-solving are situational and contextual (Ford & Leinonen, 2006).

As South Africa is a developing country, the focus is particularly on those schools that have limited access to learning support and reference material (either using the internet or via traditional paper-based libraries), and teaching resources (teachers and text books). Although the project is not limited to these environments, this objective will always enjoy priority (van den Bergh & Aucamp, 2007).

From a technology perspective, all tools and platforms developed will be made available as Open Source Software

(OSS), in support of the collaborative, knowledge-sharing philosophy of the project. Probably the most important benefit of Open Source Software is that it stimulates the local IT sector in a country, which is crucial in developing countries to ensure full participation in the information society. From the social angle, OSS is highly beneficial because it allows software to be customised to local conditions by the communities themselves (Go OpenSource, 2006).

4. The Platform

It was decided to start with technology that is readily available in the poorest communities of South Africa. Although there is a very high level of mobile phone penetration in South Africa, the phones only have very basic functionality (RNCOS, 2006). This influenced the decision to base the first phase of the project only on voice and text (SMS) capabilities of mobile phones.

The first learning scenario developed consisted of a prototype mobile audio-wikipedia. The MobilED audio-wikipedia utilises the basic texting capabilities of mobile phones and enables the user to send a text message (SMS) with a search term to Wikipedia. The server responds to the user-initiated query with a return call where the article is read using a speech synthesizer. The user can navigate through the article using the phone keypad and may also add information by dictating content over the phone. The voice file is then appended to the article, for other users to access. This gives a user in Africa without access to a traditional computer connected to the internet the opportunity to use a very basic mobile phone to both access and contribute information to the body of knowledge, thus becoming a fully-fledged member of the information society.

Based on the scenarios developed, the technology development team built version 1 of the MobilEd platform. MobilEd employs three main technology platforms to achieve its goal (Aucamp, 2006):

- An SMS communication interface/gateway, such as Kannel (http://www.kannel.org) or Alamin (http://www.alamin.org/) to send and receive SMS's,
- the Asterisk Open Source PBX (http://www.asterisk.org/) for audio telephony communications, and
- a MediaWiki (http://www.mediawiki.org/) server with suitable content, such as en.wikipedia.org

A typical high-level use case of the system is provided in Figure 2, below.

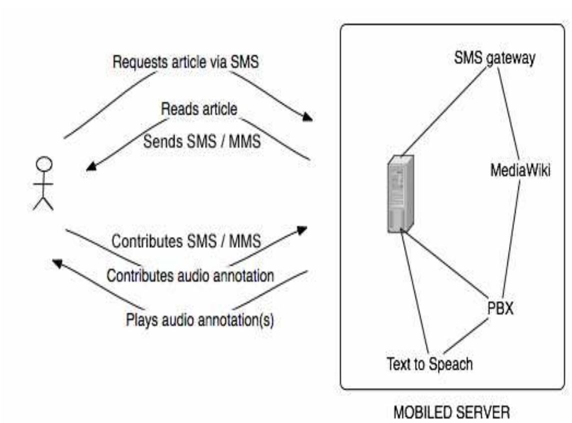

Figure : Simple high-level usage scenario (user's perspective). (Aucamp, 2006)

5. The Pilots

In the pilots the topic of investigation was HIV/AIDS. Various social aspects around AIDS were explored and investigated by the learners in an effort to explore and add to our rich "African Philosophical Thinking" and to promote sensitivity across a range of social contexts, cultures and races (Batchelor, 2007). The lessons were designed to be part of a two-week learning event and were classroom-based. Two double and a single lesson were used for the intervention, which involved 4 hours of contact time. Learning was group-centred and inquiry-based using the Jigsaw cooperative learning technique (Aronson et.al, 1978). The aim was for each group of learners to create an "audiocast" containing information about HIV/AIDS from their own perspective to their peers.

As part of the pilots, a MobilED "kit" was conceptualised. It consisted of a box containing:

- one mobile phone
- a set of speakers to amplify the audio received via the phone
- optional earphones
- electrical sockets for charging the phone
- instructions on how to use the MobilED service

All objects were colour-coded with stickers, and placed into a corresponding container to make distribution and control easier. The reason behind the compilation of the kit was that in an under-resourced environment, in a class of 30+ learners, the kit could be used with ease during collaborative learning events with easy assembly, charging and storage in a lock-up facility for safekeeping (Batchelor, 2007).

5.1 Pilot 1

It was decided to run the first pilot in a private school, where learners are from an affluent community and are fully technology-literate, since there was a need to test the first version of the platform. The results would then influence the design of a further, more advanced version of the platform (and learning design) which would be piloted in a poor, disadvantaged school.

The learners were very enthusiastic and supportive of the concept throughout the pilot period. Research questions were grouped together in themes and included those related to the group interaction, access of information, text-to-speech voice, reaction of the service, service settings and audiocastings.

Some of the results of the pilot are listed below (Ford & Botha, 2007).

- It was not necessary to "teach" the learners how to use a phone – it was an everyday skill that they had already mastered. Although these learners did not like the fact that the phones were shared in the group, the use of shared phones with speakers supported collaboration towards the shared task and video data shows that peer learning and support took place.
- The boys tended to "dominate" the technology usage.
- Learners were uncertain about the synthesized voice. Feedback was that the voice was very difficult to understand and that the speakers didn't work very well.
- The learners were enthusiastic about the (legal) use of mobile phones in the classroom and enjoyed the audiocasting experience.

- An unexpected consequence of the first pilot was that because of the positive experience from all involved, the school requested another pilot. Although this was not planned as part of the original intervention, an additional pilot (Pilot 1A) was run. In this pilot learners went on a trip to a theme park as part of a science lesson on energy. All interactions between the teachers and learners were via SMS. Some content was "seeded" on a wiki and the MobilED platform was expanded to include information retrieval via SMS as well. The learners used their own mobile phones and there was spontaneous sharing of mobile phone capabilities (such as photos, audio and video).

5.2 Pilot 2

Pilot 2 was run at a local government school. The learners were from very poor backgrounds and most travelled long distances from outlying rural areas on a daily basis to get school. Most learners did not own their own mobile phone, and many had never used a mobile phone. Although the school did have a computer lab, the computers had been stolen and the learners were not at all ICT-literate. The learners do not speak English as a home language, but are educated in English from Grade 6.

The learners were given a longer period of time to familiarize themselves with the mobile phones and they were also given a printout of a typical Wikipedia article. Since very few articles exist on Wikipedia in their home languages (Sepedi, Setswana, isiZulu), the lesson was given in English.

The experience for the learners during this pilot was once more very positive. In scripting and practising their audiocastings, a lot of indigenous song was used to contextualize their script. Their castings contained a lot of excitement, and some were very emotional in their recordings. The heightened emotions can be relayed to the topic of HIV/AIDS and their own personal experience of this disease (Batchelor, 2006).

Some results were as follows (Ford & Botha 2007):

- The teachers and learners wholeheartedly supported the concept. Learners were motivated and energized and clearly enjoyed the learning process. Whereas in the private school, teachers were conscious of the negative aspects of mobile phones in schools and were cautious in their approach, in the government school teachers wholeheartedly supported the MobilED concept. This can be attributed to the fact that most learners in the private school already had access to mobile phones and that there had already been some misuse of these phones in the school environment. In the government school, teachers had not yet experienced problems since the vast majority of learners did not have personal mobile phones.
- The teachers needed a lot of support to develop the lesson plans, and depended a lot on the work done in the previous pilot.
- Many of the learners spontaneously used the tool to find out information about other topics that they were currently studying. This was evidenced by the server log data recorded.
- Although the learners were not ICT-literate and very few had access to mobile phones, they took a very short time to familiarize themselves with the technology. For example, they discovered that the mobile phones had FM radio capabilities, and before long they had tuned in to the local radio station. They also discovered the games on the phones.
- Since many mobile phones are shared in their culture, they did not have a problem with sharing the mobile phone during the lesson and enjoyed the collaborative aspects of the tasks.
- It was interesting to note that the boys did not dominate the technology as in the previous pilot – there was equal use by both sexes.
- They were also less critical of the artificial voice (which had been improved in the interim).
- They said in interviews that they preferred using English as their language of choice for learning. They see English as the "academic" language and the gateway to opportunities later in life. It was interesting to note that interactions between participants were in their home languages, but most produced audiocasts in English. They were excited that their contributions could potentially reach a huge audience worldwide. It was obvious, though, that using English as the language of instruction was a major problem for some of the learners, as evidenced by the written responses to some of our questionnaires, which were in poor and broken English.

6. FROM PILOT TO IMPLEMENTATION

Although it is still early in the piloting phase, one of the deliverables of the project is to develop potential sustainability and business models for full implementation of MobilED in schools in South Africa. The need to support learning with appropriate ICTs in Africa is urgent – in our environment we cannot afford to only undertake academic research - learning from such pilots needs to be applied into real world environments. Over the next year, specific focus will be placed on a model for the "massification" of this technology. This model has to take cognizance of the current anti-mobile phone situation in schools. Some of the questions regarding mobile phones as learning tools are addressed below.

Is the mobile phone a viable learning tool? Isn't the screen too small to be useful?

The pilots clearly showed that mobile phones could be used constructively during the teaching and learning process in a formal school environment. The barrier of entry was very low - the learners themselves were very open to using the technology and the teachers could focus on facilitating the learning process, rather than having to grapple with new, unfamiliar technologies (as is the case with traditional computers). Thus both learners and teachers felt empowered and confident in using the phones as learning tools.

The pilots showed that there is a need to change the perceptions of using mobile phones in schools. They should not be seen as *only* mini-computers, and used in a similar fashion as a traditional computer. The focus should be on the strength of the device as a communication medium (whether using text-based or voice-based capabilities) to support learning paradigms such as social constructivism and problem- and inquiry-based learning. Our results did show that there is a need to provide some support to teachers with regard to employing mobile phones in learning situations. One of the methods in which this could be done is to extend the MobilED kit to include pedagogical guidebooks with descriptions of learning events, some reusable physical "learning objects" (e.g. laminated paper sheets) that will help teachers and learners implement mobile learning events, and a DVD with video footage of example projects. The MobilED kit could be part of the school's facilities, just like blackboards, overhead projectors, computers, etc. When a teacher wants to implement a mobile learning project it will be easy to take the MobilED kit to the classroom and when the project is over to return it to a secure environment (such as the teacher's room or school library).

Since a mobile phone is a portable device and can be used anywhere, anytime – the teacher does not need to take her learners to the technology (as per the computer lab model), but is able to take the technology to the learner – it also opens up the possibility of using the technology on field-trips and out of typical classroom environments. In the developed world a "socially and educationally responsible definition (of mobile learning) must view the learner as the one being mobile and not his/her devices" (Laouris & Eteokleous, 2005). This is a distinct advantage of employing mobile learning in the developing world - however, issues such as accessibility and affordability are still the main drivers. If we separate "mobile learning" into "mobile" and "learning", the "learning" aspect is the most important concept in the developing world.

What about cost implications?

Since the mobile phones used in the first pilots were basic models and only needed to support the ability to send an SMS, the cost factor for the handset was small. However, the network costs (sending an SMS and providing the content via a phone call) could become prohibitive if the service were to be provided widely in South Africa and Africa. It seems obvious that some kind of support would be needed from the mobile network operators in the various countries where MobilED could be implemented. One possibility is to give schools free or discounted rates for the educational use of mobile phones. There is already a special e-rate specified in the South African Schools Act, 1996 (Act No. 84 of 1996). This e-rate gives schools Internet access at a 50 percent discount. There may be a possibility of including mobile learning in the definition of the e-rate.

Other technologies which can cut costs include Voice-Over-IP solutions and other GPRS-supported services, such as the instant messaging service, MXit. In South Africa the cost of mobile data services is much cheaper than voice-, SMS- and MMS-related services and the situation is similar in other African countries.

All these options will be investigated in detail over the next 2 years.

How do we reverse the current negative public opinion on mobile phones in schools?

There is no question that currently there is a lot of "under the table" use of mobile phones in classrooms and that they are distracting influences. This came out very strongly in many of the interviews held while we were collecting data for MobilED. However, our approach is to educate teachers, learners and parents with examples of the positive use of mobile phones in a learning environment. We have therefore embarked on a series of interviews with the media where we are describing the pilots and are giving examples of how mobile phones could be used in pragmatic, positive and meaningful ways to support education.

One of the first mobile learning projects, M-learning (funded by the European Commission, the project partners and the UK Learning and Skills Council), which started in 2001 was instrumental in exploring the concept of mobile learning. Before that time they found that few people could even envisage the potential of mobile devices for learning (Attewell, 2005). In M-learning they did experience excessive use of devices for non-project activities and when this occurred they temporarily blocked phones and issued warnings that resulted in improved behaviour. In the MobilED project there were no similar cases (other than the phones being used to access other learning material). Learners were each given a fixed amount of airtime and they were expected to complete the assignment within that restriction.

M-learning also only had one reported case of inappropriate use of a device to access a pornographic website. At that stage the access to these sites, but recently the tools necessary to restrict website access have become available (Attewell, 2005). It is therefore possible to control such a mobile learning environment, if a school finds this necessary.

We have also found that the schools themselves are the best champions for mobile learning. Cornwall Hill College, the private school in which MobilED's Pilot 1 was undertaken, has embraced the idea and is involved with various of their own mobile learning pilots.

What about health and safety issues for children using mobile phones?

There are concerns with regard to the safety of children carrying mobile phones. One potential solution would be to store the phones at schools in a secure facility. This would not be the ideal situation, since it would hinder the use of the phone in out-of-school learning environments (such as using it as a tool to support homework).

The health issues regarding mobile phones are also still quite controversial. M-learning (Attewell, 2005) reports that the UK National Radiation Protection Board's (NRPB) independent Advisory Group on Non-Ionising Radiation (AGNIR) examined recent experimental and epidemiological evidence for adverse health effects caused by exposure to radiofrequency (RF) transmissions, including those associated with mobile telephone handsets and base stations. AGNIR has concluded that there is no biological evidence for mutation or tumour causation by RF exposure, and epidemiological studies overall do not support causal associations between exposures to RF and the risk of cancer, in particular from mobile phone use. AGNIR found a number of studies that suggested possible effects on brain function at RF exposure levels comparable with those from mobile phone handset use. However, AGNIR regarded the overall evidence as inconclusive (Attewell, 2005).

How could a school institutionalize mobile phones as learning tools?

After the pilots, Cornwall Hill decided to champion the use of mobile phones in their school and started developing a strategy for institutionalizing the phones. Additional work needs to be done, but some of the results are discussed below.

Because mobile phone use is difficult to monitor in a classroom setting, the appropriate use of these instruments can be encouraged through values-based principles, instead of managing it on a rules-based system. Values must be clearly defined, understood, communicated and practiced. Individual responsibility and accountability can be stipulated and its acceptance is to be encouraged amongst all stakeholders. Well-established communication channels can also ensure well informed participant behaviour.

Developing a clear strategy for the formal use of these instruments to facilitate learning is paramount to the success of adoption. This strategy can be divided into three different phases. The first phase focuses on creating awareness amongst the various stakeholders in a school setting. This can be achieved by creating an atmosphere of informed curiosity by running pilots and publishing the results in a local and global context. The second phase consists of an adjustment and developing phase where competencies are identified and policies drafted. It is crucial at this stage to offer support to those who want to come on board to keep the momentum and growing interest going. The final phase involves the identifying of mentors to coach and form ongoing relationships with those already involved in the initiative. Their role is to have a clear understanding of organizational context and to give advice on how to move forward.

The crucial factor in determining successful implementation of new strategies is to create cause champions in the process. It is the role of the champion to demystify the mobile instruments and to create an environment in which it can be viewed as just another tool in the toolbox of the educator to help them in their efforts to facilitate lifelong learning.

7. CONCLUSION

It is our contention that the mobile phone could be the de-facto ICT learning tool in Africa. Although there have been negative experiences with regard to mobile phones being misused in schools, we believe the vast potential of mobile phones integrated into the learning process outweighs this, as demonstrated by the first two pilots of MobilED. Rather than banning the device in schools (and sending it "underground"), we suggest that schools embrace the technology. It is a way of reaching today's generation in a medium in which they feel comfortable. Schools and parents need to be aware of the pitfalls of the digital world and the onus is on them to support and prepare learners to be digital citizens. Prensky (2005) puts the issue quite succinctly:

"Educators have slid into the 21st century — and into the digital age — still doing a great many things the old way. It's time for education leaders to raise their heads above the daily grind and observe the new landscape that's emerging. Recognizing and analyzing its characteristics will help define the education leadership with which we should be providing our students, both now and in the coming decades. Times have changed. So, too, have the students, the tools, and the requisite skills and knowledge. Let's take a look at some of the features of our 21st century landscape that will be of utmost importance to those entrusted with the stewardship of our children's 21st century education."

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Technology in Distance Teaching of Computational Models

Judith Gal-Ezer
The Open University of Israel
POB 808, Raanana 43107

Mark Trakhtenbrot
Holon Institute of Technology, POB 305 Holon
and
The Open University of Israel,
POB 808, Raanana 43107

ABSTRACT

The paper presents two complementary approaches in using Web technologies to address typical difficulties arising in distance learning of theoretical CS courses such as Automata and Formal Languages (AFL). The first focuses on reasoning-related problems that are addressed through pro-active tutor-driven discussions in a course netforum. It is based on an analysis of typical mistakes and misconceptions revealed in discussions of a set of appropriate examples developed especially for this purpose. The second approach addresses problems relating to the creation, validation and transformation of computational models; it is based on the use of software tools for hands-on exploration of the concepts and algorithms studied. Tools developed for distance learning of AFL are presented; they use visualization and animation to make mathematical models live and tangible. Integration of these tools into the asynchronous distance learning process is discussed.

Keywords: Computational models, analysis of misconceptions, visual tools, distance learning, active learning.

1. INTRODUCTION

Studying theoretical CS (TCS) courses represents a significant challenge for students: while many of the topics studied play a crucial role in the CS curriculum, they are characterized by a high level of abstraction. For example, the undergraduate course Automata and Formal Languages (AFL) explores mathematical models of computation such as automata and grammars, their properties and expressive power, transformations and translations between the various types of models. It provides a strong conceptual background for a variety of CS areas: construction of compilers, verification, design of digital systems, etc. However, students have serious difficulties in properly understanding the concepts and algorithms, their power and limitations. The challenge is even more severe in distance education, where communication obstacles may affect students' ability to cope with the course material (due to rare or no face-to-face tutorials).

Several researchers have addressed problems arising in studying AFL and other TCS courses, but without specific emphasis on distance education. Difficulties in learning non-deterministic automata were analyzed in [1]. Papers [3, 12] suggest various didactic strategies (e.g., using simulators, or relating AFL topics to programming languages) to help students achieve significant learning of AFL. In [9], ways to reduce abstraction when learning computability and other TCS courses are considered.

Based on the experience with distance teaching of AFL at the Open University of Israel (OUI), this paper analyzes and classifies the typical difficulties and misconceptions faced by students in TCS courses and their causes. It then presents two complementary approaches for overcoming these difficulties through active learning.

At the core of the first approach is the use of pro-active netforum discussions led by the tutor [16]. The goal is to reveal typical mistakes in reasoning (e.g., logical errors, incorrect analogies, etc.) and to see how they may lead to “proofs” of incorrect “facts”. For these discussions, a series of examples were developed that cover a variety of AFL topics and are based on an analysis of typical difficulties related to the theoretical nature of the course. The analysis focuses on reasoning problems as these relate to key skills required in TCS courses; such problems often lead to a variety of misconceptions and result in inadequate knowledge. This approach follows the guidelines to addressing misconceptions in science education suggested in [15]: identify students' misconceptions; determine what causes these misconceptions (in particular, what are the most difficult skills, and what errors occur most often during the execution of these skills); provide a forum for students to confront their misconceptions; help students to reconstruct and internalize their knowledge, based on scientific concepts.

The second approach is based on the use of tools for hands-on exploration of the models and algorithms studied. Tools developed at the OUI [7] help to achieve two major goals: to make the abstract concepts clearer and more tangible through visualization and animation, and to improve communication among participants by sharing visual executable models.

Recently, the need for visualization-based tools has become widely recognized. Research and development in this direction is performed in many universities worldwide, and includes tools for TCS courses, e.g., [2, 4, 6, 8, 11]. Report [14] presents an in-depth analysis of the role of visualization and engagement in CS education. In particular, it provides an overview of commonly accepted "best practices" on which visualization tools should be based, and offers a taxonomy that includes six forms of learner engagement with visualization technology. It also emphasizes that such tools are of real educational value only when they allow for student involvement in an active learning activity.

The OUI tools are based on this important principle, and support most of the "best practices" and engagement forms presented in [14]. These tools allow the creation of graphical models, their multiple views and static checks; simulation and animation with flexible execution control and dynamic feedback; transformations with visual traceability between the source and result models. Students can select a level of detail that ranges from viewing only the final result to presentation of all intermediate stages, with explanations and references to the textbook. In this way, students gain a good sense of the material and many problems are clarified in real time. Sharing models created with the tools allows for simpler communication (posting questions and solutions, checking and discussing them).

The combination of the two approaches has shown promising results. Students confirmed that it significantly improved their understanding of the material, and "opened their eyes" to many points whose meaning and importance were otherwise not sufficiently clear.

2. WHY IS STUDYING TCS DIFFICULT?

There are a variety of reasons for difficulties in studying TCS courses. Analysis of these reasons is essential for understanding typical difficulties and misconceptions, and for finding ways to address them.

Course nature and required skills

The nature of courses such as AFL implies heavy use of formal methods, and this is the main source of most problems experienced by students. First, motivation and intuition underlying theoretical concepts are often not sufficiently clear, so that the material remains overly abstract and intangible. Second, the use of formal language to describe abstract objects, their properties and relations, represents a serious challenge. This has direct impact on the students' ability to properly understand and discuss the material. Finally, the key skill required in TCS courses is an aptitude for precise mathematical reasoning; yet this is extremely difficult and even frightening for students [5]. Problems in attempting to employ formal reasoning methods lead to various misconceptions and end in inadequate knowledge. A student may complete a course and be able to solve problems mechanically (following canonical procedures), but without having developed an appropriate understanding of underlying concepts [9]. This shortcoming may seriously impair subsequent learning.

Students' background and motivation

OUI students can be characterized by a diversity of ages, backgrounds and goals. The majority are non-traditional students: they are older and often part-time students, with external job and family responsibilities. Such diversity is becoming a relatively common phenomenon, and the use of e-learning as a way to address it has been discussed; for example, in [13]. The emphasis on distance learning, self-study, flexibility in deadlines, and an open admissions policy (specifically, no math requirements for prospective CS students), seems to better fit the OUI students' needs. On the other hand, such flexibility affects their ability to cope with theoretical material.

While older students make a more mature choose of a study program, the significant break after finishing high school causes certain erosion in math skills required for CS studies. Furthermore, while the majority of CS students at the OUI study toward a full degree, some have different objectives in mind. It is common for students initially to take a few courses (that may count for them later) before making a final choice of what to study. Some students take only specific courses in order to close certain gaps in their existing education, or even simply to extend their horizons.

Finally, many CS students work in high-tech companies or hope for a high-tech career. Their emphasis is on courses that provide practical knowledge in programming languages, operating systems, development methods and environments, etc. They tend to view theoretical courses as something that they will not need for "real work".

Communication difficulties

In distance education, the use of the formal math language becomes an even more painful problem. While in traditional classes, students see formulas and diagrams appearing on a whiteboard, discussions in a netforum are typically conducted in natural language, with very little math notation. One reason is that many students do not feel comfortable enough with such notation. Other reasons are purely technical: integration of math symbols and pictures (e.g. state-transition diagrams) is not supported in regular message text; combining Hebrew (the language of study at the OUI) with Latin texts is complicated. The resulting verbal descriptions suffer from ambiguity that may cause misunderstandings and further misconceptions.

3. ANALYSIS OF MISCONCEPTIONS

This study covers four academic years of teaching AFL at the OUI; a number of students has grown over these years from 75 to almost 200 per semester (total 924 students). The study is based on an analysis of frequently occurring mistakes and misconceptions (and of FAQs) observed in classes, netforum discussions, e-mail messages, phone consultations, homework assignments and exams. A wide spectrum of typical problems have been identified and classified as follows:

- *Definitions of basic concepts*: misunderstanding nuances and their impact on the correctness of definitions

- *Reasoning-based problem solutions*: misunderstanding of theorem conditions and their necessity for theorem correctness (e.g., confusion of *if* and *iff*, misuse or mis-ordering of quantifiers; etc.); incorrect application of proof techniques; logical errors (e.g., "backwards" instead of "forwards" application of a theorem); incorrect analogy (e.g., all closure properties for regular languages are assumed also to hold for context-free languages)

- *Construction-based problem solutions*: difficulty in identifying sub-problems and integrating their solutions; difficulty in validating the solution

- *Application of learned algorithms* (e.g., determinization and minimization of finite automata): understanding and checking the pre-conditions of the algorithm; validation of the obtained result.

Such problems seem to be common to TCS courses in general. This paper considers two approaches that address them according to category. For reasoning-related problems appropriate examples are presented, and students are involved in netforum discussions that aim in revealing and highlighting typical mistakes and misconceptions, and showing how they lead to wrong results (see section 4). On the other hand, problems related to construction, transformation and exploration of properties of the studied models are better addressed via visualization and animation. For this, appropriate software tools are used. Section 5 presents the tools developed at OUI and discusses their integration in the distance education process.

4. ADDRESSING REASONING PROBLEM

We present an approach used at the OUI to address reasoning problems in distance education.

Combining question-driven and pro-active discussions

Netforum discussions are traditionally driven by students' questions regarding the material, assignments and exams. Our investigation has led us to the conclusion that this commonly-used method is not sufficient. It is helpful only when students themselves are able to identify their difficulties and then ask the relevant questions. In reality, students often become aware of their problems too late, e.g. after getting their checked assignments back. This usually happens weeks after assignment submission, when students are already busy studying other material. Hence the danger that many common misconceptions will be left without proper consideration.

OUI's experience shows that better results are achieved when this method is combined with a ***pro-active*** approach, driven by the course team. The basic idea behind it is similar to the guidelines in [15]: anticipate the most common misconceptions; use questions and discussions to probe for additional misconceptions; encourage students to test their conceptual frameworks in discussions with other students; address common misconceptions through appropriate demonstrations.

Shortly after students begin to learn new material, the tutor initiates a discussion on typical reasoning problems related to the topic. For this purpose, a series of examples have been developed that demonstrate "proofs" of wrong "facts" based on common reasoning mistakes. Students are invited to analyze these "proofs" and to find the mistakes and their cause. Instead of knowledge transmission by presenting an established truth, this approach involves students in the active construction of proper understanding by confronting their misconceptions. Some examples used in such discussions are presented in Section 4.2.

Another way used to involve students in pro-active discussions on conceptual issues is by providing extra materials and challenges. Where possible, interesting discussions related to the AFL material are brought in from general newsgroups, such as *comp.theory.* In addition, a variety of riddles are offered on the course Website. These are less standard than regular assignments, and yet are based only on the course material. Discussions around such riddles are fully open, and students can earn bonus points for taking part in them.

Regardless of their level of activity in the netforum, students confirmed that they view the pro-active discussions as very helpful for understanding many difficult points whose meaning and importance would otherwise remain unclear. Active and more advanced students gain additional confidence in their level of knowledge. More passive students (who mainly follow the discussions but rarely participate in them) see the issues raised by others and the relevant feedback; this helps them to identify their own difficulties and may trigger further questions.

Sample analysis of typical mistakes

Examples developed for pro-active discussions cover almost all study units of the AFL material at the OUI. Two are given below. Both present wrong proofs based on a misunderstanding of how closure properties for regular languages work. They "prove" that a certain language is regular, even though it is not.

"Theorem". Language $L = \{a^i b a^i \mid i \geq 1\}$ is regular.

"Proof" 1 (based on closure under homomorphism). Consider homomorphism $h : \{a,b\} \rightarrow \{a\}^*$ defined as $h(a) = a$, $h(b) = \varepsilon$. Therefore, $h(L) = (a^{2i})^+$, which is a regular expression. Due to the closure of regular languages under homomorphism, *L* is also regular.

Error: Closure under homomorphism states that if *L* is a regular language, then *h(L)* is also regular, while the "proof" applies this property in the opposite direction.

"Proof" 2 (based on closure under reverse homomorphism). Define homomorphism *h* as in "Proof" 1. Now, $L = h^{-1}(h(L))$ and *h(L)* is regular; hence due to the closure of regular languages under reverse homomorphism, *L* is also regular.

Error: This time the problem is caused by the incorrect assumption that $L = h^{-1}(h(L))$; this is based on an incorrect analogy with properties of basic arithmetic operations (e.g., *(n+1)-1 = n*). Inaccurate definition of h^{-1} for a given mapping *h* is a common mistake. In this case, $h^{-1}(h(L))$ includes all words over $\{a,b\}$ with an even number of *a*'s, not only those in *L*.

5. SOFTWARE TOOLS FOR EXPLORING COMPUTATIONAL MODELS

Recently, visual educational tools for exploring various computational models have been developed; see, e.g., [2, 8, 11], among others. Some of them (such as JFLAP in [8]) are multi-purpose software packages covering a wide spectrum of models and algorithms that relate to several courses (AFL, Computability, Compilation), while others concentrate on more specific classes of automata, Turing Machines, etc. See [4] for a survey and analysis of the main features of such tools.

The first visual tool used at the OUI in AFL from 1996 to 1999 was FinITE [10]. However, it covered a small part of the course material (only finite automata (FA); no regular expressions (RE) and no context-free grammars (CFG)), and allowed viewing of only final results in supported transformations (with no way to get a closer look at intermediate stages and no traceability to explain how the result was obtained). New tools developed at the OUI significantly extend FinITE's capabilities. The main features of these tools are presented below.

OUI tools for distance learning of AFL

Creation and editing of visual models (FA diagrams, CFG trees) is performed with easy-to-use graphic editors. Students can define and edit relevant alphabets, draw and edit elements, and define their properties (e.g. initial and final states in FA, start variable in CFG). The model can be saved in a file for future use.

Multiple views of models: At any time, a model can be viewed in either graphical representation of in formal math notation.

Static checks of models reveal properties that are hidden, e.g. letters in the FA's alphabet not used as transition triggers; or grammar variables that don't allow for any terminal derivation.

Simulation and animation are supported for deterministic (DFA) and non-deterministic (NFA) automata, as well as for CFGs. Execution can be either continuous, where only the final result is reported (e.g., whether the input word is accepted or rejected); or stepwise (forward and backward). For FA, each step shows the progress after reading the next letter in the input word; for easy monitoring of execution, visited states are highlighted. Backward stepping helps in recalling details of earlier steps, and is especially useful in simulation of NFA where at each step several states can be active simultaneously. When the input word is accepted, a detailed execution history is displayed. **Animation of derivation** in CFG is also supported in two modes. At each step one can select an occurrence of a grammar variable to be expanded (the tool then displays the list of rules for this variable), and then select a derivation rule to be applied. The animated derivation tree is then updated, making it easy to follow the derivation process.

A wide range of **transformations** is supported for various types of models: determinization and minimization of FAs; translations between regular expressions, automata and grammars; simplifications and translation of CFGs into the various normal forms. For example, in translation of an NFA into an equivalent DFA two stages are shown: elimination of epsilon-transitions and determinization. Full traceability between elements of the original and the resulting models is provided; e.g. for each state in the obtained DFA, it shows from which subset of states in the original NFA it was created. Similar traceability is supported in minimization of FA, and in the translation of a CFG into Chomsky Normal Form. In addition, student can select a level of details, to view either final result only, or all intermediate stages with explanations and references to the textbook.

Use of the tools in distance learning

An important thesis in [14] states that visualization technology, no matter how well it is designed, is of little educational value unless it engages learners in an active learning activity. Furthermore, it will be seldom used if it is not integrated as part of the teaching and learning resources of a class.

The OUI tools described here answer these challenges. Based on students' feedback, we believe that the tools improve the process of distance learning of AFL in several different aspects. The major one is the fact that the tools support (through various forms of visualization) active learning and the creation of appropriate knowledge of abstract concepts and their meaning:

During model creation, students become familiar with the various elements that constitute the model, their roles and relationships. The examples are states and transition function for FA; and for CFG - variables and derivation rules.

With multiple views of the model, students not only see the graphical representation, but also learn the relevant math notation used for model description.

Static checks uncover errors and incompleteness even before the model is simulated for the first time. This helps students to check that they understand the relevant definitions correctly.

Simulation and animation allow students to more easily validate the model and to gain the confidence that it accepts / generates the required language. Paper-and-pencil checks tend to be tedious, and students often submit wrong solutions "certified" by only 1-2 simple tests. The tools allow for comprehensive testing, localization of errors (using forward and backward stepping), modification of the model and simple repetition of checks. The animation capabilities also support the exploration of non-determinism (one of the more difficult concepts in CS) for automata and grammars.

An efficient way to improve the comprehension of various concepts and their relationships is to modify a model and to view the effect of the changes (e.g., how they affect model's correctness or its normal form). By using the tools, this process is feasible: results produced by simulations, transformations and translations before and after a change can be easily compared.

With flexible capabilities of derivation animation, students can conveniently explore such concepts as grammar ambiguity, various derivation policies (e.g., leftmost and rightmost derivation), and backtracking.

The tools help students get answers to many typical questions ***in*** real time. While this is always important, in distance learning it is crucial. Hence appropriate guidelines are provided on the course Website, describing typical workflows with the tools. The following example illustrates the workflow used for practicing FA determinization:

- Perform all the algorithm steps described in the textbook manually (i.e., without the tool) to transform the given NFA into an equivalent DFA

- Validate the obtained DFA by running it on several tests. Compare its behavior with that of the original NFA; they should produce same results on the same input words. Use the same testing technique to compare your solution (*my_DFA*) with the one generated from the NFA by the tool *(gen_DFA)*

- For full verification of correctness, use the tool again - this time to minimize both *my_DFA* and *gen_DFA*. The resulting FAs should be identical (modulo state numbering).

- If a problem *my_DFA* does not behave as expected, use the tool for determinization of the original NFA with the full level of details set at on. All intermediate stages will then be shown, with explanations and proper references to the course textbook

Finally, sharing models created with the tools improves communication between the course participants. For example, questions submitted by students are better understood when the relevant model is attached. Check of assignments also becomes easier, since models are executable (not merely static pictures!).

6. CONCLUSIONS AND FURTHER STEPS

The paper presents two complementary approaches to distance teaching of AFL. The first is based on the course netforum, and is driven by the course team (as opposed to the usual question-driven forums). Through the use of appropriate examples, it aims in analysis of typically difficult points and misconceptions related to the theoretical nature of the course. The identified categories of problems seem to be general enough and applicable to a variety of TCS courses. The second approach is based on the use of software tools for hands-on exploration of theoretical concepts and algorithms through visualization and animation. The OUI tools support most of the "best practices" and all forms of educational engagement with visualization described in [14].

Feedback from students (in the netforum and e-mail) leads the authors to believe that the combination of the two approaches has promising results. Students confirmed that it improved their understanding of the material, and opened their eyes to many points whose importance was otherwise not sufficiently clear.

Further research and development plans at the OUI relate to two directions: continuation of an analysis of typical misconceptions, and improvement of the integration of tools into the learning process. The latter will address these naturally-arising issues:

- Provide a better coverage of the course material

- Create intelligent learning tools with built-in examples and dynamic feedback (as recommended in [14])

- Develop assignments that involve mandatory use of the tools

- Provide access to the tools' functions according to the course schedule. For example, block viewing of detailed solution construction prior to submission of the relevant assignment, and re-open it after the deadline and towards the final exam.

- Check the effectiveness of the tools in synchronous teaching, both in class and in remote video sessions.

Continuation of the experimental use of the tools will surely help to achieve these goals. Planned activities include gathering and analysis of statistical data on the impact of the methods used on students' achievements in the course.

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The Lost Art of Discourse and the Unrealized Promise in Distance Education

W. R. Klemm
Professor of Neuroscience
Texas A&M University
4458 TAMU
College Station, TX 77843-4458

ABSTRACT

We live in a soap-box world where reasoned discourse is being drowned out by shouts of bloggers, talk-show hosts, TV talking heads, letters to the editor, and sound-bite politicians. People are increasingly disinclined to read, listen, reflect, and learn from the insights of others. Although everybody has an equal right to their opinions, not all opinions are equally informed or intelligent. One task of education is to teach students how to develop opinions based on reasoned discourse, a task that is made more difficult by an anti-intellectual popular culture. Distance education affords a possible remedy because it has asynchronous collaboration tools that can, when properly used, facilitate proper discourse. Yet this promise goes largely unrealized, because teachers themselves do not seem to appreciate how much we have lost of the art of reasoned discourse. Here, I hope to show how distance education technology can be deployed in systematic ways that help students to move beyond spouting of opinions to a spirit of inquiry, evidence gathering, analysis, creative synthesis, and conclusion-making based on written discourse with others.

Keywords: Computer Conferencing, Asynchronous Conferencing, Bulletin Boards, Distance Education, Conversation Theory

SOAPBOX CULTURE

These days, it seems as if everybody has an opinion — and they want to make sure you know about it. An abundance of soapbox venues makes it all too easy for anyone to spout their views. Consider the magnitude of blogging. Some 12 million adult Americans operate a blog site, according to the Pew Internet and American Life Project. Of these, 82% of the bloggers say they expect to be operating their blogs a year from now. Then there is the mind-boggling popularity of MySpace (over 60 million personal profiles), where youngsters seek out a platform to parade their experiences and views on seemingly every conceivable subject.

The associated trend is that many people are becoming loners. This trend was first captured in the famous book by Robert Putnam, *Bowling Alone* [13]. He mustered impressive data to document that, as one reviewer put it, "the United States has lost much of the social glue that once allowed our society to cohere, that we are becoming a nation of strangers to one another." In the world of public-school education, roughly 1/3 of adolescents drop out of school, an extreme indication of the preference to "go it alone." Putnam points out that there is almost a straight-line correlation between a wholesome childhood and what he calls "social capital." States (such as the Dakotas, Iowa, Nebraska, Vermont, Minnesota) where residents trust others, join organizations, volunteer, vote, and socialize, are the same states where young people are less likely to drop out of school. States where there is less social capital, particularly in many Southern states, youngsters are much more likely to be troubled. Without a background of social capital, children grow up with a dislike for working with others. The "bowling alone" syndrome is widespread, differing only in degree by geography, and may be increasingly exacerbated by electronic technology. When students are not using the Internet as a soapbox, they shut themselves off from the outside world with their iPods, videogames, and Internet surfing. Unfortunately, this isolation does not include much reading.

A marked decline in literary reading in the United States was discovered in a survey by the National Endowment of the Arts [2]. In 1992, 72.6 million adults in the U. S. did not read a single book. By 2002, that figure had increased to 89.9 million, the NEA said. The three youngest groups surveyed showed the greatest decline in reading, a 55% greater decline than in the adult population, a statistic that does not bode well for the future of education. In the U.S. in 2002, there were the same number of readers as there were 10 years earlier, despite the fact that the population had risen by 40 million [4]. Industry analyst, Jim Milliot laments, "Where Have All the Readers Gone? And Where Can We Find New Ones?"—that was the theme for the Association of American Publishers' 2006 annual meeting in New York [12]. The not surprising conclusion was that reading is losing out to electronic alternatives. This pernicious trend may not yet have caught on in all counties, but it is just a matter of time.

It is also not surprising that best-selling books are those dominated by religion, a genre dominated by self-preoccupation and by opinion, not fact. *Book Industry Trends* projects that publisher revenues will increase 18.3 percent over the next five years, but this growth will be driven by an over 50% increase in sales of books with religious themes [1].

AN EDUCATIONAL IMPERATIVE

Given the growing social isolation and self-absorption, it seems imperative for educators to help students learn the value of learning and working with others. In the workplace, discourse provides the mechanism by which workers generate and exchange ideas, reach decisions, make plans for service or product development and marketing, and evaluate services and products.

People use discourse for many purposes, but a comprehensive list would include:

- Present information and ideas
- Inform others
- Motivate
- Engage others in shared thought
- Explain
- Persuade others
- Accomplish goals and tasks

Educational practice that does not develop these social and communication skills is a disservice to students. Teaching of these skills is optimized by learning environments that require written discourse.

Written discourse has special impact because writing engages author and readers with content more rigorously than does speaking. Written discourse is always available for inspection, reflection, and refinement. Value comes from cooperative conversation in the service of creative enterprise. Written discourse promotes "listening," where the reader is invited to register information objectively, to flexibly reformulate one's own understanding and positions, and to incorporate the ideas of others into insightful analysis. Requiring students to conduct discourse in writing increases the odds that they will organize facts and ideas more coherently and with logical rigor and that argumentation will be more persuasive. Both the reading and the writing increase focus and encourage students to stay on task.

Educators now have electronic tools that can promote social and communication skills, though these are most often employed (and misused) in distance education courses. I am referring to Internet software that supports asynchronous communication. Most distance educators assign high priority to community building, because of the isolation and relative lack of social support in distance education environments. Asynchronous communication tools can greatly enrich learning in traditional teaching environments.

The asynchronous nature that on-line technologies make possible provide a way to enrich the usual nature of learning discourse. In a regular classroom, even one where discussion is encouraged, student commentary is sequential and transient. Students speak one at a time and the ideas are not preserved. In asynchronous on-line environments, everybody can speak (write) at once, and all ideas are always available for inspection and reflection. My colleague, Jim Snell, and I have briefly reviewed the comparative advantages and disadvantages of the various asynchronous on-line technologies (e-mail, list serves, threaded-discussion boards, and what we called Shared Document Collaboration Conferencing (SDCC)[7]

James Hewitt [6] has written a stinging critique of teaching with asynchronous bulletin boards. The very nature of such threaded-topic boards "provide few facilities for drawing together discourse in meaningful ways." There is no convenient capacity to cut across the hierarchical structure of a class conference for stimulating what he calls "convergent" discourse, where the assorted notes are used to synthesize or summarize ideas. He reports some interesting data from three graduate-level courses that used threaded-topic discussion boards. Of the 830 posted notes that were analyzed, only 2% even attempted convergence. Paradoxically, all students said they would benefit from higher levels of synthesis and summarization. Yet, 81% admitted that they personally never made such attempts, and 75% said that they never considered the notion of synthesizing and summarizing across different note postings.

Lack of convergent discourse is just one of the problems with bulletin boards. Some of the problem is created by instructors who accept spouting of opinion, rather than requiring students to DO something useful in asynchronous Internet communication systems. For example, teachers could use the Internet environment to help student learning teams apply what they are learning. Learning is enriched when a student group is required to make an informed decision, develop a plan, conduct a project, write a report, conduct a case study, construct a portfolio, or perform most of the other kinds of constructivist activities that rigorous student-student interaction can enable. For example, I have developed guidelines to help student groups evaluate research reports [10]. Group-based project learning is especially valuable training, because in today's world, teamwork is how most work gets done, whether in military operations, a law firm, industrial services, corporate product development, or in a scientific research lab.

Discussion boards do not facilitate the key pedagogical elements of building learning communities: collaborative learning activities that demand data collection, analysis, and convergent thinking that is performed in the service of a constructivist task that creates educational deliverables. We teachers like to say that we want our students to be creative and critical thinkers, but we opt out when given the opportunity to teach those skills. I have seen numerous discussion boards where the teacher does not structure conversation to require back-and-forth dialog among students. Feedback from the teacher is often lacking. In many classes, most students do not even participate, acting as "lurkers" who may or may not even be reading the postings. A common teacher response to lurking is to require a specified number of postings, which of course can easily degenerate into a game where students just go through the motions of conversing. The problems of engaging students in on-line discussion prompted me to specify devices that teachers can use to get students more involved in on-line discussion [8].

SHARED-DOCUMENT COMPUTER CONFERENCING – A BETTER ALTERNATIVE

Shared-document computer conferencing (SDCC) overcomes the limitations of bulletin boards. The basic advantage arises from encouraging student groups to integrate and synthesize multiple ideas and commentary. Synthesis and summary are the hallmarks of effective discourse. Learners are obliged not only to speak but to listen and enrich their knowledge and thinking. The academic deliverables that emerge are communal.

What is the role of technology in collaborative learning? In the "old" days, students had to e-mail their written materials to every member of the learning group, who in turn had to e-mail their responses to everyone. This crude approach does not provide a convenient environment for creating or re-structuring material in the group's assignment or for hyperlinking sets of shared documents or external digital resources. SDCC software enables a new and better way of sharing documents. For example, in my Introductory Neuroscience course, I required students to participate in "insight exercises" in which each student in a learning team asked a creative question and testable hypothesis about the reading assignment and then provided a rationale and strategy for answering it [9]. Each student in the group then made in-context critique comments in a shared document, building up a basis for the group to select the "Best Question and Answer" for the week which they then refined before submitting for a group grade. A process for teaching collaborative writing has just been published [5].

SDCC systems liberate students from the limited discourse available with bulletin board notes. Maintaining a working memory of the intellectual content is facilitated, because everything can be seen in one self-contained document. At worst, one only has to scroll up and down to see the various facts and ideas contained therein, which is far more convenient that having the same content put in separate e-mail messages that have to be opened and closed one at a time, obliging the reader to remember what information is in each posting.

Most importantly, responses to points made by others in the group can be done in context, in the form of pop-up notes, for example, that still let you see the original text of what is being responded to and the context in which comments are embedded.

SDCC software provides shared workspaces for the insertion and iterative organization of information and insights, leading to evolving intellectual products that are continuously available for editing and annotation - in that same workspace — by all peers and instructors. The value of such software has been reviewed by Sherry et al. [14] and many predecessors.

FAILURE OF SDCC SOFTWARE IN THE MARKETPLACE

In the last dozen or so years, multiple varieties of SDCC software have been born only to endure a short and troubled life. Jim Snell and I created one of early forms of SDCC with a product called "FORUM," an innovation that won us in 1993 the First Prize in an international contest for the "Best New Idea in Distance Education." Limitations of the early versions have been overcome in our latest Web-based version, Forum MATRIX (http://xshare.tamu.edu), now available free as open-source code (Matrix also operates as a tool in Web CT). Our innovation was succeeded about four years later by a similar commercial product, "Groove," developed by the IBM icon, Ray Ozzie, who created Lotus Notes,. This product apparently failed in the market place, despite having much more financial backing and a much more sophisticated marketing program. About the same time, other similar products came along, but they too have seen little success. Most of these have been designed for corporations and government, not education. A review of currently leading SDCC products has been published recently [11].

Next came Web-based "Wiki's," a large assortment of which are now available. Many of these are even hosted free. Wikis are generally used like blogs, but with an emphasis on participants annotating what is posted by others. Wiki's often lack sophisticated management tools for user certification, access permissions (no access, read only, read and write), multiple independent workspaces, and seamless integration with a digital library.

Why did the SDCC concept fail to catch on? Many of the early systems were just too expensive for the education community. Examples of systems included Hummingbird, NextPage, E-room, and WebEx. WebEx, for example, cost $6,000 to set up and $100 per user per month. And some of these systems require extensive support infrastructure. But cost is not the explanation for lack of acceptance, because free systems, like Wikis, are available.

One problem with systems that are maintained on other people's servers is that, as an Editor of PC Magazine put it, "there's no way to know who's behind the glossy interface, which unnamed third parties are involved, or how well your data is (sic) protected" [11]. Microsoft has now plunged into the SDCC market with its "Microsoft Office Live," and Microsoft's marketing muscle may well push SDCC over the top, Mendelson reminds us that Microsoft has a very poor credentials when it comes to computer security. The important thing is that coincident with Microsoft's foray into SDCC is the recent introduction of other similar products. Google has introduced Google Docs and Spreadsheets (docs.google.com). There is also ThinkFree (thinkfree.com), Zoho (zoho.com), and gOffice (gooffice.com). These products are free (or almost free), and they operate on the principle of storing files and software applications on an Internet server hosted by the SDCC company. These products are pitched to the business community [3], where the culture of collaboration is well established.

In education, collaboration has a bad reputation among many teachers for a variety of reasons. Some teachers think of collaborative learning as a form of cheating, apparently without realizing that the teacher can still hold individuals accountable by suitable apportionment ratios for individual versus group grades. Many teachers have had bad experiences with group learning when they were students, brought on by teachers who were ignorant of group-learning theory and best practices. There is also the explanation that educators, particularly college professors, are slow to change their ways. Finally, my own experience is that even many students object to group learning, in part because of bad experiences in other courses that were poorly managed.

We originally thought that Forum MATRIX and other SDCC products were not catching on among educators because the products were not packaged in a way where teachers could see the value. In the decade and more that followed, a whole host of SDCC products appeared in a variety of packaging, at least one of which should have had mass appeal, we thought. There has always been the problem that it was hard to find such products from Internet search engines, because they are called by different names: enterprise solutions, Web conferencing, meetingware, project ware, or peer-to-peer netware. Also, the names don't mean the same thing to everyone.

At one time we thought that maybe the SDCC products were too hard to use. But the same people who could write formulas for Excel would not use SDCC. Any new software paradigm takes a few years to catch on, but by the time SDCC had a chance to get accepted, we were all hurled into the simple, point-and-click world of the Internet. Students were not obliged to show much more initiative and creativity than browsing with point and clicking.

This brings us to what I now think is the heart of the problem. Students are not particularly attracted to do the hard work of research, logical analysis, synthesis of ideas and data, and creation of interactive discourse. Pointing and clicking is so much easier. When required by a teacher to do more than find stuff on the Internet, students would prefer to express opinions, rather than engage in a discourse that requires them to listen to what others have to say and integrate that with data and evidence to produce a creative synthesis. And what teacher wants to read and grade all this creative discourse? Professors, for example, barely have enough time to do their research and grade multiple-choice tests.

An added, and perhaps more fundamental problem, relates to what I said at the beginning about the growing individualism of our culture.

REDEEMING EDUCATION VIA SDCC TECHNOLOGY

Educational leadership should come from our universities. Too often, universities are the problem, not the solution. Except for Colleges of Education, university faculty and administrators show relatively little involvement in K-12 and show more commitment to research and varsity sports than they do to educational practice in their own institutions. In their book on the need for reform of universities, William Willimon and Thomas Naylor [15] assert that university faculties and administrators are insufficiently concerned about the learning experiences of their students. Willimon and Naylor ask, "Is the real purpose of college life to entertain students for four years before they enter the workforce?" Rather than promoting "shared values and common aims," our campuses seem to be dominated by "narcissism and hedonism." Eileen Brown is quoted as saying that "American institutions of higher learning today, are among the more conservative forces in our society, continuing to educate in a hierarchical, individualistic, and passive manner out of tune with our society's growing need to create learning communities in every area of business, government, and social services."

So, my point is that universities not only have an obligation to enrich the sense of communal learning, they also now have, through SDCC technology, the means to facilitate such learning. Thankfully, my university now has a heightened awareness of the value of written discourse and is creating an array of "W courses" that require intensive writing experiences. And of course, our Forum MATRIX is available, not only in stand-alone form, but also as a tool in the university-wide WebCT. Collaborative writing is the best kind of writing for students because the emphasis is not just on writing as such but on *communication*.

MAKING SDCC ACCEPTABLE AS A MEDIUM FOR INSTRUCTION

Teachers may need reminding that our intellectual culture deteriorates as we shift education away from dialog to monolog, from group-based reasoned analysis to the individual soapbox. Many teachers deceive themselves into thinking they have solved the problem by using "discussion boards" that are routinely available in typical course management operating systems, such as WebCT.

In a modern SDCC environment, students not only can view scrollable documents in their Web browser, but most importantly, they can check a document out for inserting text and graphics, editing, or for making links (to Web sites, other documents in the same SDCC, or to pop-up notes). Documents are saved in word processor or html format. In Forum MATRIX, the documents are not only archived on our own Web server, always available to all authorized participants, but they can be saved to a local PC.

Our open-source Forum MATRIX features an unusually simple and clean interface that runs inside a Web browser. A user (student) logs into a local server and is given a menu of work spaces ("conferences") in which the user is registered. Clicking on the desired conference opens a menu of the folders therein, which are the topics that are in the "conference" (Fig. 3a, left panel). In this case, the topics are the workspaces of various students. Also shown is a link for accessing the digital library that houses the references and background material for the conference. When the link to a topic is clicked, the tree expands and the right-hand panel displays the documents that are filed therein. When one of these is selected, it can be checked out (or deleted). Clicking on a document title downloads it and opens it in the appropriate software application. Any type of document or sub-document can be put in the workspace (Fig. 3B), and can be worked on by any authorized group member as long as the member has the software application on their local PC.

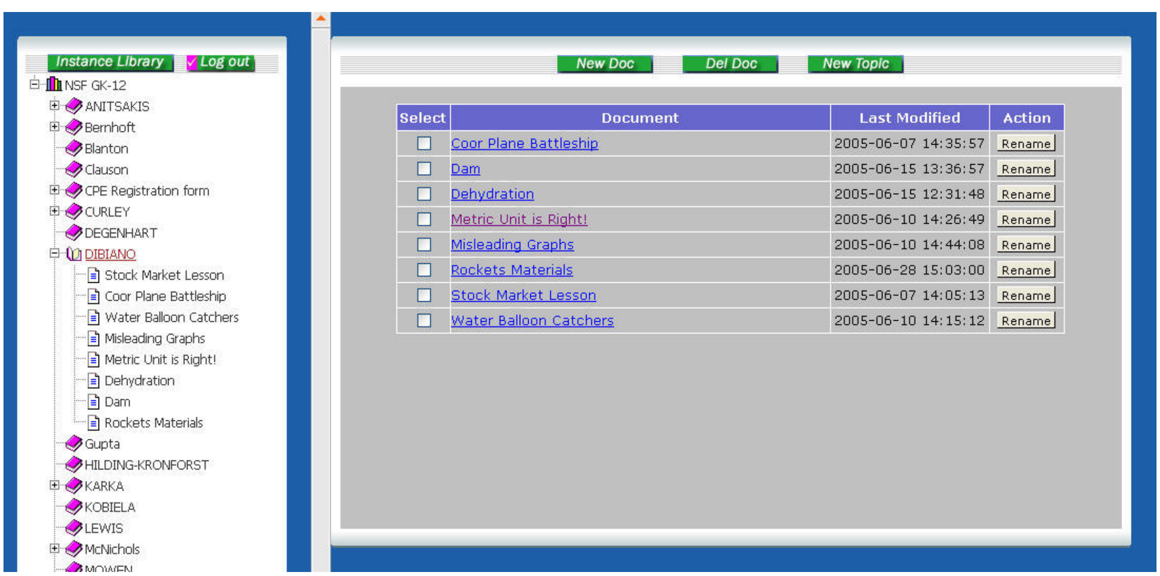

Figure 3a. Screen display of a SDCC workspace (NSF GK-12), with links to its digital library reference source (Instance Library) and a list of folders ("Topics") accessible by all students registered in this workspace. One topic folder is opened to show in the right-panel the various documents filed in this space and when they were last worked on.

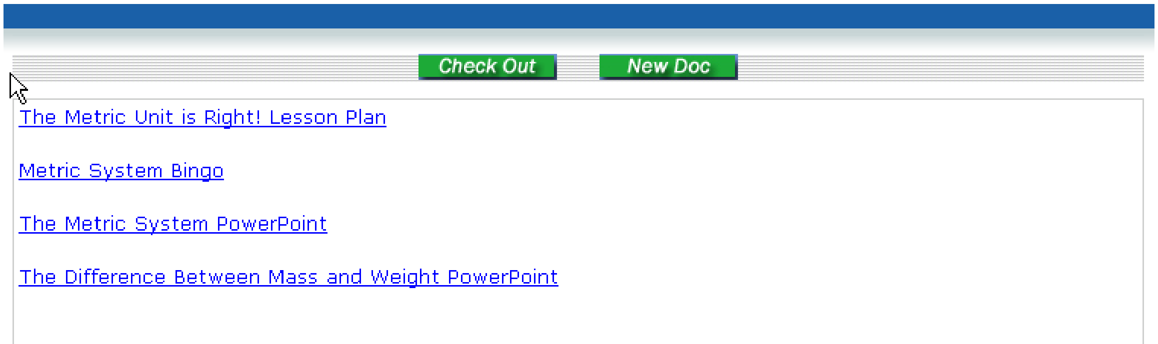

Fig. 3b. Expansion of "Metric Unit" in Fig. 3a to show links to its sub-documents and PowerPoint presentation.

Multiple items from different students can be put into the same document. Students and teacher can scroll quickly through documents, recognizing quickly which inserts and pop-ups have special importance because of the context in which they occur. Unlike postings on discussion boards, the inserts can be seen **in context** - without any opening and closing of files. Pop-up notes, also in-context, open and close quicker than e-mail because they are stored as an integral part of the document, which has already been opened in RAM.

The real power of SDCC systems is that documents can be fully shared. Student teams can work together on the same copy of a document, adding inserts, deleting, making strikeouts, and inserting links. Such work may be a case study, a literature report, plans or results of a project, or other kind of document deliverable. The group can select an "editor" to convert the marked up copy into a new version, which can be pasted in as a "new article." They can likewise create successive versions as the project evolves. The teacher does not have to judge and grade all the individual commentary, but rather needs only to assign a single group grade. Students can rate each other on the value of each student to the group effort.

CONCLUSIONS

Message-based on-line discourse can overwhelm teachers with more e-mail than they or the students have time or inclination to read. The solution is to structure discussions in ways that shift the burden of communication from to teacher to the students. That is, require the discussion to be contained within learning teams and to be focused on accomplishing an assigned task. Thus, the bulk of the information and commentary does not require teacher involvement, and when it does, the teacher can communicate with the group as a whole rather than with separate mail to each learner.

The important teaching issue is that this kind of asynchronous discourse can be used to collect e-mail messages or it can be extended to support the creation of collaborative group products. To me, it makes more sense to use software that will allow a teacher to capitalize on the advantages afforded by collaborative learning.

The typical threaded-topic discussion board in on-line learning wastes an opportunity for more complete constructivist collaboration. This lost opportunity occurs for two main reasons: 1) teachers have not thought enough about how to enhance on-line learning; and 2) discussion-board software typically does not allow document sharing and in-context annotation, both of which are needed to optimize written discourse.

On-line discourse is optimized with these conditions:

- The discourse has a clear objective that requires some kind of group-written deliverable.
- Students are required to go beyond the mere expression of opinion (for example: identify, compare and contrast, explain, argue, and decide).
- Students work in teams, using collaborative learning formalisms, to help each other to produce an academic deliverable.

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THE CHALLENGE OF IMPLEMENTING AN ENTERPRISE LEARNING MANAGEMENT SYSTEM – The Singapore Armed Force's Experience

MS LEE Hwee Ling
Senior Project Manager
Defence Science & Technology Agency, Singapore
lhweelin@dsta.gov.sg

MAJ CHUA Kok Siang
Head Instructional Design
Instructional Technology Education Center
Singapore Armed Force
chuaks@starnet.gov.sg

MAJ JAIGANTH Arumugam
Staff Officer
Joint Operations Department
Singapore Armed Force
Singapore

AUTHORS' BIOGRAPHIES

Ms LEE Hwee Ling is a senior project manager with the Defence Science & Technology Agency (DSTA) – the technology acquisition and R&D manager for the Ministry of Defence in Singapore. She assisted to conceptualise the vision and master plan for Singapore Armed Forces's (SAF) eLearning programme. In the year of 2005/06, Ms LEE oversees the development of the various eLearning initiatives in SAF, in particular the implementation of enterprise Learning Management System (LMS) and Content Authoring programme. Beside eLearning projects, Ms LEE is also actively involved in Leadership Competency development initiative within the SAF. She assisted to adopt Dr Gary Klein's Recognition Prime Decision Model and had designed a system prototype to support tactical decision making for the SAF.

In the late 90s, she was involved in knowledge management projects, overseeing the development of knowledge audit framework for the defence headquarters, using Dave Snowden's Organic KM methodologies. She graduated from the National University of Singapore in 1996, with a Bachelor Degree in Information Science.

MAJ JAIGANTH was Staff Officer in the Joint Training Branch, Joint Operations Department, Singaproe Armed Force. He was involved in the conceptualisation, masterplanning and implementation of Joint services training development and SAF training policies. The branch provides future direction and steers the SAF's eLearning programme. As the designated operations manager for this programme, he was responsible for ensuring the future learning needs of the 3rd Generation SAF were embeded in the plans and direction forward to cater to the vision of 'Anytime and Anywhere' learning. MAJ Jaiganth graduated from National University of Singapore in 1997, with a Bachelor of Science Degree in Economics.

MAJ CHUA Kok Siang is currently the Head Instructional Design and Development (IDD) in Instructional Technology Centre, SAFTI Military Institute, Singapore Armed Force. Prior to this, MAJ CHUA was a staff officer in Training Development Branch, Air Training Department. He worked closely with Joint Training Branch to strategise and implemented eLearning initiatives and programmes in the Republic of Singapore Air Force (RSAF) from 2005 to 2006. MAJ CHUA now oversees and manages Instructor Development programmes for more than 2500 instructors in the Singapore Armed Forces. He also oversees the eLearning courseware conversion, development and training efforts in SAFTI Military Institute. He is also actively involved in the conceptualisation and implementation of Smart Learning Rooms in SAFTI Military Institute. He graduated from National University of Singapore in 1994 with a 2nd Upper Honours Degree in Civil Engineering. He obtained his Masters of Science in Instructional Technology from Utah State University, USA in 2003.

ORGANISATION INFORMATION

Defence Science & Technology Agency
1 Depot Road #08-01
Defence Technology Tower A
Singapore 109678
Tel: (65) 6373 2936
Fax: (65) 6273 5288

Singapore Armed Force
303 Gombak Drive #03-12
SINGAPORE 669645
Tel: (65) 6768-2946
Fax: (65) 6768-4428

I. INTRODUCTION

A servicemen's training forms the bedrock for development of competencies and skills. Embracing emerging technologies in the educational sphere aids the Singapore Armed Force (SAF) to train better, more safely and efficiently. Pedagogies for adult learning are also introduced into teaching methodology and infused into design of the classroom.

The SAF has moved from A-frames and flip charts to Computer-Based Training (CBT); from classrooms to boundary-less training; and from teacher-centric to learner-centric. Riding on technologies like learning management system and island wide Internet connectivity, SAF can truly train any time and anywhere!

II. SINGAPORE ARMED FORCE's 3rd GENERATION LEARNING MANAGEMENT STRATEGIC THRUSTS

As the SAF transform itself into a 3rd generation forces, education leaders are under increasing pressure to close the gap between knowledge and skills that trainees learn in school today, and knowledge and skills required for their success in their future communities and workplace. In 2005, the SAF and DSTA embarked jointly on the 3rd Generation Learning Management (3GLM) journey. Leveraging on technology, the transformation initiative encompassed four key thrusts:

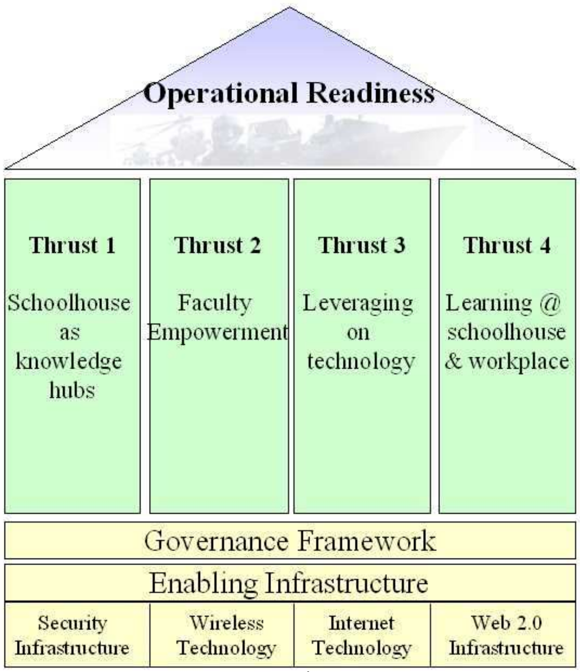

Figure 1 – The SAF's 3rd Generation Learning Management Strategic Thrusts

a. Schoolhouse as knowledge hubs. In the 3rd Generation SAF, major training institutions and schools will be repositioned as knowledge hubs to serve as knowledge and information sources for the organisation. With access to electronic repositories, the major training institutions and schools will be able to validate, summarise and manage the currency of content and structured thought for re-use. Information technology will help translate the SAF training institutions and schools into dynamic knowledge hubs. This will enhance access and reduce knowledge transfer latency.

b. Faculty empowerment programme. Fundamental to the success of the entire system is the availability of relevant and appropriately structured content, created in-house, in order to avoid high out-sourcing costs. SAF instructors will be equipped with a user-friendly content packaging tool and trained to author and publish content in the new environment. Through this programme, the SAF will adopt SCORM as the eLearning standards for the organisation. This strategic move would also allow SAF to better collaborate and integrate with other institutes.

c. Leveraging on technology. With the advancement in technology, the SAF standardises a common platform across the organisation to host, organise and share the learning content among schoolhouses. The Learning Management System (LMS) will enable the intuitive harvesting of knowledge by learners, instructors and other knowledge workers through a taxonomy-based engine that will allow the systematic mining of contextual knowledge. The LMS will also enable collaboration among learners, instructors and knowledge workers.

d. Learning @ schoolhouse and workplace. Upon graduation from the schoolhouse, knowledge workers in the workplace will need frequent referencing to previously engaged learning content in order to build upon their understanding. There is a need to reduce the latency between knowledge generated in the workplace and the parcelling of knowledge to audiences in the training institutions. In view of the anticipated immediacy of information and knowledge in the 3rd Generation SAF, training institutions will need to share the same information architecture as in the workplace. Advancement in technology will help SAF address this requirement.

This paper shares the SAF's experience, challenges and lessons learnt in our 3rd Generation Learning Management journey, in particular the implementation of our enterprise Learning Management System.

III. IMPLEMENTATION APPROACH

Our 3rd Generation Learning Management transformation journey is a four-year implementation roadmap. Instead of a big-bang approach, selected schools were nominated to pioneer the experience of LMS application, redesign curricula, work processes and course organisation. The following development and implementation phases was adopted:

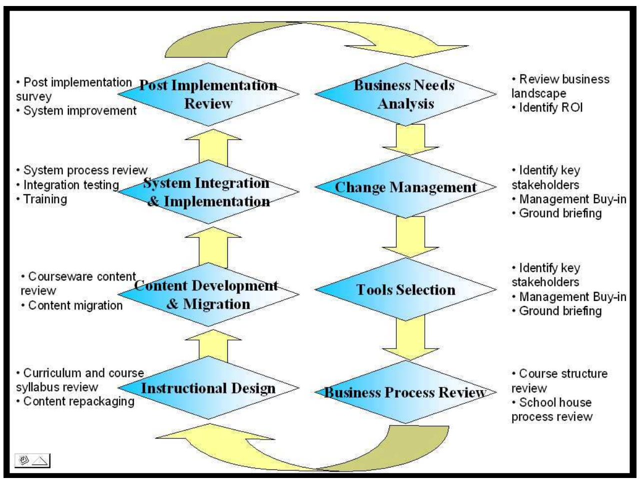

Figure 2 – The SAF's Learning Management Implementation Approach

A. BUSINESS NEEDS ANALYSIS

As the SAF transforms to a 3rd Generation force, training and education in the knowledge age has surfaced new requirements for learning, creativity and thinking. It was recognised that to maximise the time spent at training institutions and schools, SAF has to optimise storage, access and delivery of learning content, to meet individual and organisational learning needs. Our legacy eLearning application has reached its maximum shelf life and there is a need to reinvigorate the system to meet the new business demand. Learning Management Systems (LMS) was identified as the platform to facilitate the intuitive harvesting of knowledge by learners, instructors and other knowledge workers.

Identification of ROI. As in all other projects, identifying ROI for the project is a crucial step in order to solicit management buy-in and funding. Base on the study and results gathered from the LMS trial conducted at one of the advanced school, the immediate and obvious tangible benefits of LMS is a 20% reduction in course administration overhead and 25% cost saving from printing of course content.

Learner Effectiveness. With the LMS, both the SAF instructors and trainees would have continuous access to updated learning content anytime, anywhere (from the schoolhouse, workplace and home etc). The ability to pre-engage learning content before class and stay connected virtually would allow institutional time to be leveraged for instructor-student or student-student interactions and discussion. In terms of learner retention rates, the traditional methods of lectures and readings yield on average 10% retention. The use of audiovisual (through courseware), demonstration and group discussion will raise retention rate to 50%.

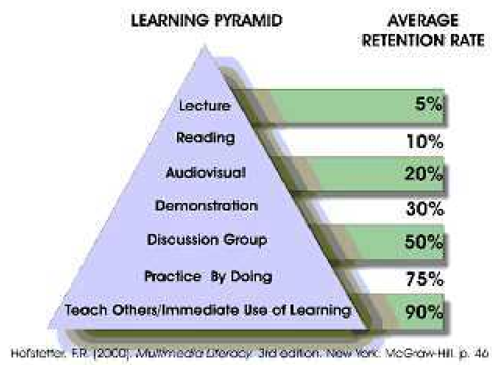

Figure 3 – The Learning Pyramid

B. CHANGE MANAGEMENT PLAN

Stakeholder identification and support. It was recognised that simply buying software and training soldiers to use it would not work. Key stakeholders were identified well in advance, and a series of internal marketing plan with senior management was established.

Consultative approach to gather ground requirements. Right after buy-in and support was solicited from the top, a consultative approach and process was adopted on the ground with the aim of instilling system ownership. The project team actively engaged representatives from the various military schools to understand and match their unique instructional environments. Each individual school has unique business processes and requirement. Developing a system to satisfy all requirements would result in a highly complex system that may not be cost effective. A governance board was thus established to resolve inter-schools challenges and make final decisions.

C. ACQUISITION OF LMS SOFTWARE

Prior to the funding approval process, the project team conducted a market survey. From the onset, we were aware that no single LMS product would be able to meet all the SAF schoolhouse requirements. The acquisition strategy is to procure a cost-effective solution that will meet most of SAF's requirements, in particular the transformation to e-Learning methodology, with minimal customisation. This approach will meet the management intent for speedy implementation and ease of maintenance and application support.

An open tender was released and industry players were invited to participate in the tender exercise via the Singapore Government Electronic Business System (GeBIZ).

Evaluation process. For the purpose of LMS evaluation, an SAF Evaluation team co-chaired by Head Joint Training Branch was established. Its members include key representatives from each of the schoolhouses. The following evaluation criteria framework was adopted:

	Criteria
LMS Features	User Experience, ease of use
	Course Structure
	Assignment Management
	Assessment/Quiz
	Collaboration
	Feedback Management
	Reporting
	Training Administration
	Search Functions
	System Administration
System Architecture	AICC and SCORM Compliant
	Able to support 128 SSL encryption
	Able to support 3-Tier architecture, ensure secured and scalable environment
	Platform (Operation system, database) independent
	Ease of configuration & customisation, support Open Scripting
Vendor Technical Competency	Implementation experience of SI team members, any large-scale (>10,000 users) implementation experience?
	Resource commitment. How many engineers to be dedicated to this project? Over relying on 1 or 2 person?
	How strong is the vendor's local customer service contact center?
	Relationship between local SI and development team, back-to-back support between vendors
Product Strategy/Market Presence	Installed base, how large is the vendor's installed base of customers for this product?
	Product roadmap. Sound product roadmap in the next 2-3 years?
	Technology partners. How strong do technology partners support this product?
	Revenue growth. How strong is the vendor's revenue? What is the vendor year-over-year quarterly revenue growth?

Figure 4 – Evaluation Criteria for enterprise LMS

After numerous rounds of product demonstration and testing, a Commercial-Off-The-Shelf (COTS) solution provided by a local vendor was acquired. This solution is able to meet most of our requirements with minimal customisation.

D. BUSINESS PROCESS REVIEW

Work process review. While the vendor configure and set-up the system, the project team visited individual schoolhouse to help review their course structure design and business processes. One of the uphill tasks is to convince and assist the schools to modify their business process, instead of customising the LMS intensively. This process took much longer time than our original plan, as most users are too comfortable with their old ways of doing things. As demonstrated in one of the school houses, LMS bring along a series of changes and transformation to the school: course syllabus was revamped, printing office was down-sized, training co-ordination department was re-organised, instructors were tasked with new responsibilities etc. Without command emphasis from the school commander, these process changes would not be possible.

E. INSTRUCTIONAL DESIGN

Instructional Design is the systematic development of instructional specifications using learning and instructional theory to ensure the quality of instruction. Learning Management System equip instructors with a new set of tools like discussion forum, white board collaboration, instant polling, online quizzes etc. With these new functions, SAF instructors have to review the current training methodologies, learning objectives and decide which tools and methods best meet the learning outcomes. Once the instructional methodologies have been identified, the next step is to assemble the necessary instructional materials. The materials may be in various forms: courseware, slides, paper document, audio, audio-video, etc. Although the necessary instructional materials may already exist, there is always a need to revise and integrate all the instructional elements. Our instructors were also sent for instructional design course so as to equip them with the new skill and thinking.

F. CONTENT DEVELOPMENT AND MIGRATION

Content upgrading of legacy courseware and faculty empowerment. Over the past 10 years, SAF has accumulated 2,500+ hours of courseware. Most of these legacy coursewares are not web-enabled and does not conform to any eLearning standard. Running in parallel with the LMS initiative, we also initiated the content re-purposing program, whereby infocomm-literate SME (instructors/faculty) were empowered with a user-friendly content packaging tool, training and mentoring programme to develop CBT courseware more quickly and cheaply. Content that need to be migrated from the old system was also reviewed and refreshed to ensure they are web-enabled and SCORM compliant; SAF also made use of this opportunity to adopt SCORM as the eLearning standards within SAF. This strategic move helps to eliminate system compatability and migration issues in the future.

G. IMPLEMENTING THE SYSTEM

System configuration and integration. The SAF has an old legacy eLearning application that existed since 1995. To avoid any disruption to the conduct of courses on the ground, the old system co-exists for a duration of 18 months until the new system was fully tested and certified operational. The technical team did a thorough study on the centrliased ver de-centralised system archiecture model. Due to our small geographical location, a centralised LMS was adopted. Interfaces between the LMS and other management information systems, in particular the human resource systems were thoroughly reviewed.

Training. A 'train the trainer' concept was adopted in the deployment of LMS usage skills. Schools provided an LMS 'champion' who was trained by the vendors, in a one-day training programme. They then provided the necessary cascade training to their instructors on the use of the LMS. The enterprise LMS was successfully commissioned in Nov 05, supporting 6,600 users.

Figure 5 – The enterprise LMS homepage

Community of Practice. Three months after the commissioning, the project team established a virtual LMS CoP, where members can exchange ideas and tips on using the LMS. A CoP forum was organised once every 6-month for members interaction and for project team to provide periodic update and share best practices. The CoP has proven to be a very effective platform for communications, faculty members who are early adopters reply on this platform to help and educate the next tier.

H. POST IMPLEMENTATION REVIEW

One year after the implementation, a Post Implementation Review (PIR) survey was conducted. A total of 1099 responses[1] (51%) were received. Key findings from the PIR survey is summarised as follows:

a. Features of LMS. More than 67% of the population feel the features are useful and adequate, in particular, the TimeTable, Content Repository, Online Assignment and Online Survey.

1Out of 6,600 LMS accounts, 2,010 accounts are active during the month of Sept 06.

However, 38% also highlighted that the user interface can be further improved.

b. Response time and performance of LMS. 50.9% of the population was satisfied with the system performance. Most of them highlighted that the system was slow especially when there were high concurrent access of courseware and downloading of lecture notes at the schoolhouse. This is expected due to the constraint on network bandwidth between remote camps and computer centre.

c. Operation Support. This was provided by school instructors, co-ordinators and DSTA technical agency. Students were generally satisfied with the means of getting help from all the parties and the responsiveness of the DS and staff to their queries and feedback.

d. Self-paced eLearning. 76% of the students generally subscribed to the idea of self-paced eLearning via Internet. They valued the opportunity to pre-engage with learning content before class and agree that they have more valued-added classroom discussions.

e. User Interface. Despite the tender evaluation process it was observed that the initial user interface comments in the eyes of the trainee were unsatisfactory. The user interface of common operating systems, such as MS Office and Explorer, were used as a benchmark to the LMS. This derived less than desired initial user satisfaction. Once the system was used frequently over two or three weeks, trainees acceptance of the interface grew, but was overall inclined to the more common icons and page layout available across Microsoft products.

f. Infrastructure. The initial implementation at each school reinforced the reliance of LMS success on the network access infrastructure. For example once the wireless connectivity stability issues at a particular camp was resolved, the LMS usage was improved by 30%. Thus adequate network infrastructure directly affects the LMS experience and must be addressed.

IV. RELATED FINDINGS AND OBSERVATIONS

Importance of Command Emphasis. The emphasis of the School Commander contributed significantly to the success of the project. This was clearly demonstrated by some of the schools like SAF Command Staff College and the Air Force School. Beside business process reviewed, the school's organisation structure was also re-organised so as to reflect the key roles required to support the LMS. This resulted in better usage of the system at the command, staff and trainee level.

Importance of Governance. Courseware had been traditionally delivered localised in classroom settings over the LAN or distributed via CD-ROMs. With the proliferation of LMS, schoolhouses started to ride on the LMS to deliver content over the wide-area-network. Due to the limited network bandwidth between remote camps and computer centre, performance and quality of courseware delivery were affected. The lack of a video server, due to security and network concerns, further compounded the problem. It was thus essential to proliferate and enforce a guideline on courseware creation facilitate smooth delivery over the WAN. After detailed study on the WAN, the courseware creation guideline was promulgated to the ground. To help enforce the policy, the LMS application was further customised to build-in the necessary control measures like file types, file size etc.

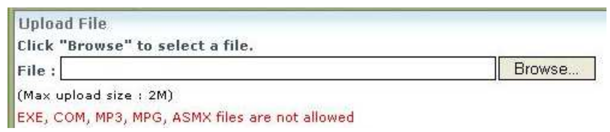

Figure 6 – Enforcing the policy via strict control measures at application level

Continuous training. While the "'train the trainer' concept" is an effective approach during the initial implementation, it is not sustainable in the long run, especially in an environment where officers and instructors rotate appointments about every 2 years. We need to maintain a core team to regularly provide refresher course for new instructors.

Multi-media and Instructional Design Support. While instructors were able to create basic CBT packages containing instructional content and basic interactivity, additional resources were required to create the illustrations, animations and supporting media to complement the text or image information alone. Multi-media works took up a large portion of the conversion time and would lengthen the total conversion time considerably if done improperly. For creation of new courseware, instructional design is an important skill-set required. SAF is currently reviewing the curriculum of Instructional Design Courses in the Specialist Diploma in Learning Science Programme, and ensure vacancies are sufficient to meet the demand.

Facilitation and mentoring skillsets of Instructors. As more lessons are conducted online via eLearning mode, instructors were able to spend more time interacting with the class and facilitating classroom discussion. Current instructor development training focuses on classroom mentoring. However, with the LMS the instructor needs to be equipped with the skill of mentoring to augment/supplement his classroom efforts.

V. CONCLUSION

Progress and momentum has been achieved under the Phase 1 of the SAF's 3rd Generation Learning Management initiative. The efforts of our instructors, administrators, and students, together with the command emphasis from the school commanders have been instrumental in moving the project forward. Riding on this success, we will complete the 3rd Generation Learning Management implementation over the next 2 years. Future efforts will focus on providing seamless access, mitigating the military security concerns, establishing framework for reusable learning objects and adapting to the wave of open source solutions.

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MAJ Jaiganth Arumugam, Staff Officer JTB JOD

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Collaborative Learning in the Remote Laboratory NetLab

Jan MACHOTKA
School of Electrical and Information Engineering, University of South Australia
Adelaide SA 5001, Australia

and

Zorica NEDIĆ
School of Electrical and Information Engineering, University of South Australia
Adelaide SA 5001, Australia

and

Özdemir GÖL
School of Electrical and Information Engineering, University of South Australia
Adelaide SA 5001, Australia

ABSTRACT

At the University of South Australia (UniSA) the practical component of engineering education is considered to be a vital factor in developing university graduate qualities [1]. Practical experiments performed in laboratory facilitate students' abilities to apply their knowledge, work collaboratively, control equipment and analyse the measured data. The remote laboratory NetLab has been developed within the School of Electrical and Information Engineering (EIE). A fully functional system has been used by up to 200 onshore and offshore students to conduct remote experiments every year since 2003. This paper describes the remote laboratory and discusses how collaborative team oriented tasks can be conducted in the online environment. The functionality of NetLab is demonstrated by an example of a remote experiment.

Keywords: NetLab, remote experiments, and collaborative learning

1. INTRODUCTION

One of the main requirements of 21 century society is to have highly developed professionals, who are able to work as a team. The introduction of e – environment with its fast development in the past decade, individuals are required to work and collaborate regardless of their global positions. For example a project to be accomplished in Australia would require involvement of team members from other continents. This requires that professionals, who are a product of higher education institutions, are equipped with specific skills and qualities to enable them to work collaboratively online. The University of South Australia is well aware about this requirement and its teaching and learning strategy has been modified accordingly. The remote laboratory NetLab, funded by the University teaching grant of $40,000 in 2002 [2], has been developed and implemented under the authors' supervision by senior undergraduate and postgraduate students [3]. For science and engineering professionals, the laboratory part of their tertiary education is very important to reinforce learning of theoretical concepts and provide the translation from theory into practical understanding. During this process students are also developing collaborative skills, as they usually work in teams. But the traditional approach to practical sessions in the real laboratories is changing dramatically with new available technologies and with remote laboratories spreading worldwide [4, 5]. The Internet has enabled conducting of real experiments at any time at any location. However, the question arises: Can remote experiments develop collaborative students' skills in the same way or even better as traditional real experiments? All authors have been very active education researchers in the past, always trying to implement the newest available technologies and teaching methodologies. They have implemented more than 10 teaching and learning innovative projects supported by UniSA. This paper is focused on their most successful project, the remote laboratory NetLab, respective discussing and demonstrating NetLab impact on student collaborative learning.

2. COLLABORATIVE LEARNING

Collaborative learning or cooperative learning are types of situated learning, that include group activities with emphasise on cooperation rather competition among students. These types require students to have additional skill such as the ability to work in groups. Cooperative learning is distinguished from collaborative learning. In cooperative learning teachers take most of responsibility for decisions about what is to be studied and how the groups are to cooperate, while in collaborative non-competitive learning group activities, students are engaged in making decisions about what is learned and how [6]. Collaborative learning has been defined in a number ways, but generally understood to refer to small group learning, where the group members actively support the learning processes of one another [7]. The introduction of the Internet also established online cooperative environment [8]. The range from the small group learning confined to the classroom or laboratory,

advanced to the cyber space, where the computing and information technology increasingly assumed a dominant importance [9]. Collaborative work is has always been anchored in engineering practice, as engineers seldom work in isolation. Great engineering projects must be created by a team of engineers and consequently collaborative learning is most suited and a natural must in preparing engineering students for the challenges that lie ahead.
The application of collaborative learning approaches is a highly valued scholarly activity which the UniSA encourages and facilitates in various ways including through teaching awards, promotions criteria and professional development activities.

3. LABORATORY EXPERIMENTS IN THE ENGINEERING EDUCATION

One of the most important factors in forming the engineering graduate qualities is the practical component of the engineering curriculum. The professional engineering community expects engineering graduates to develop practical skills during their undergraduate educational experience. Work in the engineering laboratory environment provides students with opportunities:

- to test conceptual knowledge
- to work collaboratively
- to interact with equipment
- to learn by trial and error
- to perform analysis on experimental data

The practical component can be conducted in the form of a real experiment in the real laboratory, in the form of simulated experiment or in the form of remote laboratory experiment. Many software packages have been developed for the simulation of real experiments and although very useful, none of them are as effective as learning from undertaking real experimental work.

During the last decade the exponential expansion of the Internet has had an enormous impact on the tertiary education sector. Yet in the beginning the Internet was not considered to be suitable for learning, as providing students with information on line is not sufficient for learning [10]. But the new technology has brought a significant improvement in communication within the academic community and also has brought an opportunity to create systems which enable students to conduct remote experiments at any time at any distance. Students are performing experiments using real devices and components in the real laboratory via the Internet. Comparative studies have been conducted comparing advantages and disadvantages of all three modes of laboratory experiments, real, simulated and remote experiments [11-13]. It has been investigated and documented that remote laboratories provide similar learning outcomes, if not better, to their class analogues [14].

4. REMOTE LABORATORY NETLAB

The NetLab, located at http://netlab.unisa.edu.au/, allows lecturers and students to interact with real equipment located elsewhere, via the use of the Internet from a computer, which could be in a lecture theatre, office or at home as shown in Figure 1. From the year 2003 the NetLab was integrated into three undergraduate courses. The whole system is still under development to enhance the existing features [15, 16]. To improve students' learning outcomes regular feedback responses are acquired from students, evaluated and later used to modify the system. Not only are university staff and students able to access NetLab, but also the general public can access the system as visitors after registering. The system is able to be accessed at any time from any location that has a PC with an Internet connection. This allows students to conduct experiments outside of university hours and lecturers are able to easily include practical demonstrations in their lectures.

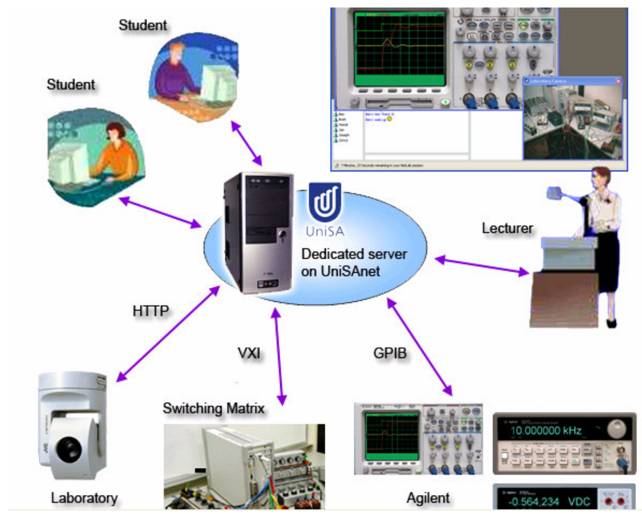

Figure 1. NetLab architecture

The NetLab server is located in a locked room at the University of South Australia. The real equipment is connected to the NetLab server via an IEEE 4888.2 interface, otherwise known as GPIB (General Purpose Interface Bus). The server is also connected to the Internet. A photograph of the laboratory equipment is shown in Figure 2.

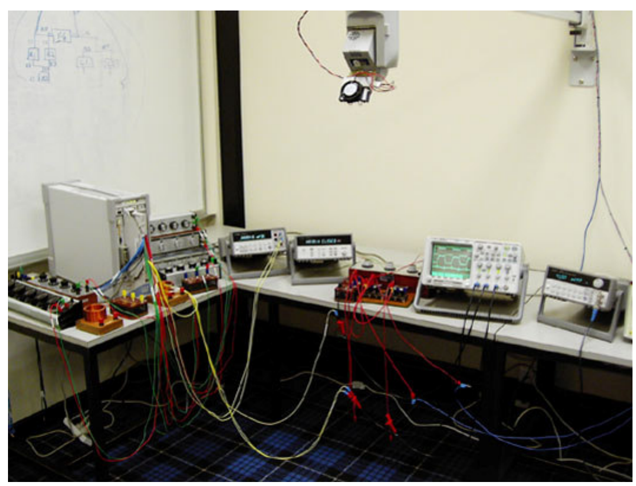
Figure 2. NetLab real equipment

NetLab's Graphical User Interface (GUI) is written in Java; hence the Java Runtime Environment (JRE) must be installed to allow the NetLab application to run. The user can control the real instruments through the client software, consisting of the interactive GUI. The users' commands are then sent to the NetLab server and processed by the server software, originally written in LabVIEW but redeveloped using Java in 2006, The

NetLab server uses an implementation of the Virtual Instrumentation Software Architecture (VISA) Application Programming Interface (API) to direct the commands to the appropriate programmable instrument. The VISA API allows software to communicate with a variety of hardware devices, using a variety of connection, from the same software interface. The instruments are connected through an industry standard General Purpose Interface Bus (GPIB) port. This same GPIB port is used to retrieve the relevant data from the instruments and passed on to all connected users. This data, such as the data points acquired with the oscilloscope, can then be exported to a file for use with relevant software such as MATLAB (a software package from MathWorks) for further analysis.

The main client Graphical User Interface (GUI) is shown in Figure 3. The all windows frames are available from the drop down main bar at the top. Under Instruments there are all GUIs of available instruments which students can choose and use to conduct an experiment. The GUI of the specially developed software of the Circuit Builder is also located there. It allows electrical circuits to be wired and configured remotely. When activated, students are able to configure their own circuit required for the experiment and then they can send their configuration to the NetLab, where the real components and devices are then connected exactly in the same way via the relay matrix switch [15]. Under Camera there is a camera window available with the real live video image and camera control movement buttons. In the left low bottom corner there is window showing all present users names. A chat window which enables a students' communication is located in the middle bottom panel. The notification pane, located at the bottom right of the GUI, broadcasts the interacting actions taken by all of the users to ensure that other users in the group can see the instruments' status and are aware of any changes that are made to instruments' settings.

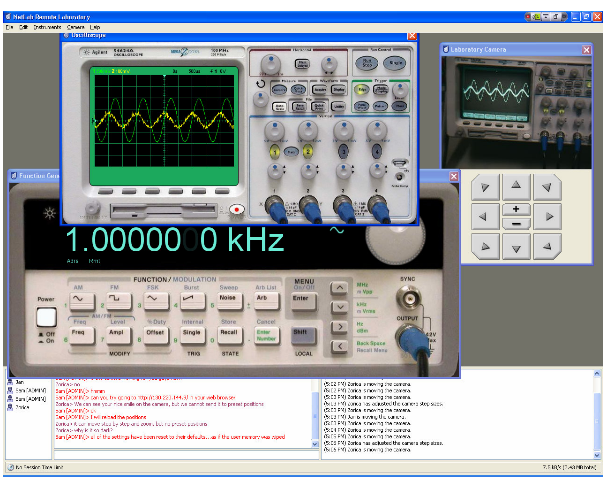

Figure 4: Main Graphical User Interface of NetLab

The GUIs of NetLab instruments are created from photographic images of the instruments' front panels. A click on one of the instrument images brings up a larger interactive image of that instrument giving increased readability. Figure 4. shows an example of the resulting window when the oscilloscope is clicked on, which contains an interactive image of the oscilloscope that is approximately 1:1 ratio, on a standard 17" monitor, with the size of the physical oscilloscope.

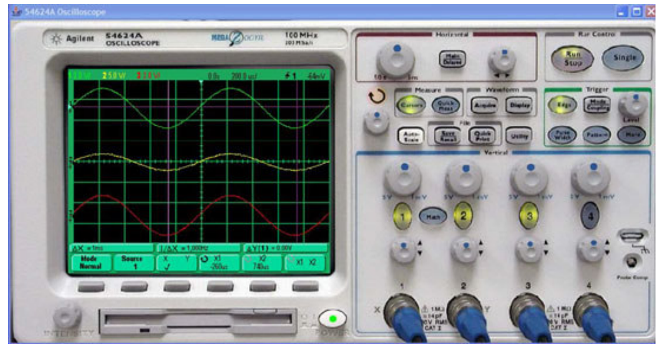

Figure 4. Larger interactive image of oscilloscope

Users are then able to interact with these instrument images, which includes animated controls and displays, in the same way that they would when physically operating the instruments. For example, the mouse is used to click on a button or rotate a knob in the same way that a finger would be used to press the button or turn the knob. The GUI presents the instruments with a sense of realism and functionality that matches the physical instruments.

The interactively realistic GUI gives students a sense of physically being in the laboratory, since the instruments they see and the tasks they perform are the same as those in a physical laboratory. All of the buttons on the GUI give a form of visual feedback, such as button illumination or depression of the button, to show the user that the button has been pressed or activated.

A JVC web camera, which has its own server, is also present in the remote laboratory. The camera provides live video streaming of the remote laboratory to the NetLab user. The camera is able to be controlled by the user through the use of the GUI. This includes zoom, pan and tilt functions that allow users to view the laboratory, as well as preset positions that focus on specific instruments. The camera can be used to view the equipment in the laboratory as well as monitor the execution of the user's commands on the instruments. The camera further enhances the user's feeling of being present in the laboratory. The live streaming is able to be switched off at any time to conserve bandwidth usage.

Multiple users are able to use NetLab at the same time, as long as they are all booked for the appropriate session time slot. Groups of up to three users can all be accessing and interacting with NetLab at the same time, as well as administrators who can access NetLab at any time.

The real physical laboratory is situated in the Sir Charles Todd Building, which is the house of the School of Electrical and Information Engineering at Mawson Lakes Campus of UniSA. Students or visitors access the remote laboratory via the Internet through the UniSA server where they are required to register first and to book their time slot to conduct an experiment. They obtain their password for the future login. The log-on information is recorded and once the information is accepted, the access is granted and students or visitors are directed to the laboratory site where they can conduct experiments. It can be done at any time from any location with the Internet access.

5. PROCESSES IN REAL AND REMOTE EXPERIMENTS

Work on experiments follows certain steps and procedures which may be similar or very different for real experiments and remote experiments. The following paragraphs are based on practical work procedure in real laboratories and the remote laboratory NetLab in the School of Electrical and Information Engineering at UniSA which may vary from other schools and universities.

Generally, students' laboratory work involves the following steps and procedures:

- Students' preparation for experiments
- Conducting experiments
- Analysis of results
- Submitting practical reports
- Assessment
- Evaluation and reflection

Collaborative learning can be encouraged during preparation, conduction and analysis of experiments, when students are asked to work as a team. This can be implemented for peer assessment, evaluation and reflection as well.

Students' preparation for experiments

For a real experiment students are required to perform a detailed preparation, possibly including required formulae, procedures and tables for recording measured results. Student preparation is checked at the beginning of the practical session, and sometimes assessed. Without preparation, students are often not allowed to conduct the experiment resulting in a zero mark for the experiment. In remote laboratories students also need to do a prescribed preparation but no one will check it. This leaves the responsibility on students. They can try to perform the experiment and if they are lost and have difficulties, which are reasonable to expect without proper preparation, they can log out and reattempt the experiment at later dates after doing the proper preparation until they successfully finish the experiment. In this sense the remote laboratories show the advantage as students need not only to do the prescribed preparation but to gain a full understanding of the experiment before they attempt it, because there is no supervisor in the laboratory to lead them through. Students are encouraged to do preparation as a team, as they can exchange ideas and proposals for conducting experiments, as are not supplied with detailed instructions for practical experiments. Responsibility for learning is fully left to the students, thus also enforcing students' centred learning [17].

Conducting experiments

Conducting the experiment itself is the crucial component of the whole laboratory process. In the real experimental session students are usually working in teams of 2-3 students. In our School a teacher usually supervises a class of 6 teams during a 2 hour laboratory session. In remote experiments students are also working in teams of up to 3 students, but there is no supervisor. This is a stage when students have to collaborate to conduct an experiment successfully.

During experiments students first connect the required circuit in order to obtain specific measurement results using available instruments and circuit components using the Circuit Builder[15]. Circuit Builder software has been developed for NetLab to allow students to connect real instruments and components remotely via the Internet. Students are also able to change values of circuit components. As can be seen from Figure 5 wiring using the Circuit Builder can be as messy as in a real laboratory. Circuit Builder uses photographic images of components and instruments in order to make wiring look as realistic as possible.

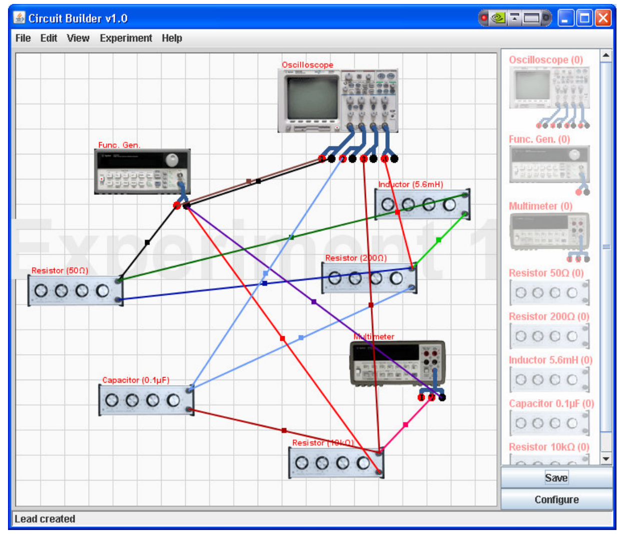

Figure 5. Example of the Circuit Builder wiring

The connection of right components in the right order requires theoretical knowledge as well as hands-on skills. Students also have to communicate efficiently to achieve required results as a team. Most of the available remote labs use prewired circuits. Thus the whole exercise lacks the typical stage of real experiments, where students are often lost in the messy heap of wires, instruments and components. This is one of the most important part of an experiment where students learn how to connect supply or measurement devices to obtain the proper responses and not to damage or destroy anything. This really requires the team work and proper collaboration among students.

Once the circuit is connected, the next stage of the experiment is to control the instruments and take measurements. This requires again collaborative work of the all team members. Most of the remote laboratories use a text based Graphical User Interface (GUI) for users to control devices which are not only unrealistic but also prevent students from learning to operate the real instruments.

Once students are satisfied with the measurement results, which can also be seen using the NetLab web camera, they can download data to their computer as they would do in the real experiment scenario in the laboratory.

Analysis of results

The next stage is nearly identical for real and remote experiments. Students are using saved data to produce the experiment report. They are often asked to carry out mathematical calculations and simulations and compare measured, calculated and simulated results. Students are encouraged to work as a team, to split tasks and/or to conduct same tasks and to compare results. If everything went smoothly they should obtain three very similar responses. If not, remote laboratory offers a superior advantage over the real laboratory. Normally, students do not have an opportunity to come back to the real laboratory and repeat the experiment. However, in remote laboratory they can easily book another time slot, which is what many students do even before they start the first session "just in case" to repeat the experiment or part of the experiment where they believe is a mistake.

Students' access to NetLab
When NetLab was just introduced in 2002, the majority of students conducted experiments in computer pools at UniSA campuses, where they could communicate and collaborate in person. Now, after five years, most of remote experiments are conducted "from home". Our recent survey revealed that out of 52 students participating in the survey only 2 did not have access to the Internet at home; 45 students had a broadband connection at home, which eliminated the difference between the access of the system from a UniSA campus and the access from home. Conducting experiments via the Internet requires online collaboration.

Evaluation and reflextion
Every year students are asked to submit a critical evaluation of NetLab, which is used for its continuous improvements. The improvements do not only include hardware and software development and the support material, but also the ways in which students collaborate in remote laboratory. As students asked for a better communication tool in remote laboratory, the incorporation of the telecommunication among students conducting experiments, is now under consideration. The implementation of web cameras into new laptops is making the telecommunication task possible in the near future.

However, our first impression is that students learning outcomes are much better in remote laboratories than in real laboratories. The last year, for the first time students had to use NetLab to perform all experiments in the course Electrical Circuit Theory. This is the first year course run in the second half of the academic year. These students already had experience, although not extensive, in using basic electrical engineering instruments while working in real laboratory during the first half of the year. They were required to work on experiments in their own time as teams and submit a cumulative report for all experiments at the end of the study period.

Their reports show clearly the superior learning benefits from this mode of laboratory work when compared to learning outcomes of previous generations of students who worked in a supervised real laboratory during the scheduled classes. Despite the occasional technical difficulties with remote access these students repeated experiments whenever they found differences between measured, calculated and simulated results if they suspected there may have been an error in the experiment. They also spend more time checking their calculation and thus learning the theory. They also often repeated the simulations. Consequently they developed better knowledge base, better analytical skills and also better collaborative skills, which was reflected in their laboratory reports.

6. CONCLUSION

It is evident from students' responses that they realised they had learned essential skills during the remote experiments skills, which they will need when they go to work in the present "real world", where online collaboration, consultation and team work is required. Moreover, it is the belief of the authors that if the current level of remote experiment development continues, it will ultimately lead it to be becoming the preferred method of learning for future graduates.

7. ACKNOWLEDGEMENTS

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We would also like to thank all our undergraduate and postgraduate students who contributed to the development of the NetLab for their hard work and for sharing our enthusiasm for the project.

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On-line Assessment in Engineering Education

Zorica NEDIĆ
School of Electrical and Information Engineering, University of South Australia
Adelaide SA 5001, Australia

and

Özdemir GÖL
School of Electrical and Information Engineering, University of South Australia
Adelaide SA 5001, Australia

and

Jan MACHOTKA
School of Electrical and Information Engineering, University of South Australia
Adelaide SA 5001, Australia

ABSTRACT

Recent technology developments instigated educational institutions worldwide to develop and use various forms of on-line assessments. These are particularly valuable tools in distance education and teaching large classes. However, they are becoming a common feature of every course and are now used also in small classes and by on-campus students. Despite their wide implementation there are still important issues to be resolved, particularly when used in summative assessment, and many institutions are seeking clear guidelines on how to best utilize them. Over the past decade, we developed and implemented a number of on-line assessment tools in teaching undergraduate engineering courses at the University of South Australia. This paper draws on our experience and showcases our latest development, a new generation of interactive electronic quizzes with randomized parameters. In these quizzes, each attempt initiates questions to appear with different parameters making it impossible for students to memorize correct answers. Rather, students have to use their knowledge to solve numerical problems in order to answer correctly. Although we developed quizzes for early year electrical and electronic engineering courses the concept is universal and can be effectively implemented in all disciplines.

Keywords: on-line assessment, interactive tutorials, randomized parameters quizzes.

1. INTRODUCTION

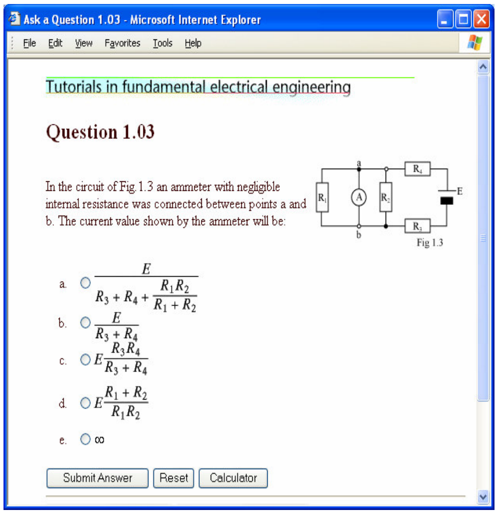
The new technology is immensely reshaping the society in general and education in particular. Research [1] has already shown that e-learning environment has a potential to enthuse, encourage and motivated students to learn, and to take the ownership and the responsibility and of their own learning. In this new learning environment on-line assessment is its critical component and needs to be carefully designed to meaningfully integrate and support the learning process.

On-line assessment has different formats and is used to assess different skills. The University of South Australia (UniSA) prohibits the use of on-line assessment as a form of summative assessment. Consequently, in this paper we present tools that we have developed for on-line formative assessment and implemented in teaching electrical and electronics engineering courses where students need to acquire good fundamental scientific knowledge and problem solving skills.

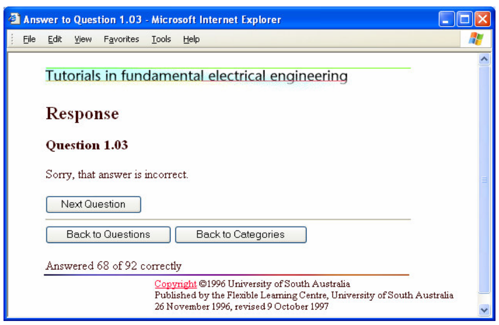
For electrical and electronic engineering students, good knowledge of solving electrical circuits is not only an important practical skill, but also helps them gain good knowledge of theoretical concepts fundamental to their understanding of new concepts in the later years of their programs. To acquire this important skill, students need to practice solving circuits and sometimes solve a large number of different circuits until they master this skill. Some students have the impression that learning the necessary rules is enough; however, they fail when it comes to applications of the rules: every circuit is different and if the mathematical rigor is not applied, small mistakes lead to wrong results. Thus, assessment is a valuable tool in providing realistic information to students as well as to lecturers on students' performance. However, extensive testing of students' knowledge is time consuming for lecturers and unnecessary for some students; some students acquire these skills much quicker than others and need less practice and less testing. With the development of the new, computer based technology, the obvious solution to this problem is to implement electronic quizzes [2, 3] and to allow students to use them as often as they want for self-assessment [4]. They are also very useful for lecturers to monitor students' progress [5].

2. PAST AND PRESENT EXPERIENCES

Over the last ten years, we developed and used a number of software packages for computer based learning and assessment for electrical and electronic engineering courses. Among the fist ones was Self-Directed-Assessment (SDA) software [6]. The software was developed for teaching first year engineering students and introductory course in electricity. It constitutes of six tests listed on its main access page. Each test has a number of questions that cover one of the course topics. Figure 1 shows an example of a question and the system feedback both for a correct and a wrong answer.



(a)



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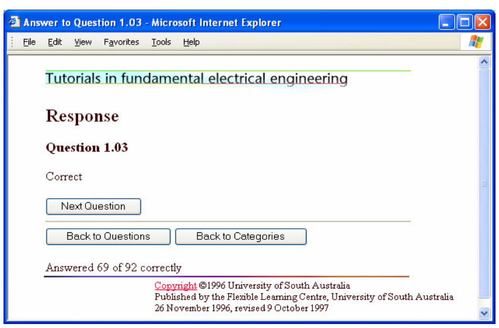


(c)

Figure 1. Self-Directed Assessment software, (a) Example of a question, (b) Wrong answer feedback, (c) Correct answer feedback.

At the time of its creation it was quite a novel and a very useful educational tool. However, this project required a significant effort as the web authoring tools at that time were just at the down of their development. This tool is still available to students in its original form as the changes would require a significant programming effort due to obsolescence of the application software used for its creation. Nevertheless, students find it useful and use it for their preparation for tests and exams. Our next project was a more advanced tool, Interactive Electronic Tutorials (IET), which was developed for teaching an introductory course in signal processing [7]. This software included a set of tutorials, which unlike the previous package consisting of tests only, each IET tutorial consisted of the overview of the related theory including animations, a number of solved problems and a test for students to check their knowledge.

IET was created using Asymetrix Toolbook II Instructor, a powerful application software for development of on-line multimedia courseware which enabled us to create a comprehensive software for computer based teaching. IET aimed not only to test students' knowledge but also to be used for teaching and therefore included solved problems. Each problem is presented to students as a problem that needs to be solved. In this way students are encouraged to attempt to solve the problem before looking at the solution. While solving a problem students are offered help in the form of "hot spots" that provide links either to the hint or to the relevant theory overview, but also the solution in case students are not able to solve the problem. In several places the animations were used for presenting a number of new concepts in an effective and an attractive way.

Figure 2 shows a typical multiple-choice question implemented in IET. The question must be answered within the allowed time. The horizontal bar is an animated representation of the elapsed time. In order to make the package more attractive to students a variety of different types of questions were used like: true – false, multiple-choice, matching answers with questions by creating links or by moving them into correct positions. Also, an animation with an arrow hitting or missing the target appear as feedback in the cases of correct or wrong answer respectively. The package was not only able to give students feedback, but also to send students' scores to the lecturer.

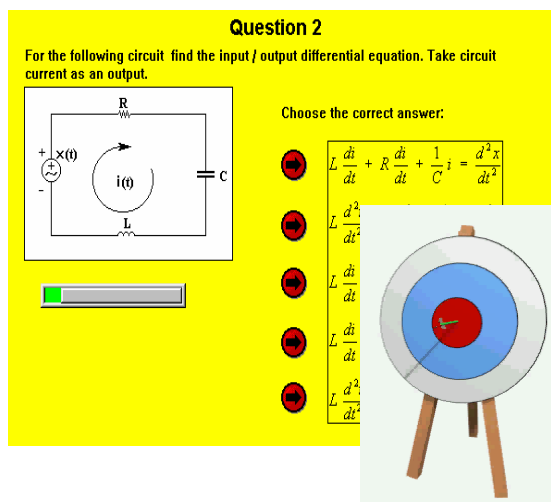


Figure 2. An example of a quiz question and the animated target appearing as a feedback to students for the correct answer.

IET was originally developed with an intention to replace class face-to-face tutorials. In 1998 the system was implemented for the first time. The system was able to record students' activities and it was observed that some students were attempting quizzes numerous times just to find out correct answers and then in the final attempt they used them to obtain perfect scores without leaning anything. As a consequence, we abandoned our initial intention to use the scores for summative assessment. Furthermore, we decided to run conventional in-class tutorials in parallel with electronic tutorials. The evaluation of IET was performed in 1998 and 1999. Our survey showed that majority of students preferred conventional tutorials. However, none of the students was strongly against IET and they appreciated its advantages. Students pointed out the inability of the package to answer their questions as the major deficiency of the system. As a consequence, to this date IET has been used as a complementary tool rather than a replacement for conventional tutorials.

In 1999 the University of South Australia developed an on-line teaching and learning environment called UniSAnet as an in-house product which included web authoring tool. UniSAnet enabled easy creation of course web pages for academic staff with very little computing experience. Among other features, UniSAnet provides a sophisticated tool for creation of on-line tests. It allows a library of questions to be created and then quizzes to be composed by requesting random selection of a number of questions from the library and presenting them to students in random order as shown in Figure 3(a). The quizzes can be set to be scoring or non scoring. The UniSAnet tool also offers a variety of questions to be created and a variety of feedback to students to be inserted for both correct and for wrong answers as shown in Figure 3(b). We use UniSA web authoring environment to create on-line quizzes for weekly review of topics.

However, even this new generation of quizzes are not suitable for assessing engineering students' problem solving skills in electrical circuit analysis because the questions are stationary and it is easier to find correct answers by numerous attempts rather than learning the theory and using mathematical tools to obtain the answer. As a consequence we decided to develop a set of quizzes with randomized parameters for which is not possible to discover a set of correct answers as the questions and answers never appear with a same set of parameters.

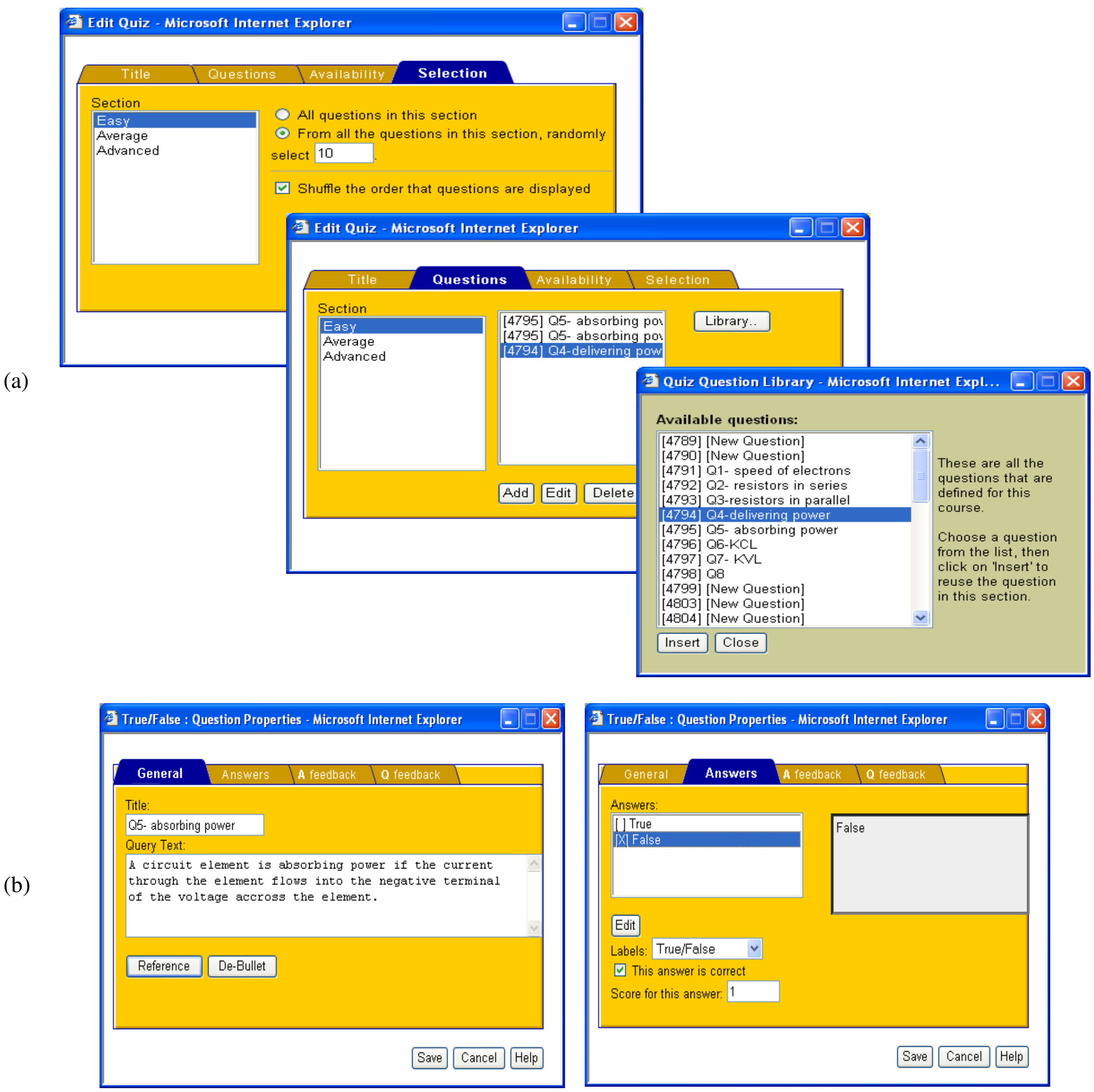
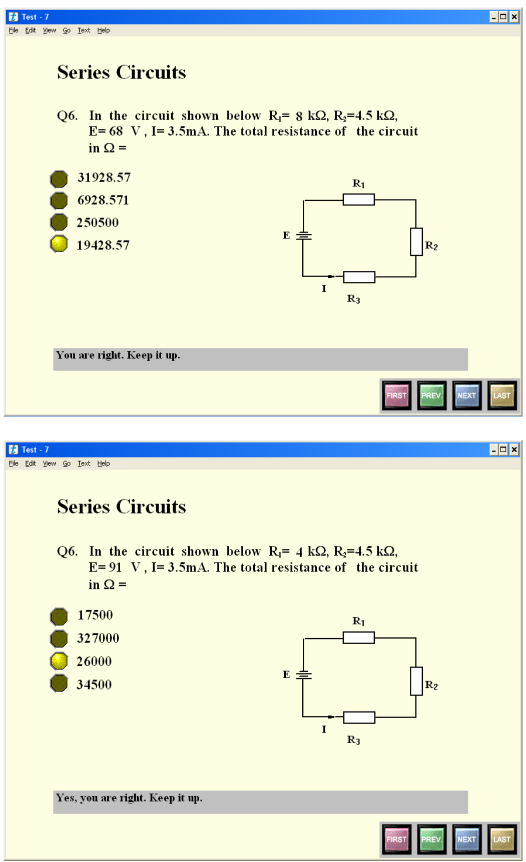


Figure 3. UniSAnet web authoring environment: (a) Creating quizzes from a library of questions; (b) creating questions with feedback to students.

3. QUIZZES WITH RANDOMIZES PARAMETERS

In this section we present our new development of self-assessment quizzes that utilize questions with randomized parameters. Figure 4 shows two attempts of the same question. In each attempt the question appears with a different set of parameters and also a different set of answers making it impossible for students to memorize correct answers.

The tool was initially developed using the software application Asymmetrix ToolBook II Instructor, version 6 and then redeveloped using the later version of the same software now marketed as ToolBook Instructor 2004 by company SumTotal System Inc. This software has two levels of operation, the Author's level and the Reader's level. At the Author's level one can create and modify courseware using the ToolBook development tools or with the help of OpenScript programming. At the Reader's level users can only interact with the electronic courseware, but cannot modify it.



(a)

(b)

Figure 4. (a)Two attempts of the same question with randomised parameters; (b) Example of OpenScript program

OpenScript is the ToolBook programming language. It gives the programmer a full control over the application. Randomization of parameters was only possible with the use of the OpenScript programming language within the ToolBook. The program generates random parameters for questions, calculates the correct answers, but also generates a set of wrong answers for each question and places the correct answers among the wrong answers in a random order.

The tool also supports other question types like "fill-in a blank" and "true-false" type of questions. An example of a "fill-in a blank" type of question is shown in Figure 5. In this example there are two parameters that change randomly, and the correct answer must be calculated each time the question is attempted, based on the value of the parameters. In this case the correct answer is not displayed, but the student is required to enter an answer in the required field. Then the student's answer is checked against the correct answer and the feedback is printed at the bottom of the page. The package requires all numerical answers to be entered within of $\pm 1\%$ of the correct answer. This was adopted for the unification and simplification of OpenScript programming.

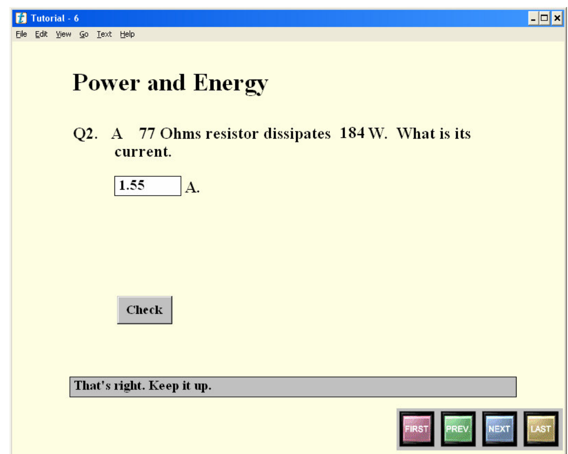


Figure 5. An example of a fill-in-blanks question.

4. EVALUATION

A preliminary evaluation was conducted by a group of ten students who volunteered to test the tool. Students are asked to select one topic of their choice and to comment on the test. Their responses are very positive and include the following comments and suggestions:

- *Tests are very helpful,*
- *It made me have to learn the circuits laws*
- *More questions should be included*
- *questions should show difficulty level*
- *feedback should give correct answers*
- *links to theory would be good*
- *hints will help me*
- *I've learned new things by doing this test*
- *Test is good but I got a low score*

Thorough evaluation of the effects of this tool on students' learning is a complex task and will be a subject in our future publications. As shown by Schneberger, et al. [8], there are many factors, including social factors, that influence effect of on-line training and on-line assessment on students' learning. These factors range from the performance of in-class instructors, through the available technical support, students' perceived benefits, down to students' computing literacy.

5. CONCLUSIONS

In this paper we presented the development of on-line quizzes with randomized parameters. Although this on-line assessment tool has been developed for a specific course, the concept is universal and can be applied easily to other mathematics, science and engineering based courses. However, the development of this tool requires a significant programming effort in OpenScript language, which may be also done in Java or other programming languages.

This problem is relatively easy to solve in the School of Electrical and Information Engineering and schools of related disciplines, where students learn programming languages in their undergraduate courses. Engaging our students to work on projects like this has a number of benefits for students. Firstly, they learn and practice their programming skills. Secondly, they review and deepen their circuit analysis knowledge. Thirdly, they have an opportunity to creatively communicate a course material to their younger peers. Also, it should not be neglected that they gain a feeling of contributing something useful that will help future generations of students in their career endeavors.

Our preliminary evaluation of this package shows students' positive reaction to this new tool as an additional help offered to them to improve their performance in the course. Students also suggested a number of improvements that we consider implementing in the next version of this tool. This certainly includes further work on the feedback to students.

It is expected that over time the number of quizzes and questions will grow to form a well structured library of a significant size and variation of questions that would help students evaluate their knowledge as part of their learning process and also prepare for the formal assessment. It is also expected that the package will significantly improve students' attitude towards this valuable self-assessment tool and will discourage students from memorizing answers as often happens with the computer based self-assessment quizzes.

As research also shows, students often repeatedly attempt questions with scores increasing with each subsequent attempt [9, 10]. However, because it is impossible to discover and memorize the correct answers, if properly implemented, this package has a potential to capitalize on students' desire to achieve the perfect scores [9] and provide a valuable learning environment.

Acknowledgements
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THE ETWINNING PROJECT: A STUDY WITH PORTUGUESE 9TH GRADE STUDENTS

Clara **PEREIRA COUTINHO**
Departamento de Currículo e Tecnologia Educativa, Universidade do Minho,
Braga, Portugal

Catarina **ROCHA**
Departamento de Ciências Exactas e da Natureza, Colégio Teresiano de Braga,
Braga, Portugal

ABSTRACT

In this paper we present a pedagogical experience with 9th grade Portuguese students attending an eLearning Programme of the European Union named eTwinning Project. The main goal of this EU project is to create a network of collaborative work between European schools, involving all school levels in the development of common projects through the use of Information and Communication Technologies, specially the Internet. The eTwinning Project we present in this paper was named *Crossing the Borders* and engaged a Portuguese school in Braga, Portugal and a similar school in the Czech Republic during the school year of 2006/2007. The implementation of an innovative and motivating strategy was at the basis of the project. It should promote not only a broad range of ICT skills, but also the students' moral and social development. In this paper we present the results of a semester of electronic twining experience.

Key words: eLearning, eTwinning, ICT, blog, citizenship competencies.

1. INTRODUCTION

The European Union pursues the goal of becoming the world's most competitive economy, based upon the conception of a new Europe, whose economy is based on knowledge and therefore strongly investing in Education and Training. In order to attain such goals, the European Commission has been engaged in concentrating on matters such as social cohesion, employability, access to information and info- exclusion since the very beginning of the new millennium.

If Europe grasps the opportunities presented, the Information Society promises to deliver a range of benefits, including higher living standards, entrepreneurial opportunities to participate in new growth markets, changes to the ways in which existing products and services are produced and delivered with productivity gains, more fulfilling jobs using advanced technologies and flexible working arrangements. These same technologies will enable workers to upgrade their skills as part of a process of lifelong learning designed to improve their employment prospects and earnings, and enhance education and learning in schools. (European Commission, 2000b: 3)[3].

The advent of the Knowledge Era raised the need to draw new lines to promote a society of information, which is available to everyone. The European Council held in Lisbon in March 2000 established the beginning of the eEurope debate (Information Society available to all), in which issues such as information, the new economy and the implications of the digital era were discussed.

On May 24th of the same year the European Commission adopted the eLearning initiative as a means to reflect upon the future of Education and the need to define the plans necessary to achieve the goals of the eEurope.

The eTwinning Project consists of part of the eLearning Programme of the European Union. The main goal of the project is to create a network of collaborative work between European schools, involving all school levels in the development of common projects through the use of Information and Communication Technologies, especially the Internet.

ETwinning is a long term association between at least two European schools which use ICTs as tools to develop relevant pedagogic activities. (CRIE, 2006)[7].

These activities intend to be a catalysing force which might promote the development of a wide range of skills which should be optimized: learning to learn, sharing points of view, making friends, and promoting greater awareness of the new model of the European society – a multilingual and multicultural one. The use of ICT is faced as a means to enable and produce communication. It is a valuable contribution in terms of changing and reorganizing pedagogical methods. This idea is expressed by the official authorities in Portugal as so one can read in the diploma the following suggestion to ICT teachers for 9th and 10th grades classes:

EU faces challenges of diverse origins that urge for reflection. Those are questions of citizenship and democratic intervention that must be analysed in a more holistic way taking advantage of ICT potential. In order to attain such goals we suggest students participate in european projects, namely the ones that make use of the internet facilities. (CRIE, 2006, p. 5)[7].

In the same curricular orientations policies it is expressed that "the development of small projects should be a priority, starting in the beginning of the school year, with particular emphasis in the 9th grade (…)". (CRIE, 2006, p.6) [7]

The idea of starting the eTwinning project together with a school from the European Union emerged from this context of teaching using a methodology of project work.

2. THE ETWINNING PROJECT

The eTwinning Project **Crossing the Borders** is an electronic twinning between the Colégio Teresiano in Braga, Portugal and the ZS T.G.Masaryka, Opava (Czech Republic) during the school year of 2006/2007.
The implementation of an innovative and motivating strategy was at the basis of the project. It should promote not only a broad range of ICT skills, but also the students' moral and social development.
From the beginning, the twinning with an Opavian School in the Czech Republic aimed towards the use of a foreign language (English) as well as citizenship and multiculturalism awareness using ICT as vehicle and object of study.
The following aims were set by the two partner schools and lied at the basis for the eTwinning Project:

> We would like to introduce and develop cultural links between our countries. We hope that our pupils will feel more comfortable when using English and that they will learn a lot about areas such as citizenship and cultural differences using ICT tools.

The project is being monitored by an English teacher in the Czech Republic and an ICT teacher in Portugal. It is being developed by teenagers of the same age: 56 students in Portugal and 19 students in the Czech Republic.
The Project wishes to increase students level of ICT literacy, the proficiency in using virtual communication tools and the use of English as a foreign language. Moreover, is also intended to achieve the following goals:

ICT Objectives

- Promoting the use of ICT as a means to a generalized digital literacy level, prevent info-exclusion and the equality of opportunities between European students.
- Raising awareness to the need for lifelong learning as a necessary condition to adapt to new situations and solving problems in a knowledge society;
- Promoting autonomy, creativity, responsibility and team work as necessary features for students to be open to change, cultural diversity and active citizenship;
- Increasing students' interest in research, problem solving and innovation as a means to face challenges in a knowledge-based society.
- ○ Developing the ability to thoroughly use computer applications, namely in articulating them with information and technologies from other fields of knowledge;
- Developing the ability to research, handle, produce, communicate, exchange, cooperate and share information not only through traditional means, but also using modern information and communication technologies;
- Respecting the safety and exchange rules of virtual data sharing, without neither place nor time restrictions.

English language skills

- Acquiring basic (essential) communication skills in English as a foreign language;
- Understanding oral and written pieces of information of different types which are adequate to students' linguistic, psychological and social development;
- Producing oral and written essays which are adequate to students' linguistic, psychological and social development;

Citizenship and social skills

- Reflecting upon their own social and cultural reality through exposure to different cultures;
- Raising awareness of their individuality through family, project peers and schoolmates integration;
- Developing sociability, tolerance and cooperation skills.

3. PROJECT DESCRIPTION

The eTwinning Crossing the Borders Project began on 29th September 2006 and will finish in the end of May 2007. The electronic twinning with the ZS T.G.Masaryka happened as a result of a combination of both teachers' proposals, possible thanks to the automatic research and proposal mechanism which makes it possible to find compatible and converging projects (twin finder). After some email contacts, the teachers outlined the plan for the activities they intended to implement throughout the year, in conformity with the National Syllabus for ICT (9th grade) and English and the annual planning of both subjects.

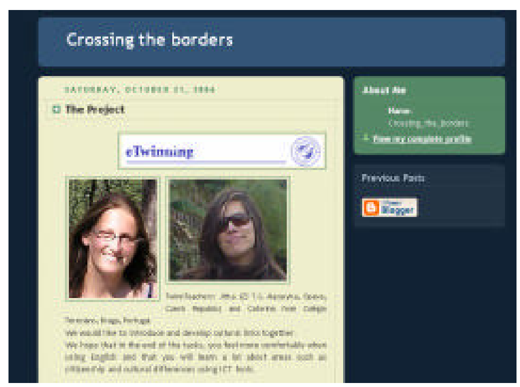

Figure 1 -Print Screen of the introductory blog *Post,* in which the Crossing the borders project and the teachers are presented

The teachers presented their projects and corresponding aims and activities to their classes in October and November. They simultaneously started the process of planning and creating supporting environments: the virtual space in the eTwinning platform, a moodle subject and a collaborative blog.

The evaluation of this experience is based on 6 instruments: a questionnaire about ICT literacy, a questionnaire to evaluate students perceptions (4.1), interviews to English Teachers involved in the project, teacher's e-mail contents analyses, Collaborative Blog´s interactions analyses and products (works) analyses (4.2).

A final report will be performed in order to evaluate:

- Whether there has been a successful development in the way students work;
- Whether these tools are actually useful in a curricular context;
- Whether the project helped to increase students' interaction;
- Whether there has been active participation of all the students;
- Whether the project led to meaningful learning;
- Whether great changes in methodology have taken place;
- Whether there has been a good work environment;
- Whether the project helped the students improve their level of autonomy in the use of these tools;
- Whether they were faced with any problems related to the use of the tools;
- Whether the level of motivation to learn English increased;
- Whether the students have become more aware of the cultural differences between the two countries.

4. SOME RESULTS

Although the study isn't finished, we will present some results about the conclusions of the students' perceptions questionnaire and the product's evaluation and analyses.

4.1. "Students perceptions"

When students were asked about the most positive aspects, they corresponded with vast feedback. We identified convergence points, about some subjects, which were organized in topics, so that could be read and understood.

The improvement of the ability to use computer applications

- We enjoyed working in the project because we developed abilities of text processing, creation of presentations and we could improve our competences in English language. We knew that our works would be seen by the Czechs, therefore we worked a lot.
- It was very interesting. We organized the ideas, we wrote the texts, we edited the works in the Word and the PowerPoint, and the teachers of English and ICT corrected them.
- "I liked creating a blog, writing posts and commenting posts of my colleagues.

- "We sent e-mails, we published posts in the blogs, and we placed our works in the eTwinning platform."

Autonomy, creativity and responsibility promotion

- "This was a funny and challenging way of working about interesting subjects.
- "What was difficult in the beginning, started to become easier."

Team works promotion

- "It was complicated because I had to write everything in English, and I am not a regular student in English, but my pair helped me.
- "In my group we helped each other, when it was really complicated, we asked the teacher."

Increase of the students' interest in research, problem solving and innovation.

- "When I wanted to say something in English that I didn't know I searched in the on-line translator and I got it."
- "Initially I had difficulty on placing the works in the platform, but now it is very easy . "

Acquire basic communication skills in English
- "I was interested to be able to communicate with the eTwinning partners, so I developed competences of English language."

Reflecting upon their own social and cultural reality through exposure to different cultures

- "We feel good when we understand that there are more people of our age, with equal problems."

The increase of the knowledge about Portugal
- "I liked because I knew some Portuguese monuments that I didn´t know."
- "It was important because I learned about Braga."

The increase of the knowledge Czech Republic

- "We learned a lot about Opava."
- "I learned Czech Republic geography, about their schools, how they have fun (…)"

Development of sociability, tolerance and cooperation skills

- "Now, I know that it's very easy to make friends, although speaking a different language.
- "There are lots of schools in all Europe developing projects similar to this one."
- "Czech girls are very nice and boys are shy."
- "We invited them to visit Portugal, but it wasn't possible."

Students were questioned about the negative aspects of the experience. Through the answers, it was possible to organize data, and make categories with similar point views. We found 2 hot points: the communication and the differences of the knowledge level between the 2 groups.

Asynchronous communication

- "We would prefer to chat on-line with our partners on Messenger or in the virtual space in the platform."

Differences between the both groups

- "I would like to have more partners. We were 55 and they were just 17."
- "Our partners had lot of problems in writing in English."
- "The Czech students didn't answer my questions."

- "They have an inferior level of knowledge in English and ICT."

4.2. ICT Skills

In the first stage of the Project, the following task was performed – creating a self-portrait of each of the students involved in the project**.** The students used Microsoft Word to perform this tasks.

Word processing is an important section of the ICT syllabus, so it was used both as a tool to create the profiles and object of study. This unit is eminently practical, so students should be given opportunities to practice. The teacher (…) should assign a practical task, in which students must use editing and formatting techniques and also the styles and models at their disposal. The products of that assignment should then be used to evaluate the students. (ICT syllabus, p. 22)[10].The need to create the self-portraits was chosen as pretext to use *Word Processing* as a tool. At first, the profiles were written in English in the English classes. Then, they were corrected by the English teacher. After that, the potential of word processing tools was presented and discussed in ICT classes. Finally, after the texts and corresponding images had been edited and formatted, the students' profiles were ready to be posted.In creating their profiles, the students described themselves in terms of their psychological and personality features (the students did not describe themselves physically, because photographs were posted together with their profiles), they also described their families, habits, hobbies and artistic preferences: music, favourite films, favourite sports (as performers and viewers), favourite school subjects and other personal interests. The personal details involved in these tasks, made it possible for the students to get to know each other better and also to establish new bonds with some elements of the classes. After their profiles had been posted, students were able to comment their colleagues' profiles by editing posts in the collaborative blog.

The collaborative blog is available on www.crossing-the-borders.blogspot.com. It was created as a collaborative tool for student interaction as a place where students could publish information (text and image) which everyone would access and contribute to. This would enable communication between all project members.

By allowing multiple authorship and creating the possibility of several co-collaborators to publish posts and comment on existing messages, blogs can become not only spaces where people can publish information, but also spaces of true communication." (Gomes, 2005, p. 43)[9].

This virtual space was then used by the students to comment on their profiles and also to Exchange emails and personal photographs. According to Gomes (2005)[9], Coutinho (2006, 2007)[4],[5] and Birney, Barry & Eigeartaigh (2006)[1], the creation and dinamization of blogs with educational purposes should be implemented as a way to develop several social skills and to promote learning.

An important work dynamics was created in which it was possible to optimize students' critical spirit, autonomy, creativity, responsibility and team work skills, as well as a stronger openness to change, cultural diversity and active citizenship. (ICT syllabus, p.4)[10]

The second stage of the project was based on exchanging information about both towns: Braga and Opava. The presentation of both towns (Braga and Opava) happened in December, in articulation between three subject areas: English, ICT and Project Area.

The document which regulates the guidelines for ICT (9th and 10th grades) recommends that "ICT teachers should promote small projects together with teachers of other subjects, in articulation with the teacher of Project Area (…) (CRIE, 2006, p.6)[7]. Therefore, our intention was to promote interaction between several curricular subjects, so that it would be possible to correlate information and knowledge among different curricular areas.

The elaboration of student´s town´s electronic presentation was done in groups using Microsoft Powerpoint. At first, students explored this application and acquired fundamental skills in terms of its use as done in previous author´ s experiences (Coutinho & Rocha, 2006)[6]. Using it as a supporting tool in their work, they then created the electronic presentations of their towns in Portugal and in the Czech Republic, in which aspects related to culture, tradition, landscape and history would be some of the aspects to be presented.

Products	Portuguese works	Czech works
Self-Portrait (Microsoft Word)	55	17
My country and traditions (Microsoft PowerPoint)	25	17
My town (Microsoft PowerPoint)	25	17

Table 1 – Products

The purpose of this task was to raise reflection upon students' own social and cultural reality through the comparison and confrontation with aspects of another culture. The presentations were created using electronic presentations, blogs and video. All the works were filed in eTwinning virtual space. All the students have a password with which they could access the information.

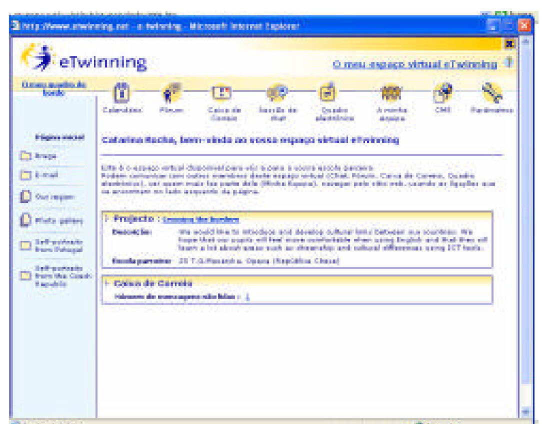

Figure 2 – Print Screen of the virtual space at the eTwinning Platform

URL of the subject:
http://www.nonio.uminho.pt/moodle/course/view.php?id=200
URL of the blog: www.crossing-the-borders.blogspot.com
URL of the Etwinning platform: www.etwinning.net

5. FINAL REMARKS

We hope that the Project will be a strategy of pedagogic innovation and that it will lead to positive outcomes in terms of the students' learning and teaching skills. We also wish to help our students develop the ability to learn, individually and together with other students, to share points of view, make new friends and become aware of the European model as a multilingual and multicultural one.

Technologies considerably multiply the amount of available information and they create the possibility to produce and publish materials. Therefore, the use of ICTs is vital for the development of this project. We fully agree with Castells [2], who sates that "technology is society and society cannot be understood or represented without its technological tools." (Castells, 2000:25)[2].

The equality of opportunity in terms of accessing and sharing information is a necessary condition for a network society (Dias, 2006). Paulo Dias[8] calls attention to the emerging need to equalize the level of opportunity in accessing information. In conclusion, the use of the Internet was essential for the development of our twinning.

The Internet brought our worlds closer together; it connected them by crossing the borders of time and space. All the students who took part in the project had the possibility to access all the information available on the net and, in particular, they had the opportunity to access and participate in the creation of the information of the eTwinning platform, the collaborative blog and the moodle subject. This opportunity allowed them to research, select, share and use the information. These skills are mentioned in the Curricular Guidelines for ICTs in 9th and 10th grades:
"it is our aim that the activities developed in ICT classes are predominantly practical, so that, from the first moment on, students will be active users of the computers and the Internet, so as to create situations in which autonomy can be promoted and therefore letting students play the role of explorers monitored by the teacher." (CRIE, 2006, p.5)[7].

The project was useful in terms of fundamental skills such as Word processing, creation of powepoint presentations, adequate use of the Internet , email, blog and electronic platform and file transfer, but also other types of aims were reached, namely in terms of students' citizenship and sociability skills and their awareness of tolerance, cooperation, multiculturalism and team work.

This project allowed for us to increase and improve the critical analysis of the functions and power of the new information and communication technologies.

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Web Development on a Stick

Simon SHARP and Louise RICHARDS
Faculty of Innovation North, Leeds Metropolitan University
Leeds, LS6 3QS, UK

ABSTRACT

Over the past two years there have been several drivers for change at Leeds Metropolitan University, including the University's Assessment, Learning and Teaching strategy. In the Faculty of Innovation North (INN), this has led to the restructuring of the curriculum and, in many cases, a need for more flexible and versatile learning resources.

This paper discusses these drivers and outlines how the web development modules have successfully addressed these by providing versatile learning objects, convenient development tools, stimulating assessments and an effective use of an e-learning platform. Evidence of success is provided through student feedback, improved retention and progression statistics, employability and a growing external interest in the Faculty's courses.

Keywords: Web Development, Learning Object

INTRODUCTION

Leeds Metropolitan University is one of the largest universities in the UK, with over 52,000 students and 3,500 staff. The University also forms the hub of a regional university network, which involves fourteen partner further education colleges, with over 300,000 students between them.

Information and Communication Technology (ICT) awards available in the Faculty of Innovation North (INN) include Computing, Interactive Multimedia, Animation, Entertainment Technology and Games Design. Currently students enrolled on Computing awards can take web development modules at all levels of study, although the intention in the Faculty is to widen the participation next year in these modules to all awards.

In the 2006/7 academic year approximately 300 students studied basic web development at level 1, with around 100 students taking the more specialist web modules at level 2 and 3. At Masters Level, a new MSc in Web Application Development has been introduced and enrolled its first cohort this year.

Whilst the web development courses have proved popular for a number of years now, there are drivers for change to improve the educational experience of our students and contribute to the success of the University in general. This means taking a regular fresh look at learning resources, content and delivery.

DRIVERS FOR CHANGE

Changing Delivery Patterns

Over the past three years the Faculty has implemented significant changes to the delivery patterns of the curriculum. Students at level 1 now study two paired modules at a time in three intensive seven week blocks, with a team-based project-driven module at the start and end of the academic year. The pairs of modules are taught in a 'carousel' format. See appendix A for an example structure chart. At level 2 there is a similar block structure during the first semester, culminating in an extended team project during the second semester. At level 3, students study four semester-long modules, with a final team-based project in the second semester, with supplemental learning delivered via learning objects [1]**.** At Masters Level students receive a mixture of tutor-supported sessions combined with a distance learning approach supported via the WebCT e-learning environment.

This focussed, compact delivery is aimed at increasing retention rates and improving student performance [2]. However, the increased commonality and blocking has led to a greater need for more flexible learning, and more efficient use of learning resources.

University Assessment, Learning and Teaching Strategy

The introduction of the Leeds Met Assessment, Learning and Teaching strategy [3] has also been a significant driver for change. The strategy supports widening participation and encourages the accommodation of differing learning styles and environments.

Specific targets that the web development modules would need to incorporate include:

- Extending e-learning and computer-aided assessment
- Maximising the formative feedback available to students
- Exploring the wider use of re-usable learning objects
- Adopting a receptive approach to non-standard delivery patterns, and innovative approaches to teaching and learning
- Promoting work-related learning and employability

Retention and Progression Rates

In the highly competitive UK higher education market, courses with poor retention and progression rates cannot be supported. The reasons for poor engagement are manifold and well documented [4], but often relate to stimulating student interest, engagement and developing an effective assessment and feedback strategy [5]. A key driver for change therefore was to address these issues through the development of stimulating learning objects, engaging assessment activities and learning spaces buzzing with activity and enthusiasm.

Increased Project work

Team-based project work at all levels has played an increasingly important role over the past two years, as team-working is recognised as being beneficial to learning [6]. Project-based learning approaches emphasise the importance of realistic and relevant contexts [7] , combined with flexible learning opportunities.

Web 2.0

Finally, the connected world is changing fast. New technologies associated with Web 2.0 are emerging and information is commonly being accessed from devices other than PC-based browsers. Students are excited and motivated by these developments [8], hence the importance in incorporating these technologies into the curriculum

IMPLEMENTING CHANGES

Versatile Learning Object and Development Tools

To address the issues of versatility and flexibility, learning resources are required that can be easily customised and configured to fit a range of different deliveries from undergraduate to postgraduate, along with 'taster days'. This led to the development of the **PHPAcademy**, where course material and supporting worked examples are blended together into an **e-learning object**. The structure and content of this learning object can be customised depending on the target audience. For example, an installation script has been developed to allow students to customise their installation of the PHPAcademy, for example to exclude the Oracle examples and leave MySQL examples only.

A key factor in encouraging engagement is the provision of a **convenient web hosting and development environment**. Whilst the Faculty offers hosting facilities, these are available only on campus and many students also wish to work elsewhere. A very useful solution to this issue is to bundle web technologies together in an environment which is easy to install and use. These bundled solutions are open source and available from organisations such as Apachefriends [9] (XAMPP) and easyPHP [10]. The bundles typically consist of an Apache server, the PHP language and MySQL database. With the PHPAcademy and XAMPP on a USB memory stick, students have a completely portable environment which they can plug into any PC or laptop, and continue to work on their web applications or exercises.

Effective Use of E-Learning Platform

All web development modules are hosted on the WebCT e-learning platform, where students can find a range of other supportive learning resources, for example, discussion boards, links to allow browsing of the best student web sites and a method for cohort-wide announcements. WebCT also provides an efficient process for securely uploading student assessments. It is used to give private feedback and marks to students, which complements the face to face feedback in class time.

Stimulating Assessment

To address the issue of assessment, students are required to construct individual websites that utilise the skills learned at that level. They implement unique sites that meet a specified set of criteria, but which are based on any context of their choosing. This not only removes much potential for plagiarism, but also fosters enthusiasm and ownership of the site created. An early assessment 'milestone' focuses the students and provides staff with useful feedback regarding engagement and progress. Grading is via student demonstration of the site. This is fast and efficient, and immediate feedback can be given to the student. Marks and feedback are also entered on to WebCT where they can be accessed privately by the students. At level 3, students complete 'Evaluation and Reflection Templates' where they concisely demonstrate critical analysis of design and implementation issues.

EVALUATION

Learning Resources

The web learning resources and the hosting and development tools have now been successfully used on a range of courses from undergraduate to postgraduate level. At Masters Level they are used on the M.Sc. in Web Application Development where they have been applied effectively to the distance learning component. The resources have been adapted for use on Summer schools and 'taster' courses, as well as on short course training programmes. The pace and level of delivery has been easily customised to be appropriate to each target level and cohort.

Student Feedback

Modules within the Faculty of INN use an on-line feedback form where students rate various qualitative criteria (Table 1) on a scale of 1 to 5, where 1 is strongly agree and 5 is strongly disagree.

Interest Stimulated	Staff Responsiveness
Useful Module Information	Acquire Skills
Quality of Teaching	Module Relationship
Learning Activities	Plan Learning
Support Materials	Repetition Avoided
Assessments	Think Critically
Feedback available	Recommend course

Table 1: Criteria used in student feedback form

In addition there are two open questions at the end of the module survey where students are asked to list anything they particularly liked about the module or thought needed improving.

For all web development modules **student responses have been consistently good** and particularly high for 'Interest Stimulated', 'Assessments', 'Acquire Skills' and 'Recommend Course'. Some example statistics are given in tables 2 and 3 from the level 3 Interactive Internet Technologies module and level 2 Internet Information Systems module. For each criterion, the highest possible rating is 1 and the lowest is 5, and so the statistics indicate that these modules are highly regarded by the students.

Title	Mean	SD	Median	Mode
Interest Stimulated	1.63	0.85	1.0	a
Assessments	1.65	0.77	2.0	b
Acquire Skills	1.72	0.89	2.0	a
Recommend course	1.63	0.83	1.0	a
Support Materials	1.93	0.85	2.0	b

Table 2: L3 Interactive Internet Technologies

Title	Mean	SD	Median	Mode
Interest Stimulated	1.77	0.76	2.0	b
Support Materials	1.95	1.08	1.0	a
Assessments	1.84	1.00	1.0	a
Acquire Skills	1.89	0.89	2.0	b
Recommend course	1.98	0.92	2.0	b

Table 3: L2 Internet Information Systems

In addition there have been some very positive qualitative comments relating to these modules. For example several students commented on the usefulness of the PHPAcademy learning object and development tools. Example comments include:

'A lot of time given to do website, good help on WebCT and the PHPAcademy. I learned a lot.
'PHPAcademy was good'
It was easy to work from home with example code readily available from PHPAcademy
'I can work from home :-)'

The approach to **assessment** has proved popular with both staff and students alike. It has proved efficient to mark and yet has been judged fair by students in terms of effort and the opportunity they have to demonstrate their work. Students also found the assessment both stimulating and interesting. They appreciated the regular formative feedback that was available in the labs and the early milestone. In addition they appreciated the open-ended nature of the assessment which allowed them to demonstrate their ability, innovation and creativity. Many took the opportunity to extend the basic requirements to include facilities for mobile devices, RSS (Really Simple Syndication) feeds and SMS (Short Message Service), as well as developing sophisticated user interfaces using CSS (Cascading Style Sheets) and Flash. Students soon developed a real sense of ownership over their work and the peer dynamics of group work added greater motivation with students endeavouring to out-do each other in terms of the sophisticated functionality they could develop. Example comments include:

'It possible to be creative on the assignment'
'Content and assessment were gr8'
'The ability to be creative'
'Assessment allowed a real world problem to be tackled'
'Learning PHP, the ability to flex my creative muscles in creating a website. None / few limitations on website content'
'The module has been effective in encouraging me to plan my own studies. The work for the assignment was a lot of fun!!!'

The workshop approach also fostered a creative and supportive environment which again attracted favourable comments such as:

'Providing workshops was good as it meant you had flexible access to labs and teachers'
'In the whole year and a half that I been at this university, I must say that this is the best module undertaken. I think the two 3 hour drop-in workshops are a very good idea'

Other general comments include:

'I thoroughly enjoyed this module...learned lots and has provided me with good foundation to build on'
'It was an enjoyable and stimulating module'
'By far the best module on the course'
'I just liked the module in general. It was good when I felt I had learnt something and put it to use. I felt a sense of achievement when stuff worked'
'It was an enjoyable and stimulating module'

'I liked everything about this module, it was by far the most interesting module for me, I enjoyed it very much'

Student Engagement and Progression

The past year has seen the best engagement and retention rates for Internet Systems courses, with some modules achieving a pass rate of 95% before reassessment. In addition there has been a significant reduction in applications for extensions for the assessment.

Employability

The employability of students has also improved. The University Job Shop and Faculty members have received an increased number of enquiries from employers about our prospective Internet Systems graduates, most of whom have little difficulty in securing web developer jobs. Many current students have already applied their skills in the 'real world', and several have already secured commissions or established their own businesses. For example:

- Jamie: Lorraine Bingham Designs - www.lorrainebinghamdesigns.co.uk/index.php
- Tim: Independent Licensing Service- http://www.antetype.net/
- Stefan: Dickory Dock - www.dickory-dock.com/index.html
- Paul: School Website builder - http://www.schoolwebsitebuilder.com/
- Ryan: Digital Fluid - http://ryanvilliers.co.uk/

In addition many of the Internet Systems students are in high demand by their peers for the final year projects which often involve web development work

External Interest

There has been increased **external interest** in the web-related courses being run within the Faculty. For example links are currently being established with Orange, the mobile communications company, who have a significant presence in Leeds. They are particularly interested in the PHP training provided and the mobile web resources currently being developed Orange are keen to become partners as they feel some courses would be useful for the professional development of their employees. Other local organisations have also expressed an interest in sending their employees on either short courses or to take some modules of a Masters level programme.

FURTHER WORK

The changing nature of web technology and curriculum will mean that the PHPAcademy learning object and development tools will require frequent updating. Current upgrades are primarily focussed on advanced PHP concepts and mobile technologies. Faculty members are studying towards Zend Certification. This will extend our training provision, allowing us to offer PHP/Zend certified courses.

It is also planned to develop a tool to facilitate the installation, customisation and targeting of the PHPAcademy learning object. This should further enhance the flexibility and versatility of the resource. The current links with external organisations will also be expanded thereby enhancing the synergy between curriculum development and the needs of business.

CONCLUSION

There have been many drivers for change as the University and the Faculty of INN strive for excellence, in key areas such as student retention and progression. This has resulted in changing delivery patterns, a greater need for commonality and an increasing emphasis on team-based project work. In addition the web related courses need to keep pace with rapid technological changes. This has necessitated a more flexible and versatile approach to learning tools and resources.

The PHPAcademy learning object which has been developed, allows simple customisation for use on a variety of courses, and can be used independently by students outside of module teaching for project work or distance learning. Open source web hosting and development tools, such as XAMPP were introduced which provide the independence and versatility students require.

E-Learning environments such as WebCT provided an invaluable platform to access learning resources and to facilitate support and assessment Stimulating, work-related assessments proved popular and gave students a great sense of ownership and pride in their work. Demonstrations and reflective evaluations proved efficient and effective for both staff and students alike. Feedback has been very positive for all web modules with students particularly commenting on their enjoyment, interest and usefulness. Engagement has been excellent and success rates have improved. Several current students are already working as part-time web developers and their skills are in demand from both their peers and employers.

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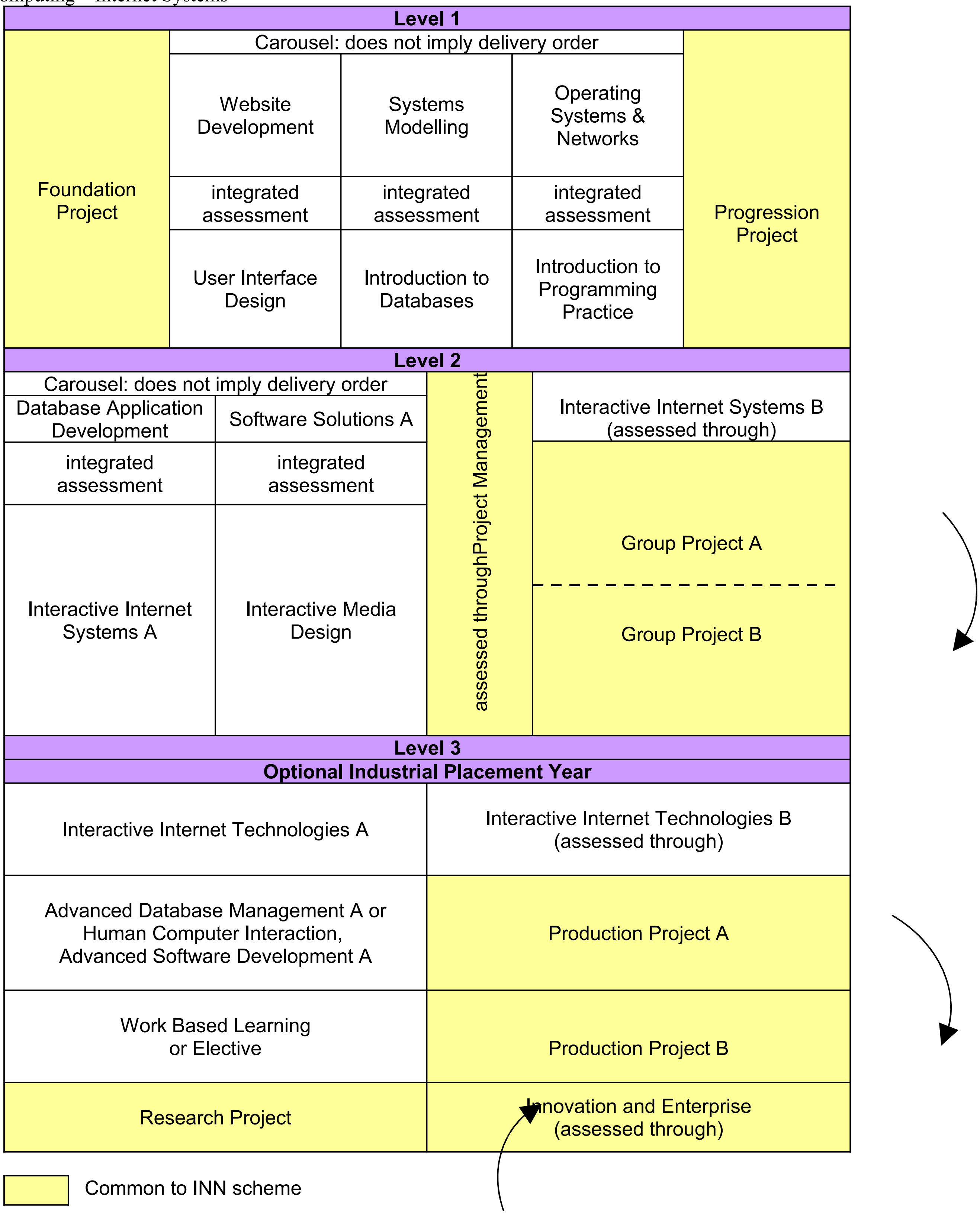
Appendix A

Example structure chart:
Business Computing – Internet Systems



PDAs as a Tool for Teachers and Teaching

Dr. Inga-Britt SKOGH
Stockholm Institute of Education, University of Stockholm
P.O. 34 103, 10026 Stockholm, Sweden

ABSTRACT

The importance of teacher students recognizing different ways of learning among their future pupils is emphasized in the Swedish Teachers Training Program. During their training the students are supposed to develop their ability to define, analyze and reflect on children's learning processes and to adapt their teaching methods accordingly.

Within the research project *Towards Professional Knowledge* a pilot project focusing teacher students' use of hand held computers (PDAs) as a tool for recording and storing reflections on learning processes (their own and other students) has been conducted. The students digitally documented their work and their reflections during the course points "Moving objects" (mechanics). The results so far show that the use of PDAs is a much appreciated tool. The results also show that PDAs increases learners' self-awareness in relation to their own learning processes. 'Forcing' the students to externalise their thinking process seems to support their meta-cognition and to deepen their awareness of their own as well as other students' repertoire of learning strategies.

Keywords

Learning strategies, teacher students, reflections, PDA's, technology

1. INTRODUCTION

Teaching and learning may be seen as two sides of a coin. Successful teaching is depending on not only to what extent the teacher has solid content knowledge in the subject area in question and her/his ability to organize teaching settings (professional skills). To be able to teach someone you also need to understand that learning is a process with many (and different) phases and also different 'faces'. The importance of teacher students developing ability to identify and support children's learning processes is stressed in the curricula of the Teachers Education Program in Sweden. Few experienced teachers would argue against this as an important competence and accordingly it is an important part of the teachers training program. However among teacher students the competence of understanding learning processes is not always mentioned among competence needed in the profession of teaching.

In a study of attitudes among technology teacher students [5] the students were asked to rate the value of technological subject knowledge against the value of pedagogical competence (in relation to their future work as practicing pedagogues/ teachers). The results show that the students considered subject knowledge to be the most important competence to a teacher and accordingly the most important competence to achieve within the Teachers Education Program.

> The students recognize two competences of importance in relation to the profession of teaching – subject knowledge and 'teaching abilities'. Subject knowledge (especially their own) is considered to be the most important competence. Teaching competence is something the students believe they will apprehend 'along the way'. (Ibid. p.32)

The students in the study expressed rather self-oriented opinions regarding what is and what is not important to be taught within a teachers program course (*'I* need to train/learn this and that more/less, so this ought to be stressed/taken away'). This (understandable) self orientation is not always something the students themselves are aware of. Among the students in the study only a few made comments that indicated that they were aware of their own tendency to put their own personal interest and development above recognition of other students' needs or the overall aims of the course. In the following quotation one student tries to explain how she feels:

> As a teachers student you are fully occupied with learning things *yourself.* To look beyond that into other aspects of the profession is not possible for me right now. (Ibid. p.33)

The study also shows that the way subject oriented courses within the Teachers Education Program are pedagogically organized seem to have effect not only on the course itself but also in relation to the way the students apprehend the value of the different aspects dealt with within the course. Highly content oriented courses seem to generate highly content oriented students.

At the institution in question, as well as in many other teachers training institutions in Sweden, pedagogical and didactic aspects of teaching and learning are not integrated in all subject oriented courses or, as one of the students put it:

> In my technology class subject studies – me learning about literature, theories and stuff – comes first. After that we deal with the teaching - how and what to teach. I think that subject studies must come first. (Ibid. p.33)

To strictly separate subject content from its pedagogical application may well be appreciated by students but by doing so the professional use of the subject knowledge in question is both delayed and, in my opinion, also obstructed.

One way of using the 'self-oriented approach' that, to my experience, not only these students show, could be to encourage awareness of the students' own personal learning processes. To document and to reflect on one's own ways of learning and to analyze and discuss these ways with others give students access to a variety of learning strategies within the subject area in question. At least two good effects could be expected from this. It is probable that this kind of discussions will support and strengthen the quality of the students' own learning process. No doubt this kind of discussions will also attract attention to the learning processes of others. To find ways of developing understanding among teacher students about *how* and *why* individuals (fellow students as well as school pupils) learn the way they do – and to help teacher students transform this knowledge into future teaching practice – is probably one of the most important tasks in teacher training programs.

The hypothesis behind the project *Towards Professional Knowledge* is based on the assumption that if you are able to identify different phases and strategies in your own learning processes this will help you understand the learning processes of others.

2. WHY PDAs?

Since 2004 Professor Richard Kimbell of Goldsmiths College in London has been a visiting professor at Stockholm Institute of Education. One of the projects Professor Kimbell was working with as the time he came to our institution was a project called *Assessing Design Innovation*. Within the first phase of this project a new portfolio assessment system had been developed by professor Kimbell and his research group TERU.[1] [1]

> The principal outcome of the project was a developed portfolio assessment system that sat somewhere between a formal examination and a piece of coursework. (Ibid. p.1)

In the second phase of this project – Project e-scape (launched in 2005) the TERU-group included the use of PDAs as a tool for documenting the activities to be assessed.

As in Sweden the British government had , since the beginning of the 1990s, embarked on a major program to digitalize many of the activities and services it offers. Both in Britain and Sweden demands to include the educational system (schools and teachers) in this development were put forward. New times demand the use of new technology and the concept of E-learning was accordingly introduced. Kimbell & Wheeler [1] explains this development in the following way:

> ***E-learning*** is a term that has emerged to describe a wide range of digitally enhanced educational experiences; from a straightforward internet search or the completion of a simple screen-based multiple choice question, to full blown multimedia managed learning environments providing access to complete courses. (Ibid. p. 2)

The above mentioned e-portfolio system developed by the TERU-group has, according to Kimbell & Wheeler [1], proven to be very successful.

> The PDA technology was warmly received and learners had no difficulty in working out how to use it. These technologies are part of youth culture and are readily adopted. The PDAs were seen as offering new potential capability to support their design work. […] The potential of PDAs for 'beaming' of files between learners was very easy and very warmly received – both by the learners and the teacher. It encouraged peer review and peer support for design ideas. … Senior managers of schools (heads and deputies) were very enthusiastic about the potential of PDAs for the classroom and more generally around the school.
>
> (Ibid. p. 3-4)

The results from the e-scape project have been an inspiration to the Swedish research team. When we got access to the PDA devices used in the TERU-project in February 2007 we immediately began the plans for a project where the potentials of the devices (and of our research ideas) could be tested in a Swedish research setting.

3. A NEW PROJECT

In the beginning of March 2007 my research group RUTE (Research Unit for Technology Education) launched the idea of a new research project called *Towards Professional Knowledge.* As mentioned above this project focuses the development of knowledge and of professional skills among technology teacher students during a course of 40 credit points within the Teachers Education Program. Three aspects are to be studied within this project:

- the development of technological subject knowledge among the students

[1] Technology Education Research Unit

- the development of pedagogical and didactic knowledge and skills among the students
- the development of digital competence (the use of handheld computers as a tool for teaching and learning) among the students

One aim of the project is to describe in what way students develop competence in relation to the three above mentioned aspects. Another aim is to develop methods that will make these processes visible to the students themselves.

Data are to be collected continuously throughout the whole course with the help of the following methods:

- *Observations* during lessons, campus activities and when the students are conducting lessons in their partnership schools
- *Interviews* with 40 students & involved teachers and lectures, at the beginning and the end of the project and also before and after each graded point/item
- *The PDA-documentation* (e-portfolios) – continuously collected by the students and reviewed by the research team at fixed interval and also before and after each graded point/item.
- *Surveys* presented to the student at the beginning and the end of the course.
- *Other documentation* e.g. examination papers, tests and alike

The students are to be provided with one PDA device per student. These devices permit the students to document their working/learning processes, record comments, remarks, write notes, drawings, sketches and to take photographs.

The development of the student's digital competence is also studied within the project. To be able to analyze the effect of the use of PDAs as a tool for reflections a comparative study will be conducted. The design of this part of the study is as follows:

- The students are to be divided into two groups
- Both groups will be confronted with the same teaching (instructed in the same way and given the same tasks)
- Both groups will be instructed to document their learning processes during the course
- Only one of the student groups will have access to the PDA devices.
- The activities of both groups will be monitored in the same way by the research team

4. THE FIRST PILOT STUDY

To test research ideas, methods and especially the potential of the PDA devices a series of pilot projects are o be effected. The first pilot (conducted in April 2007) will be followed by a second and a third in September and October 2007. In this paper I briefly present the first pilot and some of the preliminary findings that we have gained from it.

In April 2007 a group of technology teacher students (15 students in a mixed group with male and female first year students, aged 20-35 years) was studied during parts of the course point 'Mechanics'[2]. At the beginning of the first monitored lesson/session the PDAs were handed out to the students and they were instructed to make themselves acquainted with the devices. One (1) hour was designated to this activity.

The students were then instructed by their teacher to work individually with a mechanical problem presented by the teacher. The task was to present a solution to a problem (make an object move in a specific manner) and to visualize the solution with the help of a model and/or a drawing/design plan. The students were also instructed to prepare a short verbal presentation explaining their solution to an imaginary pupil.

During their work with the task the students were instructed to digitally document their efforts whenever they found it suitable. The only specific instruction they received was that they had to start and end each working session with a digital documentation of their own choice (record, drawing, notes and photo).

The activities in the classroom were monitored by the research team with the help of the same kind of PDAs as the students were using.

5. THEORETICAL BACKGROUND

In this project both students reflections on what and how they learn and their use of the PDAs (how and why they use them as they do) are in focus.

In my previous research I have found Georg Henrik von Wright's theory on *logic- of -events* [6] to be useful as a theoretical tool for understanding and explaining behaviour and actions in educational settings [2, 3, 4]. In what follows I am giving an overall view of von Wright's model of thought and my own pedagogical application of his theory.

[2] Students and course point was selected for 'practical' reasons (availability and students and teachers willing to participate).

In the essay, Determinism and the Study of Man [6] Georg Henrik von Wright formulate his theory about the logic-of-events.

Logic-of-events interpretations are based on the fact that we can learn how to identify determinants of individuals (their intentions and epistemic attitudes as well as factors and expectations that surround the activity in question). In order to do so we need to create a picture of the individual. For this purpose von Wright identifies four different intentions:

The intention *wants* refers to what the individual wants and/or considers him or herself in need of. In a teaching context, the teacher has to convince the pupil that the knowledge and experience the teaching is aiming at is in accordance with the needs and wishes of the pupil.

The intention *duty* refers to the individuals "internalised" expectance to act in accordance with a defined role – to behave in a certain way.

The intention *ability* refers to the student's individual characteristics in the learning situation. A student's (or a pupil's) ability is limited both by inherited (intelligence, memory, health, physical strength) and by acquired (learnt) qualities.

The intention *opportunity* refers to the conditions governing the situation – expectations, resources and the balance of authority.

In addition to the four intentions that von Wright identifies (*wants, duty, ability* and *opportunity*) I add, in my pedagogical application of the logic-of-events, two new student/pupil-specific intentions. With the help of these new intentions it becomes possible to describe and emphasise aspects that influence the behaviour of the student/pupil (but not that of the teacher) in the learning situation. These "new" intentions are:

The intention *concessivity* is an intention formed within the individual and tied to the subordinate position of learners. It is meant to describe to what degree a learner conforms to and subordinates him or herself ("opens up") to the teaching – the degree of concession on the part of the student. There might be a number of different motives and considerations behind a learner's decision to "play along" (a high degree of concessivity) or to withdraw from the teaching situation (a low degree of concessivity) and it is not always the case that the learner is actively aware of these reasons.

Curiosity is the second new intention. Curiosity constitutes an important pedagogic force in the teaching situation. It is in order to emphasise the fact that the inclination to examine and discover "in itself" makes the individual (here the student) act, that the intention curiosity is introduced as an intention of its own.

In addition to the intentions mentioned above, the students' perceptions of demands of the situation – their *epistemic attitude* – are also included as an internal determinant. An individual's epistemic attitude is connected to (and dependent on) external stimuli or demands. The epistemic attitude – that is how the leaner perceives and handles the "demands of the situation" and his or her role as a student – is of decisive importance as to how the learner will "succeed" in the learning situation.

In every educational setting there is continuous interplay and reciprocal action between all the different factors in and outside the institution (schools, universities) that influence the activities of the institution. What external determinants a learner is going to be exposed to depend on external factors (regulations, social, economic and cultural conditions, the tradition of the institution in question and expectations that surround the activities of the institution).

von Wright also points out the need to describe and explain the situation in which the action takes place – the event's historical context. The more we know about the conditions of the event the more accurate our conclusions are in assessing the external logic of an individual's behaviour.

Logic of events analyses of learners' actions makes it possible to acquire a deeper knowledge about the learner. The analysis model gives us the possibility to discern more general and recurring patterns of behaviour among learners – a knowledge that constitutes valuable help when it comes to dealing with other future learners in similar teaching situations. The fact that the logic-of-events interpretation model supplies concepts that put words to both the learner's "internal life" and the pedagogical situation in question makes us aware not only of the effects of the learners' actions but also of possible reasons for these actions.

The systematic structure of the model brings attention to aspects of the learners (which are of possible pedagogical significance to the teacher) that might otherwise remain undiscovered and unexploited. Furthermore, every logic-of-events interpretation includes the fact that the teacher must decide how the learner's behaviour relates to all "categories of intention" – not only those that the teacher him/herself considers to be the most likely, but also other possible interpretations.

The intellectual and mental preparedness which this provides opens up to sensitivity towards not only the individual learner in one specific situation, but also to other learners in similar situations. Logic-of-events interpretations of learners' actions can, thus, be said to increase the awareness of the learner as an individual but also of the learner as part of a larger context – of the complexity that influences every teaching situation. Insight into this complex issue can be said to constitute a valuable basis for the pedagogical work.

6. SOME PRELIMINARY RESULTS

In the first pilot (conducted in April-May 2007) we wanted to test the potentials (technical and pedagogical) of the PDA devices. We needed to find out what kind of problems and difficulties the students experienced in relation to mastering the PDA devices. We also needed to know how the students dealt with the assignment to systematically analyze and document their own working/learning processes. An additional objective was test different methods of systemizing our own data collection.

Since this is an ongoing project (data collection was completed just days ago) I am only able to present a few very preliminary results from this first pilot.

The results so far show that the use of the PDAs as a tool for documenting the working/learning processes was very much appreciated by the students. There were (to our surprise) no complains about the limited time available (1 hour) to familiarize themselves with the devices. By trial and error and the occasional help from fellow students competence of mastering the devices was obtained efficienlyt and successfully.

> No problem at all. Nice little device. I also like the possibility to 'go online'.
> (Male student)

However some students (not surprisingly) commented that they would have liked to have developed a higher level of competence than was possible given time limitation.

> I would have used the drawing possibility more if I had gotten more time to develop that possibility. (Female student)

In our instructions to the students we had deliberately restrained ourselves from being specific in relation to what kind of reflections they should do, when they should register their reflections or how they should do it (by camera, notes, drawings or voice recorder). The only instruction given was the demand to register reflections at the beginning and end of each working session. The reason for us being so restricted was our wish to discover as many obstacles as possible. This revelation of expected and unexpected problems has already given us valuable information on how to design the main project.

Most students (but not all) commented the lack of instructions. In relation to the aspect of *what* to put forward reflection wise the students commented that they would have liked to have access to some kind of question guide that they could base their reflections on. The students suggest questions like 'What is difficult right now?' or 'Why do I find this difficult?'

In relation to the way in which the students choose to register reflections, result show that a majority of them prefer documenting with the camera. The recording possibility is also frequently used. Very few of the students used more than these two ways of register with the PDA devices. One of the students commented this by saying:

> To make notes with this PDA is taking to much time. The camera is another thing. I love seeing how my work develops. It really looks better than it is! (Female student)

Another student comment the way this documentation had given him insight about his own strategies of learning.

> I did not know that I am so dependent on being able to discuss problems with other before doing things myself. I have always considered myself to be so 'a loner' when it comes to learning. Strange… (Male student)

This pilot has provided us with lots of information. Even though many results from this first pilot study still remains to be analyzed, PDAs as a tool for teachers and teaching has proven to be a useful tool in educational settings.

The use of PDAs seems to increase learners' self-awareness in relation to their own learning processes. Even though these results are very preliminary data indicates that the way the students externalise their thinking process with the help of the PDAs seems to support their meta-cognition and to deepen their awareness of their own as well as other students' repertoire of learning strategies. The fact that they also find this process amusing is very encouraging at the prospect of the next phase of our project.

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Show me "Fair" Use: Regulating File-Sharing in Research and Education

Yueyue Wang — School of Law, University of Southampton

Abstract

This paper initially examines how fair use/ fair dealing doctrine has struggled in the circumstances of file-sharing. Attention is focused on the following questions: if parties who can take advantage of fair use defence in traditional media have been losing their benefits in file-sharing networks, can the existing fair use system be adapted and/or improved on? Is a solution possible?

In seeking solutions, the paper examines typical proposals towards solving the file-sharing dilemma by categorising them into "the public model", "the private model", and "the voluntary model". By analysis of the advantages and limitations of each model, the impact of these models on fair use practice is thus highlighted and then discussed in context. Finally, it is reasoned to best anticipate a "voluntary" system as a more likely way to promote the availability and use of copyright works in research and education for the benefit of society, while at the same time ensuring that right holders are being fairly rewarded for their efforts.

Keywords:

academic file-sharing, the public model, the private model, the voluntary model

1. Background: Academic File-Sharing Deserves Attention

Most research on file-sharing technology has focused on regulating applications of file-sharing networks to illegal file downloading. In fact, file sharing has being applied much more widely to "many other types of online information, data distribution, grid computing and distributed file system"[1]. This is especially pertinent given the many more propositions related to applying file-sharing technology to research and education, such as LionShare, LOCKSS, eduCommons, Edutella, The Internet Archive Project, are now available.

2. The "Who" Issue: Taking Advantage of Fair Use Defence

The term "fair use" in this paper is described in a broader sense, i.e., it refers to an exception to copyright infringement, no matter whether it is named "fair use" in U.S. Copyright Act or called "fair dealing" in U.K. copyright law. As any court will consider whether the defendant is entitled to benefit from fair use defence at the initial stage of a copyright infringement case, the following analysis is directed to the issue of who can take advantage of fair use defence.

In contrast to traditional copyright situations, the parties to which fair use doctrine has been applied in the file-sharing field are mainly divided into two parts: the primary infringer, namely, the end-users of file-sharing networks who are uploading, downloading, distributing copyrighted works without copyright owners' permission, and the file-sharing intermediaries, namely, the file-sharing tool providers.

Applying fair use defence to the primary infringer in file-sharing networks is similar to that in traditional copyright

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[1] See OECD Information Technology Outlook 2004, *Chapter 5 Peer-To-Peer Networks in OECD Countries, (October 2004)*, available at, http://www.oecd.org/dataoecd/55/57/32927686.pdf. See also, *File-Sharing Goes to the Next Level*, USA Today, (2003).

environment. The issues surrounding whether the primary infringer is entitled to benefit from fair use doctrine can be considered from several aspects, such as the purpose of the use, the amount taken from the copyrighted works, and the market effect resulting from the primary infringing activities.

The role of the file-sharing intermediaries in applying fair use defence deserves particular attention as their special function creates a different nature between file-sharing providers and traditional copying intermediaries. This is especially so, given that the current cases such as *Napster, Grokster, MP3.com* at present recognize it is necessary to apply fair use defence to file-sharing providers. Thus the problem emerges as to whether and how a party who is neither the primary infringer nor the primary actor of the alleged infringement is supposed to exercise fair use rights on behalf of others. Current case law has made it even harder for these defendants to take advantage of the fair use doctrine in the context of file-sharing.

3. Case Studies

Napster[2] was the first case examining fair use doctrine in P2P networks which was eventually heard by the U.S. Ninth Circuit Court of Appeal in 2001. In this case, neither the end-users nor the P2P technology provider applied the fair use doctrine successfully. On the one hand, the primary infringer did "copying, downloading, uploading, transmitting, or distributing plaintiffs' copyrighted musical compositions and sound recordings protected by either federal or state law, without express permission of the rights owner",[3] which constitutes direct infringement of copyright owners' rights. On the other hand, the P2P technology provider, namely, the *Napster* technical intermediary, failed to claim fair use defence for its end-users, based on the commercial benefit derived from the technology, and the technical contribution to the primary infringement as well.

In December of 2004, the Ninth Circuit Court of Appeals held that *Grokster*[4] was not liable for contributory or vicarious copyright infringement because of its decentralized technical design. This case focuses on the use of *Grokster* network to facilitate authorized sharing and sharing of public domain works, rather than concerning end-users' private copying activities. For the first time, file-sharing technology is regarded as an intermediary with "substantial non-infringing"[5] use. It is interesting, however, to note that the fair use defence indeed was not embodied in *Grokster* in spite of the fact that Grokster can be used for both substantial infringing and non-infringing activities. As an architecture which does not provide any direct technical support for infringement, *Grokster* was also held indirectly liable for the infringement "by intentionally inducing or encouraging direct infringement, and infringes vicariously by profiting from direct infringement while declining to exercise the right to stop or limit it"[6].

Compared to *Napster* or *Grokster* which exercises fair use rights for its end-users, *MP3.com* is a "real" fair use case, given that the fair use defense is claimed by the *MP3.COM* provider for himself. In other words, *MP3.COM* is not only the primary actor of the copyright infringement for its end-users, but also the one who argues that such infringing is protected by the affirmative defense of fair use. The Court made the decision in favor of the plaintiffs for the following reasons: first of all, the *MP3.com's* aim showed that although subscribers to the service were not charged a fee, the MP3.com Company was trying to "attract as many subscribers as possible as to draw advertising". As to the portion copied, it was definitely to note that the defendant had copied the replayed entire

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[2] See A&M Records, Inc. v. Napster, Inc., No. 00-16401, U.S, D.C. No. CV-99-05183-MPH.
[3] Ibid., at 4222.
[4] See *Metro-Goldwyn-Mayer Studios, Inc. v. Grokster Ltd.*, 380 F.3d 1154, 1162-1166, (9th Cir. 2004), vacated, 125 S.Ct. 2764 (2005).
[5] Ibid.
[6] Ibid. at 486, 10-13.

works without "transforming". In addition, MP3.com's service was asserted to have invaded the plaintiffs' right to license their sound recordings to others for reproduction. The potential function of MP3.com's service to add positive impact on the plaintiffs' market did not enable the defendant any exclusion from its copyright liability.

4. Analysis: Fair Use Shrinks as File Sharing Grows

Taken together; the case law above indicates that the relationship between the file-sharing intermediaries, i.e., the file-sharing tool provider, and the fair use doctrine posed a dilemma for the Court. On the one hand, the intermediaries exercising fair use defence for the end-users, like *Napster* or *Grokster,* encountered difficulties with this defence. In this matter, the *Napster* court found that, the *Napster* P2P network is not a fair use because "the methods of shifting [in P2P networks] … simultaneously involve distribution of the copyrighted material to the general public; …[rather than] only to the original user".[7] The principle embodied in *Grokster* shows that the file-sharing technology does not benefit from the fair use doctrine no matter whether the file-sharing network is a centralised or decentralised one.

On the other hand, the file-sharing intermediaries those who appeal to fair use for the primary infringing behavior on behalf of others, like *MP3.com*, have encountered difficulties. The *MP3.com* makes it more plausible that file-sharing service providers can claim fair use protection.

As such, the chances of taking shelter under the advantage of fair use defence for both end-users and file-sharing providers have shrunk with the growth of file-sharing technology. The traditional conditions on which the fair use doctrine was utilized have withered away in the file-sharing environment. Imagine a community where the public garden is largely surrounded by private land. How could people get to the garden and enjoy flowers "without some means of access the public right to use the [garden]"[8]?

5. Solutions:

5.1 From Entertainment Industry Practice

The entertainment industry has been struggling to deal with the copyright infringement problem caused by file-sharing technology. Scholars and politicians have put forward a number of possible solutions to the file-sharing conflict. It is noteworthy to examine some typical proposals deployed in entertainment industry.

A. The Public Model: Levies, Taxes or Tariffs

One of the solutions that have been applied in entertainment file sharing practice is the "public model", known as the levy or tax scheme, which refers to those approaches involving government control[9]. Such a scheme grants a government-mandated tax or levy on purchases of recordable media, in exchange for legally copying copyright protected works. The levy and tax scheme on file-sharing equipment and services has been readily adopted in

[7] See Napster, at 4239.

[8] James Boyle, *The Enclosure Movement and the Construction of the Public Domain*, 66 Law & Contemporary Problems, (2003), at 33.

[9] To date, the government-involved approach has been discussed in different jurisdictions. For example, Jörg, Reinbothe, *Compensation for Private Taping Under Sec 53(5) of the German Copyright Act*, 12 International Review of Industrial Property and Copyright Law, (1981), at 36. See also, Ernest A. Seemann, *Sound and Video-Recording and the Copyright Law: The German Approach*, 2 Cardozo Arts and Entertainment Law Journey, (1983), at 225. Thomas Dreier, *Copyright Law and Digital Exploitation of Works: The Current Copyright Landscape in the Age of the Internet and Multimedia*, (1997), available at, http://library.fes.de/fulltext/stabsabteilung/00218toc.htm. Don E Tomlinson and Timothy Nielander, *Red Apples and Green Persimons: A Comparative Analysis of Audio Home-Recording Royalty Laws in the United States and Abroad*, Mississippi College Law Review, (1999), at 5. Rightscom and Business Software Alliance, Economic Impact Study: Private Copying Levies on Digital Equipment and Media in Europe, (Sep 2003), available at, http://global.bsa.org/eupolicy/LeviesEconomicImpactAna.pdf.

continental European law countries. The German experience presents an example of the public levy model. The German scheme was initially rooted in two cases, where the German Collecting Society for Musical Performing and Mechanical Reproduction Rights (GEMA) commended lawsuits against the manufacturers and retailers of tape recorder machines. *GEMA (1954 and 1964)*[10] introduced the statutory licence and levy "as a matter of law"[11] in 1965 new Copyright Act, the Urheberrechtsgesetz (UrhG), which, with various amendments, is still in force today. The current German private copying levies require the payment of a levy on digital media, including blank audio and audiovisual recording media and devices, such as blank CDs and DVDs, CD burners, as well as personal computers (PCs). The detailed rates of levies currently applied has been listed as follows:

Media	Cost/Data	Cost/Time
Data CD-R		€0.088 per 74min
Data CD-RW		€0.088 per 74 min
Audio CD-R RW		€0.088 per 74 min
DVD-R		€0.174 per 120 min
DVD+R		€0.174 per 120 min
DVD-RW		€0.174 per 120 min
DVD+RW		€0.174 per 120 min
Equipment	**Cost**	
Integrated CD-R RW Writers	€7.50 per unit	
Combo Drives	€7.50 per unit	
Audio CD Recorders	€1.28 per unit	
Integrated DVD R RW Writers	€9.21 per unit (From January 2003)	
Scanners		
Up to 12 copies per minute	€10.23 per unit	
From 13-35 copies per minute	€31.96 per unit	
From 36 to 70 copies per minute	€47.93 per unit	
More 70 copies per minute	€255.65 per unit	

Source: EICTA

Figure 1. Detailed Rate on Digital Media and Equipment in German[12]

B. The Private Model: Business Licensing Agreements

The other model adopted in entertainment industry practice is a private contract system, known as the "private model". Compared to the public levy system, "private contract model" refers to collecting compensation for copyright owners by agreements or contracts, while safeguarding copyright limitations and exceptions. The selling contract exemplified by Apple's iTunes Music Store is a typical proposal the entertainment industry has put forward to address the unauthorized private copying problem.

The iTunes business model relies upon the contract between Apple Company and the consumer effectively reallocating copyright entitlements. In other words, Apple uses two legal strategies to set up consumers' rights and reliability from iTunes Music Store: agreements through contract and limitations from copyright laws. On the one hand, the Apple's clickwrap contract enables change in distribution of copyrights in certain circumstance. For instance, §9(b) of iTunes Music Store Terms of Service permits users to copy a downloaded music file on up to three computers, to burn an audio playlist up to seven times, and so on.[13] In other circumstances, however, the agreement requires consumers to forgo certain rights and defences under copyright law in exchange for access to the iTunes' music. For example, §8(b) of the iTunes Music Service Terms requires iTunes users "not to attempt to, or to assist another person to, circumvent, reverse-engineer, decompile, disassemble, or otherwise tamper with any

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[10] See *GEMA v. Grundig*, 1 ZR 8/54, 17 BGHZ 266, 271,272, [1955] GRUR 492.
[11] See Andrew F. Christie, *Private Copying Licence and Levy Schemes: Resolving the Paradox of Civilian and Common Law Approaches*, Legal Studies Research Paper, No. 116, Melbourne Law School, (March 2004), available at, http://ssrn.com/abstract=690521. at 6.
[12] See *Economic Impact Study: Private Copying Levies on Digital Equipment and Media in Europe*, Report Commissioned by Business Software Alliance, (2003), at 17.
[13] See §9(b) of iTunes Music Store Terms of Service, see Appendix 2.

of the security components … for any reason whatsoever"[14]. This term waives any right related to reverse-engineer the software consumers may have under copyright law.

C. In order to save fair use, we must NOT *kill it*

Both the public levy and the business licensing strategies are economically and legally essential. *Economically*, the schemes have opened up an opportunity of copyright holders to receive compensation. *Legally*, allowing private copying in certain circumstances will improve the clarity of copyright law system. What deserves particular attention is, nevertheless, that both models potentially curtail "fair use" privileges in the context of research and education.

As we all know, fair use is non-remunerated — the copyright owner is not rewarded while the fair user is not charged directly. Within the public levy model, every user pays taxes or levies. Certain users "who rarely use networks"[15], namely, low-volume users, even need to subsidise high-volume users. If everyone is charged for this access to information, where can we see the application of fair use doctrine?

The private contract model may also limit the use of fair use doctrine. For instance, iTunes Terms of Service in US include language which could preclude fair use of downloaded music. §13(a) requires consumers agree that " the service [of the iTune Music Store], including but not limited to graphics, audio clips, and editiorial content, contains proprietary information and material that is owned by Apple and/or its licensors … and that [they] will not use such proprietary information or materials in anyway whatsoever except for use of the Service in compliance with the terms of this Agreement [the iTunes Service Terms]." According to this provision, the iTunes music is not supposed to be "in anyway whatsoever", including for fair use purposes.

5.2 From Open Access Movement: The Voluntary Model:

Another proposal deserving of particular attention suggests to the effect that authors could give away their copyright content for free and make monetary remedy by selling "ancillary services that are not easily duplicated by digital copyists",[16] also known as the "voluntary model". Scholars and researchers worldwide have set up a movement known as Open Access (OA), in order to minimize the limitations presented by traditional licensing in the context of the digital world. A variety of OA policies have been endorsed by organisations all over the world.

Notwithstanding the challenges and concerns presented by the OA licensing model, this voluntary model has some features which are able to serve the application of fair use doctrine. First of all, Open access to scholarly research is beneficial to public interest. Free online availability of information may enhance academic communications, speed scientific discoveries, and promote social progress. Given open access to knowledge, researchers and scholars can reach any article on the website, rather than merely those provided in the particular journal accessible within certain libraries. Research funding agencies have long endeavoured to promote open access to the research they fund and support. For instance, the *U.S. National Institute of Health's Public Access Policy*[17] was put into practice in 2005, which requested medical researchers provide an open access version online. In June 2005,

[14] See §8(b) and 9(b) of iTunes Music Service Terms, see Appendix 2.
[15] See Neil Weinstock Natenel, *Impose a Noncommercial Use Levy to Allow Free P2P File-Swapping and Remixing*, (Nov. 2002), available at, http://www.utdallas.edu/~liebowit/knowledge_goods/netanal%20levy.pdf
[16] See Diane Leenheer Zimmerman, *Authorship Without Ownership: Reconsidering Incentives in a Digital Age*, 52 DePaul Law Review, (2003), at 1121. See also, Esther Dyson, *Intellectual Property on the Net,* available at, http://www.eff.org/Publications/Esther_Dyson/ip_on_the_net.article.
[17] See *the U.S. National Institute of Health's Public Access Policy*, (May 2005), available at, http://publicaccess.nih.gov/. (last accessed at 14/02/2007).

the *Research Council UK's (RCUK's)* published a statement on *Access to Research Outputs policy*,[18] requiring immediate self-archiving through their institutional repositories.

Second, open access benefits users by opening up more information sources. Lack of funds and space makes it impossible for any library to subscribe to every scientific journal, a situation known as "the series crisis"[19]. Open access helps researchers and scholars obtain access to articles or journals that their libraries do not subscribe to. In addition, open access extends the domain of research beyond academic. The readers of an open access article can be anyone: a professional in the field, a student, a writer, or anyone who is interested in exploring the topic. For example, I can easily read the scholarly literature about brain tumour research on open access archives, rather than searching hundreds of books in a medical library.

Third, open access helps authors to enhance their research impact. In 2004, Eysenbach compared citations to individual articles published in the journal "*Proceedings of the National Academy of Sciences*" (PNAS) with the ones published on the open access archives. The research showed that between June 2004 and December 2004, open access articles were three times as likely to be cited as non-open access articles.[20]

Compared to business models listed above, the OA licensing system reflects the thought that copyright owners should grant some of their exclusive rights to the public, which substantially promotes public interest by ensuring basic human right of accessing knowledge, and benefits authors as well by allowing wider distribution of their works. Although it is far too early to affirm that open access is the way to solve the fair use problem in file-sharing environment, the voluntary model is worthy of further research, given the fact that the OA system is a potential way to regain balance between social benefits and authors' private interests.

6. Conclusion

As has been outlined in the earliest sections here, it is becoming increasingly problematic to apply fair use doctrine within file-sharing practice. This paper then moves on to examine the public levy model and the private licensing scheme deployed in entertainment industry practice; and explores the side-effects of these two business mechanisms towards negating the application of fair use doctrine. Then, by way of contrast, the voluntary model exemplified by the Open Access Movement is examined, with its potential positive impact on fair use practice. There is no attempt to offer any perfect theory or model for such would surely be premature at this stage given the rapidity of advances in file-sharing technology. Rather, it is suggested that the current direction of relevant case law might be seen as eroding the extent of the "right" to fair use defence, and that the voluntary model might provide a basis for discussion towards restoring an appropriate equilibrium to this doctrine.

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18 See *Access to Research Outputs*, the Research Council UK, (June 2006), available at, http://www.rcuk.ac.uk/research/outputs/access/2005.htm. (last accessed at 14/02/2007).

19 See Lee C.Van Orsdel and Kathleen Born, *Choosing Sides: Periodical Price Survey 2005*, LibraryJournal.com, available at, http://www.libraryjournal.com/article/CA516819.html.

20 See Gunther Eysenbach, *Citation Advantage of Open Access Articles*, PloS Biology, (2006),available at, http://biology.plosjournals.org/perlserv/?request=get-document&doi=10.1371%2Fjournal.pbio.0040157.

The Learning Behaviors of Users in Workplaces for a New IT

Show-Hui S. HUANG
Department of International Business & Trade
Shu-Te University, Taiwan 824, R.O.C.

and

Wen-Kai K. HSU
Department of Shipping Transportation & Management
National Kaohsiung Marine University, Taiwan 811, R.O.C.

ABSTRACT

Due to the global competitions, many organizations have implemented new Information Technology (IT) to enhance their competitiveness. The purpose of this paper was to discuss the learning behavior of workplace users for a new IT sysem. Two variables, workload pressure and learning attitude, were employed to define the learning behavior for the new IT. Through two intermediate variables, perceived ease of use and perceived usefulness, 4 exogenous variables were investigated to analyze the determinants that affect learning behavior of the user. The 4 exogenous variables included internal computer knowledge of users and 3 external environment factors: technology support, organizational climate and training. For the above analysis, a causal model with an IT of ERP system was constructed. As an empirical study, 109 workplace users from firms in Taiwan were sampled to validate the model. The results indicated that, except training factor, all of the exogenous variables have significant direct or indirect effects on user learning behavior respectively. The training factor, even though doesn't affect the learning behavior of users, has significant relations with the external factors of technology support and organizational climate. The results could provide information for organization managers in implementing new IT.

Keywords: Acceptance, TAM, ERP, Learning Attitude

1. INTRODUCTION

Business organizations constantly upgrade Information Technology (IT) to enhance their global competitiveness. However, a new IT, especially a complicated IT with mandatory use, may put pressure on users when the new technology must be learned. Users may worry that the necessary learning may increase their workloads. Generally, this is quite common for users with less computer knowledge, because they need to spend more time to learn the new IT. If such pressure can not be reduced, it may lower user learning effectiveness, and as a result, lead to poor IT performance.

Enterprise Resources Planning (ERP) is one of the most popular forms of IT for businesses. In Taiwan, a portion of businesses have implemented ERP systems, but in many cases unsuccessfully. A study by the Industrial Technology Intelligence Services Center (ITIS, 1998), indicated that the key factors in successful implementation of an ERP system include: user acceptance, organizational system and features of software, and most importantly, the user acceptance factor. Hence, when implementing new IT, improvement of user acceptance is one of the most important issues for organizational management.

For most companies, once the IT is implemented, all of the employees will be required to learn and use it. Since, the learning process usually increases extra workload of users, the new IT may put pressure on users. In such situations, reducing pressure on users to increase learning effectiveness should be a practical consideration for organizational management. Previous studies do not discuss acceptance attitudes for mandatory users of new IT in any great detail.

The purpose of this paper is to discuss the acceptance levels among workplace users of a new IT (ERP system) with mandatory use. Since the first problem users have to face with the new IT is learning it, the variables of learning attitude and workload pressure are investigated to measure user acceptance. Based on the relevant literature and the features of ERP system, 4 exogenous variables and two intermediate variables of Technology Acceptance Model (TAM), perceived ease of use (PEOU) and perceived usefulness (PU), are then employed to analyze the determinants that affect user learning behavior of the new IT. The 4 exogenous variables include one user-related factor, user internal computer knowledge, and 3 external environment factors: technology support, organizational climate and training. A causal model was constructed for the analysis. The model was validated using 109 workplace users from firms in Taiwan that had just implemented new ERP systems. The results provide useful information for organization managers in implementing new IT.

2. LITERATURE

The purpose of this paper is to discuss the learning behavior among workplace users of a new ERP IT system. Accordingly, the literature is reviewed by the user behaviors of IT and the ERP system.

The user behaviors of IT

Based on the theories of TRA (Theory of Reason Action) (Ajzen & Fishbein, 1980) and TPB (Theory of Planed Behavior) (Ajzen, 1985), the Technology Acceptance Model (TAM) (Davis,1989) is one of the most popular models for studies of IT and user behavior. TAM employs user intention to define acceptance of using a given IT system. Through 3 intermediate variables, user attitude, PEOU and PU, a causal model was constructed to analyze the user intention when using the IT. The results of the TAM indicate that intentions of users were mainly affected by their attitudes, and the user PEOU and PU for the new IT were the most direct factors to affect the attitudes. Additionally, users PEOU also has a direct effect on their PU for the new IT. For TAM, PU was the major factor and PEOU was the minor factor among determinants of user acceptance of new IT. TAM has been widely applied in subsequent research, including personal package (Lederer, Maupin, Sena & Zhuang, 2000; Gefen & Straub, 2003), organizational contexts (Igbaria, Zinatelli, Cragg, and Cavaye, 1997), and user profiles (Venkatesh, 1999; Wixom & Todd, 2005).

Since TAM derives from TRA, which is concerned with rational, volitional, and systematic behavior, TAM generally is applied to explain the behavior that user has control. That's why TAM employs intention to define user acceptance for a certain IT. However, the IT (ERP) discussed in this paper is mandatory for users, therefore this paper revised the TAM with workload pressure and learning attitude of users instead of intention.

Furthermore, the frameworks of IT have become more and more complex as technology advances. To more completely analyze user behavior, Davis, Bagozzi and Warshaw (1992) suggested that it is necessary to investigate the exogenous variables that affect TAM further. There were three main categories of exogenous variables have emerged in subsequent work (Igbaria, Iivari & Maragahh, 1995; Hong, Thong, Wong & Tam, 2002), classified as follows:

Individual difference: Individual difference is an important factor affecting new technology acceptance by users (Nelson, 1990). Computer self-efficacy and computer knowledge have frequently been employed to explain individual differences. For example, the study of Venkatesh and Davis (1996) indicated that PEOU of users to use an IT was significantly affected by their computer self-efficacy. For different populations, the same results were also obtained (Igbaria & Maragahh, 1995; Venkatesh, Morris & Ackerman, 2000; Agarwal & Prasad, 1999; Hong et al., 2002). The studies also show that professional computer knowledge of users in using an IT had a positive effect on their PEOU and PU to use the IT (Hong et al., 2002), and so did the general computer knowledge of users (Thong, 1999).

Computer self-efficacy is derived from the variable of perceived behavioral control in the TPB model. Ajzen (2002) indicated that both of those two variables basically are the same. TPB proposed that perceived behavioral control of users is one of the important factor to affect their intention. Based on TPB, the relevant studies (Dickson & Wetherbe, 1995; Hartwick & Barki,1994) indicated that IT skill of users (computer knowledge) is one of the important factors to affect their perceived behavioral control. The above results imply that user computer knowledge is a significant factor to affect their computer self-efficacy. The relevant studies also confirmed the result. For example, there were significant correlations between computer confidence (computer self-efficacy) and computer knowledge (Levine & Donitsa-Schmidt, 1998), computer achievement and computer self-efficacy (Torkzadeh & Koufteros, 1994), and computer anxiety (negative computer self-efficacy) and computer literacy (Marcoulides,1989).

System features: System features are generally defined as the design of the user interface, including the layout of computer screens and the function keys (Hong et al., 2002). The relevant literature indicates that system features have direct and indirect effects on user PU and PEOU to use an IT (Hong et al., 2002). Additionally, through certain belief variables, they also indirectly affect user intentions to use the IT (Venkatesh & Davis, 1996).

Organizational support: Most of the previous research has measured the variable by subjective norms of organizations, which is derived from TPB and generally defined as the support of colleagues, supervisors, and top managers (Davis et al., 1992; Cale & Eriksen, 1994; Karahanna & Straub, 1999; Teo, Wei & Benbasat, 2003). The TPB suggested that subjective norm is a prominent factor to affect user attitude and intention. This result has been supported in subsequent research. For example, the study of Taylor and Todd (1995) showed that the support of top managers is helpful in increasing user experience with an IT system, significantly improving their intentions and attitudes. Karahanna and Straub(1999) showed that user intentions to use an IT are determined by the subjective norms of the organization for potential users, as are attitudes toward use of the IT for current users. Hansen, Jensen and Solgaard (2004) illustrated that for on-line buying, subjective norms had a direct effect on user attitude, and through which it also had an indirect effect on user intention. Moreover, research has also demonstrated that the support, commitment and participation of top management is one of the critical successful factors (CSF) for an ERP system to be implemented successfully (Laughlin, 1999; Bingi, Maneesh & Jayanth, 1999; Adams et al., 1992).

In addition to subject norms, technology support and training are other forms of organizational support. The research indicates that technology support from the organization can effectively improve user PEOU and PU to use a new IT system (Hartwick & Barki,1994；Igbaria, Guimaraes & Davis, 1995). Training was also an important factor in successfully implementing an ERP system (Laughlin, 1999; Bingi et al., 1999). Sufficient training reduces user anxiety (Mikkelsen, Øgaard, Lindøe, & Olsen, 2002), and improves user performance (Chou, 2001a) and computer self-efficacy (Torkzadeh & Van Dyke, 2002), especially for female users (Chou, 2001b).

ERP system

The ERP system derived from the MRP (Material Requirement Planning) and MRPⅡ (Manufacturing Resource Planning) systems of manufacturing industry. In addition to contain the functions of MRP and MRPⅡ, the ERP system includes post-sales service and marketing support systems. It is also an integral system which is usually constructed using an RDBMS (relational database management system) and a Client/Server system (Mraz, 2000). The ERP system integrates all of the operating information of a business into a database and unique application programs, and it provides uniform operating interfaces (Bingi, Sharma & Godla, 1999).

The above features of an ERP system imply that it is generally a large-scale and is thus expensive, and it is generally complicated and thus a training lesson and technology support may be necessary for users.

Furthermore, ERP systems need to be constructed on complex network frameworks. Hence, in addition to professional knowledge of business administration, such as material management, production planning and accounting, users may also need computer knowledge, especially network knowledge. In addition, since most of the ERP system users are business employees, the systems generally are mandatory for users. In sum, an ERP system usually has several salient features: high cost, training, mandatory use, and knowledge of computers.

3. RESEARCH MODEL

Since an ERP system is usually costly for business, once it is implemented, modification of system features is often not feasible. Hence, this paper focuses on the exogenous variables of individual difference and organizational support. Based on the features of the ERP system, those variables are respectively defined as one internal variable: user computer knowledge, and 3 external environment variables: technology support, organizational climate, and training. Furthermore, the first problem users have to face with a new IT system is learning it. Hence, in this research, the learning attitude defines user acceptance. Additionally, for the mandatory use feature of the ERP system, pressure on the user to learn the new IT system is also considered. The research model is illustrated in Figure 1.

Insert Figure 1 here

4. METHOD

Instruments

Based on the research model (Figure 1), except the Training variable assessed by training hours, 7 self-reporting subscales were designed to measure the other variables. All of the subscales used a 5-point Likert scale (5 = strongly agree; 4 = agree; 3 = uncertain; 2 = disagree; 1 = strongly disagree) to define participant agreement with each statement. Higher scores represent greater agreement with each statement. The negative statements are reversed when scored.

For validating the survey, 3 managers and 30 employees from 2 technology and 1 traditional businesses which are Hanpin Electron (www.hanpin.com.tw), Ralec Electron (www.ralec.com) and Yonue Plastics (www.yatm.com.tw), were invited to revise and pretest the questionnaire. The EFA (Exploration Factor Analysis) and Cronbach's α were employed to examining the validation and reliabilities of each subscale respectively. The items with factor loading being less than 0.7 were eliminated. After deleting 4 statements totally, all of the items of subscales converge to their dimensions corresponding to their variables respectively, and all of the explanatory variances and Cronbach's α of subscales were greater than 65% and 0.7. The results show that the questionnaire has validity and reliability.

The Computer knowledge: This part of scale was modified based on the studies by Levine et al., (1998). The statements are designed to evaluate general computer and network knowledge of users. After the above pretest, 6 items remained, which were reorganized into 3 statements with two items each. Higher scores represent a higher level of computer knowledge.

The external environment: This part of scale was modified after the studies of Igbaria, Guimaraes & Davis (1995) and Mikkelsen et al. (2002). The statements are designed to measure user perceptions about organizational climate and technology support. The former is defined as the learning climate among colleagues and the attitudes of managers. The latter is explained as assistances from the IT department of organization. Higher scores represent a higher perception of organizational support among users. After the above pretest, 6 items remained, 3 for organizational climate and 3 for technology support.

As for the training variable, since training programs usually vary by companies, it is not easy to measure them objectively. Thus, this paper defines training as the training hours that users had attended and measured in the demographic section**.** The measurement of the training variable was classified into four levels based on training hours (4 = over 16 hours; 3 = 9-16 hours; 2 = 1-8 hours and 1 = 0 hour).

The intermediate variables: This part of scale was modified after the questionnaire of Davis et al. (1989), which was designed to measure the variables of PEOU and PU in Figure 1. Higher scores represent higher user perceptions of ease of use and greater usefulness for the new IT. After the above pretest, 6 items remained, 3 for PEOU and 3 for PU.

The acceptance variables: After the pretest, 6 items remained in the final part of scale. The first 3 items were designed to access user perception of workload pressure, defined as user anxiety about the extra workload created by the need to learn the new IT system. The other 3 items were based on the scale of Ai-Khaldi & Ai-Jabri (1998) and Igbaria et al. (1997), and was designed to evaluate user learning attitude, defined as the interest and willingness to learn the new IT. Higher scores represent stronger workload pressure and more negative learning attitude.

The Population and Sample

The ERP system providers, like SAPAG, Oracle, PeopleSoft and J. D. Edwards & Bann (Anonymous, 1999), define the modules in different ways. Since most of the companies in Taiwan use the Oracle ERP system, the research population consists of the firms have just adopted or will implement the system. In addition, the firms have just adopted or will implement any kind of IT with mandatory use could also be included in the research population.

Based on information from Oracle agents in Taiwan, this paper selected firms which had just implemented an ERP within the previous year. Then, 10 surveys were placed for each of the firms to investigate the users of material management and production planning. The sample size was 410 with a total of 109 valid responses, 77.1% from technology businesses and 22.1% from traditional businesses, and 56.9% from male users and 41.3% from female users. As for educational level, there are 19.2% of respondents with high school degree, 33.9% with two year college degree, 41.3% with four year university degree, and 5.5% of graduate degree. The average age and seniority of the participants were 33.35 (S.D. = 6.57) years and 6.28 years (S.D. = 5.13) respectively. Additionally, 12.8% of the subjects were studying part-time.

Data analysis

According to the research model (Figure 1), there are 1 manifest (Training) and 7 latent constructs, which form 26 paths (20 regression paths and 6 correlation paths). The 7 latent constructs include 3 exogenous variables (computer knowledge, organizational climate, technology support) and 4 endogenous variables (PEOU, PU, workload pressure and learning attitude). A LISREL (Linear Structure Relations) with standardized scores is employed to analyze the causal relations among the constructs in the model.

Since the χ^2 Test is sensitive to sample size, the ratio of χ^2 to degree of freedom (χ^2/df) is adopted to test the fit of the overall LISREL model instead, which was suggested to ideally be less than 3 (Hair, Anderson, Tatham & Black, 1998). Additionally, several other popular indices were applied to evaluate the model in this paper, including the AGFI (Adjusted Goodness of Fit Index), CFI (Comparative Fit Index), RMSR (Root Mean Square Residual) and RMSEA (Root Mean Square Error of Approximation). The AGFI and CFI are suggested to be greater than 0.8 and 0.9 respectively (Bentler, 1990). The RMSR and RMSEA are recommended to be less than 0.08 and 0.10 respectively (Hair, 1998). All of the above suggested values for a good fit of a model are restated in the second row of Table 1. The Cronbach'α, composite reliability, and average extracted variance of construct are employed to evaluate the measurement models used in this paper.

Insert Table 1 here

5. RESULT

Based on the research model shown on Figure 1, the LISREL is employed to analyze the causal relations among the constructs in the model. In this section, the proposed model is firstly assessed, the structure model is then discussed.

The assessment of model

The results of the LISREL analysis for Figure 1, named as the initial model, are shown in the third row of Table 2. A (χ^2/df) value of 1.70 is obtained, significantly less than the suggested value 3. In addition, almost the other indices also fit the suggested values. Therefore, the proposed model, on the whole, is fit. Since several path coefficients among constructs are not significant at $\alpha = 0.05$, the LISREL was performed again with those paths eliminated. The resulting named modified model is also presented in Table 2. It indicates that the indices generally fit the suggested values. Therefore, the modified model is still a good fit. The estimators of path coefficients are illustrated in Figure 2. These explain 67% of the variance of the learning attitude ($R^2 = 0.67$).

Insert Figure 2 here

Since the assessments of overall model are adequate, the measurement model is then evaluated further. The result of Figure 2 indicates all of the path coefficients of the indicators in the model are greater than 0.50, the cutoff value suggested by Hair et al. (1998), and most of the values exceed 0.70. From the path coefficients, all of the composite reliabilities and average extracted variances of constructs are found and shown in the third and fourth fields of Table 1, respectively. Both of the indices exceed 0.7, the cutoff values recommended by Hair et al. (1998). All of The Cronbach α of the constructs exceed 0.7 and most of them are over 0.8. In sum, the reliability and validity of the measurement models are adequate, and the explanatory power of user learning attitude is 67%.

The structure model

The results of Figure 2 indicate that PU has direct effects on workload pressure (β =-.55) and learning attitude (β =.33) respectively. Since workload pressure also has a direct effect on learning attitude (β =-.27), there is an indirect effect of PU on learning attitude (β=-.55*-.27). The total effect of PU on learning attitude is calculated thusly: β=.33+ (-.55*-.27)= .48. Similarly, since PEOU has a direct effect on PU (β=.92), the total effect for PEOU on workload pressure and learning attitude would be β=.92*-.55=-.51 and β=(.92* -.55*-.27)+(.92*.33)=.44 respectively. Totals for other effects among the constructs are found in Table 2.

Insert Table 2 here

The Figure 2 and Table 2 also show that, among exogenous variables, computer knowledge has significant (total) effects on the workload pressure (β = -.15) and learning attitude (β =.34) respectively, as does the technology support (β = -.26 and β = .22). Though organizational climate does not affect the PEOU, PU, and workload pressure, it has a direct and positive effect on learning attitude (β= .36). Training has no significant effect on any of the endogenous variables, but it does have a significant positive correlations with technology support (r = .29) and organizational climate (r = .58) respectively, as does computer knowledge (r = .22 and r = .24). In addition, there is also a significant correlation between technology support and organizational climate (r = .42).

Based on these calculations, the hypotheses in Figure 1: H_5, H_6, $H_{7,}$ and H_8 are confirmed, and the others are partly verified.

6. CONCLUSIONS

The purpose of this paper is to discuss the learning behavior among workplace users of a new IT system. Workload pressure and learning attitude are employed to define the acceptance of users. Through PEOU and PU, 4 exogenous variables are investigated to analyze the determinants that affect user acceptance. The 4 exogenous variables include computer knowledge, technology support, organizational climate and training. For the above analysis, a causal model with an implemented new ERP system is constructed. To validate the model, 109 workplace users from manufactories in Taiwan were sampled.

The results show that technology support and organizational climate can effectively improve user learning attitude for a new IT. Generally, technology support offers advanced technology assistance, and colleagues (organizational climate) provide general, but timely help. Users with a higher level of computer knowledge tend to need the former support, whereas users with lower levels of computer knowledge are likely to need the latter help. This paper suggests that companies organize teams as "QC Circles" (Quality Control Circles). Users with a higher level computer knowledge should be assigned to be the leaders of teams to offer their members general help, while the technology department concentrates their support on the leaders. These resource allocations can not only utilize the manpower of technology department, but also improve organizational climate among users for learning the new IT.

The results also show that, through PEOU, improving the computer knowledge of users can significantly increase their positive acceptance of a new IT system. Since IT advances rapidly, users need to be pushed to constantly learn new IT knowledge. This paper suggests that in addition to offering users a variety of learning methods, such as the information from IT exhibitions, IT magazines, and expert lectures, promotion of the concept of lifelong learning to improve user self-learning is also an effective way to enhance user IT knowledge. Encouraging employees to study part-time at schools is another way to increase their IT knowledge.

This paper indicates that there is a significant correlation between user computer knowledge and organizational climate. This paper defined the organizational climate as the support of colleagues and managers. Generally, the demand of users for environmental support differs by their computer knowledge level, with more knowledgeable users needed less support. However, this paper does not discuss the cross effects of computer knowledge and organizational climate. Further research is needed in this area.

In Taiwan, over 95% of businesses are small and medium scale, many of which are similar to the manufacturers discussed in this paper. Some of these firms have implemented an ERP system, while others may implement one in the future. The results of this paper may provide useful information for the managers of those businesses. Our finding may also offer useful information for managers implementing a new IT system, especially when use of the IT is mandatory. Due to socio-cultural differences, the results of this paper may not be applicable to other cultures. However, the research models may offer useful references for further research.

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Table 1
The results of goodness of fit tests of research model

Test Indices	χ^2	df	χ^2/df	AGFI	CFI	RMSR	RMSEA
Suggested value	--	--	<3	>0.800	>0.90	<0.08	<0.10
Initial model	313.4	184	1.70	0.726	0.910	0.050	0.058
Modified model	323.4	197	1.64	0.740	0.912	0.054	0.077

Table 2
The total effects of research variables

	PEOU	PU	Workload pressure	Learning attitude
Computer Knowledge	.29	.26	-.15	.34

Technology Support	.51	.47	-.26	.22
Organizational climate				.36
Training				
PEOU		.92	-.51	.44
PU			-.55	.48
Workload pressure				-.27

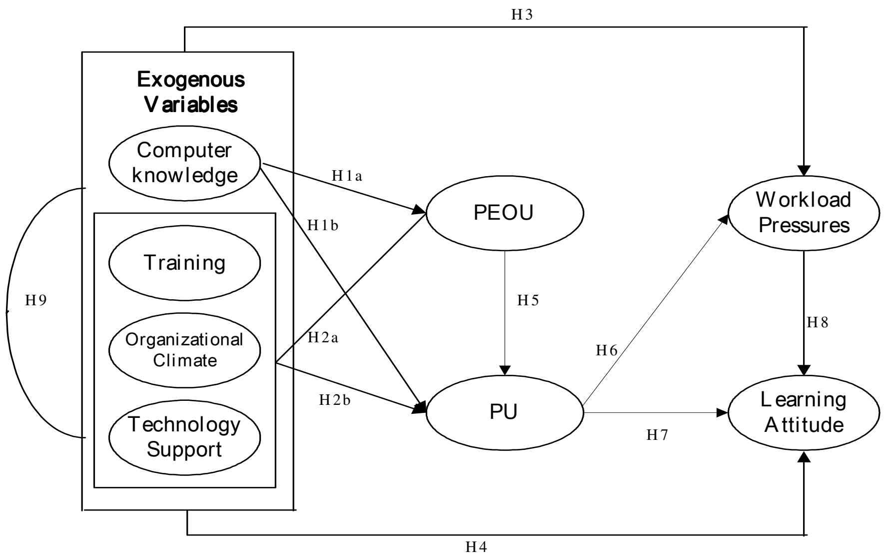
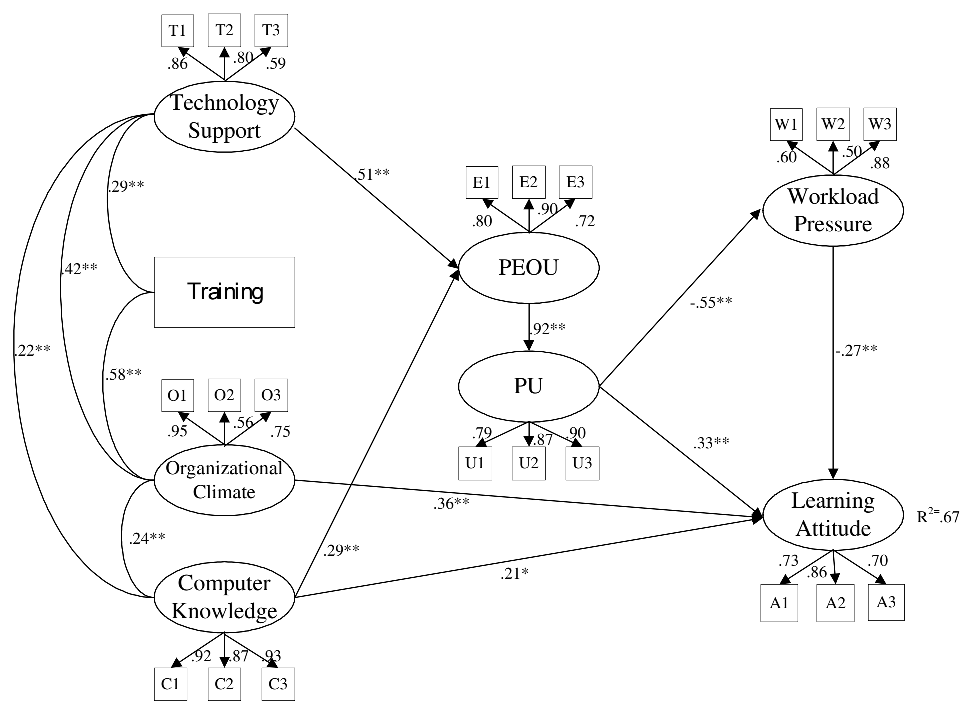


Figure 1 The research model



Note .* $p < .05$ and ** $p < .01$.

Figure 2 The result of LISREL analysis of the research model

The Implementation of Digital Whiteboards as a Teaching Tool

Ann-Charlotte Markman
Rösjöskolan
Sollentuna, Stockholm, Sweden

and

Jonas Bolander
Rösjöskolan
Sollentuna, Stockholm, Sweden

Presentation of the school

Rösjöskolan is situated in a suburb of Stockholm.
We have 380 students from 6 to 13 years of age. About 50 % of our children are immigrants or refugees. The biggest group are Kurds or Arabs from Iraq. Sweden is the country in Europe which has taken the highest number if Iraqi people in 2006 we made Sweden the home for 9000 Iraqis.

ICT as a learning resource

Teaching children from such an area requires good teaching and dedicated teachers. Our target is to challenge children to gain good results in reading and writing and maths. As so many of them have Swedish as a second language it takes effort. For many years to help us do this we have included ICT in this process. We find this is helpful for several reasons.

- to be able to create individual programs
- to help children to become computer skilled even if they do not have a computer at home
- to help them become familiar with the tools they are going to need in their future schooling and ultimately their working lives

Digital Whiteboards

Rösjöskolan has been fortunate to be involved in a European Comenius project. Since 1996 we have been linked to a school in Britain, and through this school we first learnt about IWBs. I must admit that I at first wasn't too impressed with IWBs when I first saw them being used, but when I later took my young granddaughter to a lesson where fractions were being taught, saw her reaction and the focus and participation of all the children in the group, I was thrilled.

Implementation

As a head you can't stand up in front of all teachers and just say: Let's buy IWBs. Instead I chose to send three teachers to an IWB course in Manchester UK and they came back very enthusiastic. We managed to borrow an Activeboard from the Swedish retailer and for a couple of months we used it at the school and encouraged all the staff to play with it and find out how it worked. This initial time created an interest and a desire to use the board in their teaching.

We then started the process to find out, what IWBs to buy and how much it was going to cost.

Costs

As Rösjöskolan had had a whole year of rebuilding it was time to invest in new technology. We discovered that the cost for an IWB and a projector was comparable to buying the TV, video player, DVD player and overhead projector that we had originally planned invest in.

We could afford to set up 10 classrooms the first year and needed

- a good computer with good speakers
- a projector safely attached to the ceiling
- a digital whiteboard that could be used also for small children and children with special needs

During a couple of months we tested different boards, both hardware and software, and decided to buy Activeboards.

One month after that decision we had ten rooms equipped and had started teacher training.

Interactive whiteboards – why?

- They provide electronic flipcharts that can be saved, maintained and displayed.
- They offer an on screen keyboard which enables editing on the screen and allows you to save any changes or additions.

- They can be used to present the students' own work to the rest of the class.
- You can use them to save class materials which can be used again for students who want the work repeated.
- You can use them to run on-line tests and opinion pools and display instant feedback to the group.
- They enable students to work together and focus their attention.
- They enable us to offer specialised teacher training in this new technology.
- Expand the possibility of software and materials we can use in school.

Teacher training

We soon found that many teachers and teaching assistants hesitated because they felt their computer skills were not good enough to use IWBs. So we did some initial research and decided that we needed to upgrade the technology skills of our teachers. As a means of funding this extra training we then applied for money from the EU to set up training sessions.

The training sessions we were able to provide included: Word, PowerPoint, Excel, using a digital camera and photographic editing and using Microsoft Publisher. These sessions took place during the afternoons and evenings. Teachers were able to choose and signed up to the course they felt they needed to conquer. We devised a 'Computer Driving License' composed of skills we felt they should have. About 90 percent of the staff took part in the project in different types of courses. A skilled computer teacher was hired ho do all sessions and it took half a year to have everyone on board.

As IWB technology was very new to Sweden and weren't used in Swedish schools at that point in time, we gained help from the UK. The first sessions were held the same week we got the first boards up. As the teachers saw the benefits of using IWBs in their classrooms, they worked hard and made good use of the boards. The excellent application and dedication of the Rösjöskolan teachers was recognised and in the space of only 6 months we were awarded the status of **Centre of Excellence**. This was the first award to be made to a Swedish school and is awarded when the school shows that the teachers have gained an advanced level of expertise in both teaching and materials production judged and approved in UK both technically and pedagogically. Rösjöskolan was also the first school in Europe, outside of the UK, to get that award. Four awarded teachers now teach their colleagues. We have continued to buy boards and now there is a board in each classroom, which is especially appropriate also for our children with special needs.

What are we doing today? We still use UK trainers for inspiration and good practice. They also help us to find good resources and how to use them. Right now we are building a digital library in Rösjöskolan and we have got funding to build up a national digital library.

We are looking forward to have this library to share with all teachers in Sweden.

Digital library

What are the benefits of having a digital library?

- Students focus: Children today respond very well to visual content and we need to act on that and utilise visually stimulating materials.
- Children are surrounded by electronic gadgets, mobile phones, electronic games, and computers. It is totally appropriate to broaden the classroom experience to include e-learning.
- Teachers can easily make interesting presentations and integrate up to date internet material and add video or audio clips.
- Teachers and students can repeat, revise, go forward or backwards if needed and easily review, with a visual prompt, any work done at any time.
- Teachers do not have to have their backs to the children. The board can be handled from the back of the room if necessary.
- Any work you do in the classroom, even if its just writing on the board can be saved and reused again.

During the last year and a half we have had this wonderful journey together. This hard work will culminate in a 4 day examination in England in June 2007. There is still much to learn and we will go on as a learning organisation. When I look back I can identify the crucial steps we have made.

Firstly our focus was to equip our school and just start to use the equipment.
Secondly we integrated the technology and the curriculum. The technology became an invaluable tool for teachers. We noticed that students really improved their Math skills and got better in Math tests.

From there onwards we found it was important to involve students and make them take part in their own learning process.

Conclusion

When I graduated as a teacher in 1965 I was taught five very important rules.

- Motivation
- Activity
- Creativity
- Individualised Learning
- Cooperative Learning

I think this advice still works.

Education of teachers in Activprimary and Activboard

The course is divided into three 3 hour-sessions. The objective of the course is that the participants should reach Level 1 - Designer level. Level 1 will give the participants enough knowledge to be able to use the Activboard in their teaching. The participants will also have an understanding of how the whiteboard system is structured.

The course is divided into the following lessons:

Lesson 1

Board
Projector
Pen
Tablet
Vote
The lower tool store

2 practical tasks where one is given as an objective to the next session.

Lesson 2

Repetition of the lower tool store
Save
Special tools
Camera function

Practical tasks

Lesson 3

Promethean man Design mode
Page Notes
Right-click on the object
Right-click on the background
Insert a link
Actions
Promethean World and Shared flipcharts

Each lesson starts with a one and half hour lecture and a questions and answers session. In some cases there will also be some repetition. Then the participants go in pairs to a board to practise. The teachers advise and give instructions whilst the participants work.
Between each lesson there is at least one week and the participants will have tasks to carry out until the next lesson. It is important for the participants to produce something they can use in their own teaching with the pupils. The participants are encouraged to bring thoughts, books and lesson planning to the course. All the work that is produced will be saved in a common folder so that it can be used by everybody at the school. Using flipcharts should in the long-term save time for the participants and not the opposite. At our school we have started our conferences by showing a few flipcharts and how they can be used in a classroom environment.

To make the most of the course the participants are paired into groups of language teachers, maths teachers etc. This will make it easier for the participants to understand how important it is for everybody to share flipcharts.

In the beginning of the course participants that are used to computers find it easy to understand and use the system in their teaching. It takes longer time for older participants and participants that are not used to working with computers to handle the system. But once these participants have understood they are creating fantastic flipcharts. At our school we have a teacher from the rural part of Iraq that has made excellent flipcharts. From many old teachers we have heard the comment ‘the best teaching tool in twenty years’.

At Rösjöskolan we have teachers at Level 1 - Designer level, Level 2 - Curriculum developer and some teachers at Level 3 - Training and resources developer. We are also co-operating with two other schools in Sweden in order to build a national bank of flipcharts that can be downloaded and used by other teachers in their teaching. Together with this Prometheans site Prometheanplanet is an invaluable source for different resources. Flipcharts, objects, templates and much more is available for free for teachers.

Technology Training For Teachers

Patricia McNERNEY **Karen C. DAVIS, Ph.D.**
University of Cincinnati
Cincinnati, OH 45221

Suzanne W. SOLED, Ph.D.
Northern Kentucky University
Highland Heights, KY 41099

Kelly J. OBARSKI
Knowledge Works Foundation
Cincinnati, Ohio 45202

Jim ALLEN, Bethany VICE BOWLING, Michelle DANIEL, Amy DIMMERLING, Matt ESTES, Sarah PUMPHREY, Bartley RICHARDSON, Mike RUST
University of Cincinnati

ABSTRACT

Project STEP[1] (Science and Technology Enhancement Program) at the University of Cincinnati is a program funded by the National Science Foundation GK-12 Program. A primary activity of Project STEP is to train engineering, math, science, and education graduate students (STEP Fellows) to bring their technical expertise into high school classrooms. They collaborate with secondary education teachers to generate new lessons, activities, and resources to enhance the STEM skills of high school students. In addition, the STEP Fellows conduct training for teachers to help them integrate technology into their educational activities to further enhance learning in the classroom. This paper describes our experiences in developing a technology workshop for teachers, taught by graduate students. The workshop focused on innovative and advanced uses of technology rather than basic computer skills. The workshop was well-attended and well-received; we include a summary of the evaluation feedback submitted by teachers.

Keywords: technology training, teachers, STEM education

1. DETERMINIG THE TOPICS

In order to determine the topics of each session, STEP teachers were asked to complete a survey. The survey asked several types of questions associated with seventeen different technologies including: asking teachers about their proficiency in various software, hardware or Internet resources, interest in learning the technology, the availability of the technology in their school, and whether the teacher was aware of the technology listed. The survey also provided teachers with an opportunity to add in any other technology not listed. The results were then analyzed by the STEP team in order to determine the sessions teachers were most interested in participating in. Teachers were also offered an opportunity to earn graduate credit through the University of Cincinnati for a reduced price. If teachers chose to earn credit they were required to incorporate one of the learned technologies into a lesson, evaluate the lesson, and write-up a reflection.

2. INVITING THE PARTICIPANTS

A brochure was created electronically and in print. An e-mail list was created by the grant coordinator in order to send the technology workshop information directly to teachers throughout the greater Cincinnati area. The print version of the brochure was distributed to various schools through the greater Cincinnati area in order to reach those teachers who may not open e-mail from an unknown address. Figure 1 is an excerpt from the brochure that describes some of the specific workshops. The content of each one is described and illustrated in Section 2. Figure 2 describes the goal of the workshop and the modes of instruction. Teachers participated in hands-on learning conducted by the Fellows in a computer classroom at the University of Cincinnati. The vision for the workshop was that teachers would be able to create technology-based lessons for immediate use in their classrooms.

Teachers were invited to register using a web-based registration form. A total of 25 STEM teachers from both urban and suburban school districts attended.

3. CONDUCTING THE TECHNOLOGY WORKSHOP

In this section we briefly describe the four topics covered at the workshop: concept mapping, digital storytelling, graphics and word, and Internet resources and WebQuests. More detailed explanations of each session presented in the workshop are available on the Project STEP website at www.eng.uc.edu/STEP/TechWorkshop/TechWkshp2005/. Each session was designed to benefit classroom teaching and to meet technology standards. The sessions presented ideas and skills for teachers to utilize in classroom teaching, for administration duties, and with students to assist teachers in implementing student technology standards.

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Figure 1. Excerpts from the Technology Workshop Brochure

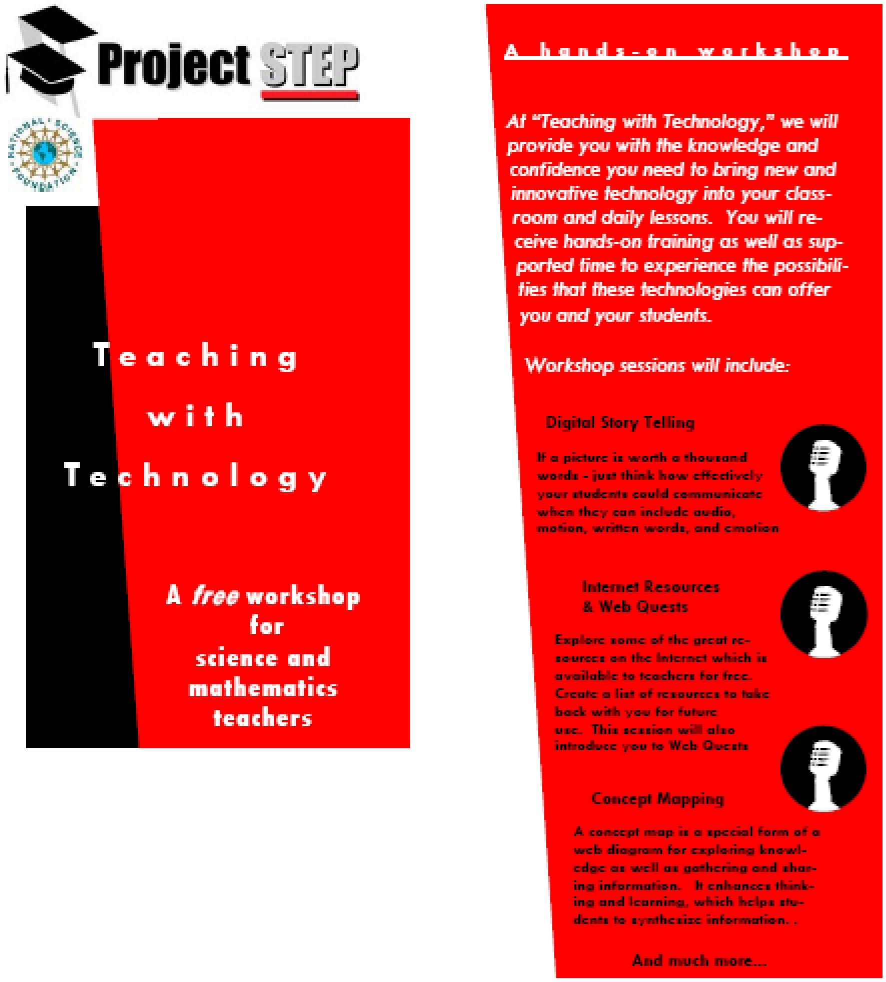
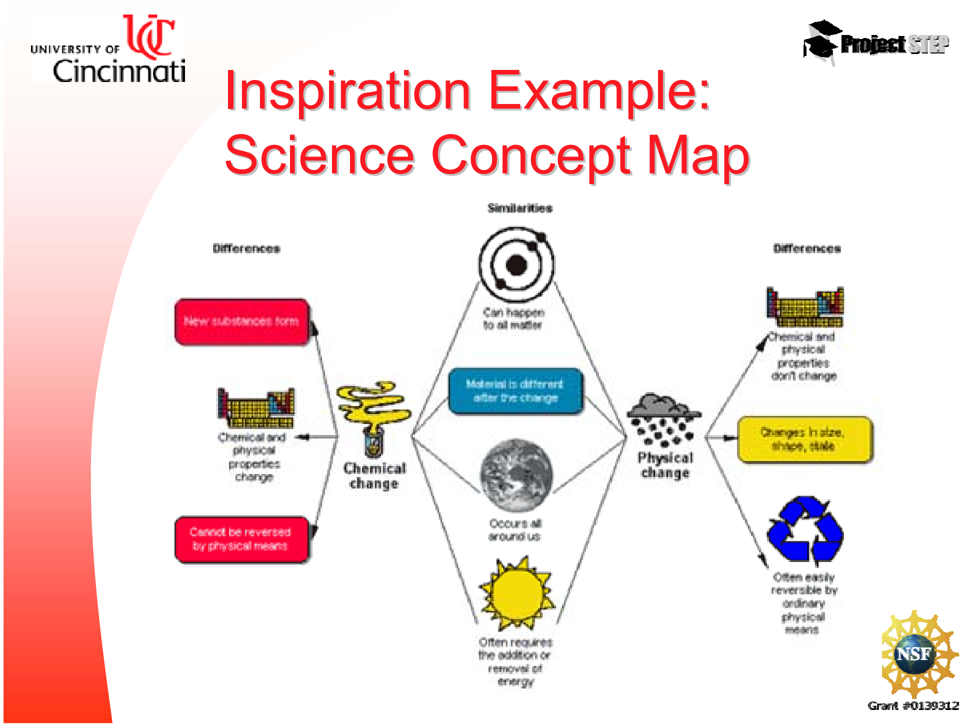


Figure 2. Excerpt from the Brochure Describing the Workshop

Figure 3. Inspiration Example



Concept Mapping
The Concept Mapping session was conducted by Michelle Daniel and Bethany Vice Bowling. The session first described general organizers that can be used in the classroom. An advanced organizer is not a summary; it bridges the gap between what a learner already knows and what is about to be learned. An advanced organizer is typically at a higher level of abstraction than the material to be introduced afterward. One such technique is a concept map. The session specifically addressed concept maps, the technology available for making the maps, and how they can be used in math and science classrooms. The tutorial includes 46 slides with many examples; one example using a software tool called Inspiration is shown in Figure 3. Inspiration is a visual learning tool (free 30-day download available at www.inspiration.com) that facilitates creation of idea maps, concept maps and webs. Teachers can use concepts and tools such as Inspiration for their own brainstorming, or they can have students use the technology to improve critical thinking, comprehension, and writing skills.

Digital Story Telling
The Digital Story Telling session was conducted by Matt Estes and Mike Rust. Digital Story Telling can be an effective teaching method used to reach students using a variety of multimedia sources assembled into a coherent lesson. It can also be used by students to organize and present their ideas. The media can include: digital imagery, text, voice, sound, music, video, and animation. When students are given an assignment to create a digital story, they are the organizers of information; they are responsible for storyboarding and concept mapping. They are the finders and evaluators of information; they can search the Internet or use digital libraries and select/edit what they find. Students are the designers of a communication strategy; they make choices about the media to use and how to organize and format the material. Additional information can be found at the website www.digitales.us. The use of digital story telling as a teaching method develops a wide variety of technology skills in students and meets numerous technology standards.

This session demonstrated how to put together a multimedia story using Microsoft Windows Movie Maker. This software is available on any platform running Windows XP (no additional purchase is necessary.) Hardware that can be used to provide sources for digital story telling includes: a microphone, a scanner, a digital video recorder, and a digital camera.

Excel
The Excel session was conducted by Jim Allen and Sarah Pumphrey. Teachers can use Excel for classroom organization: checklists, seating assignments, and team organization, as well as for classroom management: grading, attendance, and scheduling. Students can use Excel for visualization in presentations and reports as well as for analysis: performing calculations, importing data, table searching, and graphing. The session included hands-on use of auto fill, built-in functions, short-cut keys, protection, symbols and cell-formatting, formula manipulation, importing data, sheet referencing, and chart creation.

Graphics and Word
The Graphics and Word session was conducted by Bartley Richardson and Amy Dimmerling. It focused on advanced applications in Microsoft Word, such as including and formatting images in documents. The session described and illustrated four tools that are included in Word: the spelling, grammar, thesaurus, and reading statistics tools. These tools can help make a document look professional while minimizing the amount of time spent looking-up words and English rules. In addition, the session discussed and illustrated creating and formatting tables, using the drawing tool and the equation editor, and inserting hyperlinks into documents.

Table 1. Webquest Resources

www.ozline.com/learning/index.htm
www.educationworld.com/a_tech/tech/tech011.shtml
webquest.sdsu.edu/designsteps/index.html
www.internet4classrooms.com/quest.htm
webquest.org/
www.kn.pacbell.com/wired/bluewebn/
www.kn.pacbell.com/wired/fil/
school.discovery.com/schrockguide/assess.html
wizard.hprtec.org/
teacher.scholastic.com/tools/
webquest.sdsu.edu/
webquest.sdsu.edu/webquestwebquest-hs.html
webquest.org/questgarden/author/
webquest.org/
Science
www.geocities.com/kbachhuber2000/ems.html
www.yorkville.k12.il.us/webquests/webqeichhammer3/webqseichhammer3.htm
www.yorkville.k12.il.us/webquests/webqeichhammer3/webqseichhammer3.htm
www.davison.k12.mi.us/dhs/staff/hewitt/hewitt14.htm
www.aacps.org/aacps/boe/INSTR/CURR/COMED/HSwebquest.htm
Math
www.eng.uc.edu/~mdaniel/grw
www.yorkville.k12.il.us/webquests/webqrobbjork/webqsrobbjork.html
www.yorkville.k12.il.us/webquests/webqbjork/webqsbjork.html
Math and Science
www.yorkville.k12.il.us/webquests/webqbwilliams/webqswilliams.html
www.meridian.wednet.edu/~dshick/webquest.htm
sesd.sk.ca/teacherresource/webquest/math.htm
www.scs.k12.tn.us/STT99_WQ/web_toc.html#sci
www.eduscapes.com/sessions/travel/mhswebquests.htm

Internet Resources and WebQuests

The Internet Resources and WebQuest session was conducted by Kelly Obarski and Patricia McNerney. The teachers learned how to use the WebQuests, where to locate them, and explored the Internet resources where they could create their own. A WebQuest is an inquiry-oriented activity in which some or all of the information the student uses is found on the Internet. The activity requires knowledge acquisition and integration; a learner deals with a significant amount of information and processes it during the activity. The following components outline how to build a WebQuest:

- **Introduction** orients students and captures their interest.
- **Task** describes the activity's end product.
- **Process** explains strategies students should use to complete the task.
- **Resources** are the Web sites students will use to complete the task.
- **Evaluation** measures the results of the activity.
- **Conclusion** sums up the activity and encourages students to reflect on its process and results.

(webquest.sdsu.edu/webquest.html)

There are many online resources for WebQuests. A summary of selected resources is given in Table 1.

Upon conclusion of the workshop, participants were provided with a CD of workshop resources and could request an account to the workshop's Blackboard, which included session presentations, web links, and handouts.

4. EVALUATION OF THE WORKSHOP

Participants were asked to evaluate each session and asked to provide an evaluation on the overall structure of the technology workshop. A summary of the questions and average scores for individual workshop are given in Table 2 and overall technology conference summary scores in Table 3. A score of 1 indicates "Strongly Agree," 2 indicates "Agree," 3 indicates "Disagree," 4 indicates "Strongly Disagree," and NA = "Not Applicable." A blank indicates "I don't know." Twenty-five teachers attended the workshop and not all teachers responded to all surveys. The number of respondents to surveys ranged from 19 to 25.

Overall survey scores for individual workshops were excellent with average scores on all 15 items between 1.0 and 2.0 indicating high agreement that the workshop was well done and that the Fellows did a good job. Each session had open ended questions that teachers responded to and a summary from each session's responses follows.

Digital Story Telling: Teachers expressed that this session was outstanding. They indicated that they learned a new tool that would be exciting to use with students. The teachers responded that they would have liked more time to explore Digital Story Telling and Windows Movie Maker. They also mentioned that they would have liked one computer per participant and the opportunity to bring in their own files to create a movie for their own class.

Concept Mapping: Teachers expressed that they liked using Inspiration software and felt it could be applied in the classroom in meaningful ways. They also indicated that they would like to have less historical information included and more time devoted to classroom ideas and practice using skills.

Graphics and Word: Teachers indicated that they learned new skills in Microsoft Word that they had been unaware of such as readability, auto summarize, graphic manipulation, drawing and manipulation of tables, styles and format modifications, and application of short-cut keys. They included in their input that there should be a beginner and an advanced Graphics and Word sessions.

Excel: Teachers responded that they learned to format cells, to use auto fill function, charting, and to apply functions within spreadsheets. They indicated that there is a need to have a beginners and an advanced Excel class and more ideas on how to integrate the program into a classroom would be beneficial. The teachers also indicated that the presenters of this session needed to decide prior to the session who would answer what question types and distribute the duties. Lack of distributing the duties between the presenters caused distraction throughout session.

Internet Resources and WebQuests: Teachers responded that the free Internet resources were great, but they would have liked more time to explore all the sites. They mentioned that providing a CD with all the websites was valuable. Teachers responded that they felt learning about and trying WebQuests was good, but that they would have liked time to actually create their own WebQuest. This session could have been divided into two sessions to allow more time to be devoted to each topic.

Overall survey scores were excellent with average scores on all 15 items between 1.0 and 2.0 indicating high agreement that the workshop was well done and that the Fellows did a good job. Teachers added comments that this workshop was more helpful and interesting than the prior year's workshop. As one teacher put it, "*even on an off day, it was worth the effort. The presentations were very closely related*." There was no one most valuable session; each teacher responded with a different variety of skills learned and favorite session lists. Most teachers did indicate that they would like longer session times in order to explore skills learned even if this meant fewer sessions. In addition, open ended questions asked teachers what they found most useful about the workshop. Examples include:

"I really learned a lot of things to share in the classroom. I've already shared some of the WebQuest and free resource information with the math department! Overall the workshop was excellent with very applicable and valuable information. I was impressed!"

"I thought the 2005 Step Technology Workshop was fantastic. I learned many new things that I will be trying in my Computer Applications classes during the year. In fact, I have already downloaded the Inspirations Software program for a 30 day free trial, and purchased one of the computer video recorders that were demonstrated in the Digital Storybook session. I thoroughly enjoyed the day, and hope to participate in future STEP activities that are held throughout the year."

"I had such a good time at the workshop. I plan to start using at least two of the technologies immediately. The rest will need some vacation time for me to study them."

"There was no one thing that I would say I couldn't find very helpful with teaching. It was a GREAT workshop (Especially the Digital Story Telling)!"

Table 2. Survey and Average Scores for Individual Workshop Sessions

Question	**Digital Story Telling (n=25)**	**Concept Mapping (n=20)**	**Graphics and Word (n=19)**	**Excel (n=22)**	**Internet Resources and WebQuests (n=25)**
The purpose of this work shop was clear.	1.24	1.50	1.26	1.45	1.56
The work shop fulfilled this purpose.	1.08	1.50	1.21	1.32	1.32
The work shop was well organized.	1.28	1.50	1.26	1.62	1.46
The information sent in advance of the work shop was effective.	1.48	1.40	1.32	1.48	1.60
The facilities were sufficient for the work shop.	1.16	1.35	1.16	1.38	1.32
This work shop has given me valuable information for using technology in my classroom.	1.20	1.55	1.16	1.43	1.36
The work sessions were a valuable use of my time.	1.64	1.50	1.26	1.70	1.52
The material was presented in a way that makes it easy to apply to my own class room situation.	1.38	1.50	1.42	1.63	1.56
The work shop is aligned with the technology standards or will help address one or more of those standards in my class room.	1.33	1.45	1.26	1.55	1.32
I will be able to use what I learned in the work shop in my class room.	1.27	1.61	1.28	1.43	1.32
The material would be relevant to most science class rooms.	1.28	1.50	1.21	1.45	1.40
I would recommend this work shop to other educator.	1.12	1.55	1.26	1.50	1.52
The presenters were informative and well prepared.	1.24	1.50	1.37	1.77	1.52
This was a good time to offer the work shop.	1.08	1.25	1.22	1.45	1.28

The week following the workshop, seven of the teachers sent the Grant Coordinator emails giving added insight on the technology workshop. All of the responses were positive, some asked for emails of presenters to ask additional questions, some asked to be given a Blackboard account so they could access online workshop material, and some asked to be placed on the STEP newsletter mailing list. Examples of comments shared through email include:

"I thought the 2005 Step Technology Workshop was fantastic. I learned many new things that I will be trying in my Computer Applications classes during the year. In fact, I have already downloaded the Inspirations Software program for a 30 day free trial, and purchased one of the computer video recorders that were demonstrated in the Digital Storybook session."

"Thanks for offering such a nice class; I wish teacher inservice days were as productive....."

"I had such a good time at the workshop. I plan to start using at least two of the technologies immediately. The rest will need some vacation time for me to study them."

"I really learned a lot of things to share in the classroom. I've already shared some of the web quest and free resource information with the math department! Overall the workshop was excellent with very applicable and valuable information. I was impressed!"

"I have already checked into one of the websites to create a timeline for the students. (it is a standard we must teach this year in grade three.) What a great way to teach it...create one's own timeline and work from there."

Table 3. Survey and Average Scores for Overall Workshop (n=19)

Question	Average
The purpose of this workshop was clear.	1.21
The workshop fulfilled this purpose.	1.32
The workshop was well organized.	1.16
The information sent in advance of the workshop was effective.	1.39
The facilities were sufficient for the workshop.	1.16
This workshop has given me valuable information for using technology in my classroom.	1.26
The work sessions were a valuable use of my time.	1.26
The material was presented in a way that makes it easy to apply to my own classroom situation.	1.26
The workshop is aligned with the technology standards or will help address one or more of those standards in my classroom.	1.42
I will be able to use what I learned in the workshop in my classroom.	1.32
The material would be relevant to most science classrooms.	1.19
I would recommend this workshop to other educators.	1.21
The presenters were informative and well prepared.	1.16
This was a good time to offer the workshop.	1.44

5. NEXT STEPS

The Project STEP team is in the process of planning our fourth annual Technology Workshop right now. We will take the suggestions for improvement from the prior year into account as we plan for the next workshop. The suggestions for improvement included:

- add at least 15 minutes of time to each session; give participants more time to explore or try out new skills,
- add a webpage design session,
- add diagrams and charting in Microsoft Word,
- add merge and advanced skills in Microsoft Excel,
- add a Microsoft Access session,
- add advanced sessions for participants already skilled in technology,
- add additional web resources with descriptions to already prepared lists,
- check content being covered to be sure that session is not trying to cover too much without giving enough time to practice skills,
- check computers prior to sessions to verify they are working and have programs needed,
- create a webpage with email links to presenters so participants can ask questions after workshop is over,
- divide Internet Resources and WebQuest session into two sessions,
- include less historical information and cover more classroom ideas, and
- distribute duties within sessions prior to session taking place to reduce distractions.

We will keep the things that the teachers found most useful about the workshop and replicate these in our upcoming workshop such as:

- continue to list free web resources with time to explore them,
- continue to give good examples, and
- continue to present ideas and skills that are immediately usable in class and beneficial to student learning.

We are currently polling teachers about their preferred topics using Doodle (www.doodle.ch). The choices for this year include:

- Internet Resources and WebQuests,
- Intro to Podcast/Videocast,
- Digital Story Telling,
- Take/Edit Digital Pictures,
- Concept Mapping,
- Novice PowerPoint,
- Advanced PowerPoint, and
- Excel: Graphing and Advanced Features.

In addition to the delivery modes used in 2005, we will also record and prepare all of the instruction for podcast/videocast so that the workshop may be more widely disseminated for others who are not able to attend it physically.

Contemporary Educational and Training Methodologies

Author : Laxmi Saxena
C-356, Malviya Nagar, Jaipur.
Paper ID: E890JH
Registration ID : 63317Q

I. Abstract:

Informatics Application of the principles and methods of the cybernetics in different scientific areas (engineering, medical, biocybernetics, etc.). Should traditions concerning the FORM of arguments limit the SCOPE of science? Or, should the subject matter of science be guided by curiosity and the desire to construct explanations of phenomena? Cyberneticians have chosen to study certain phenomena, even if they need to use unconventional ideas and methods.

Learning and consultation are a life long process for everybody. E-consultation ensures that all citizens have the opportunity to use ICT to improve the quality of their lives and their community; contribute to the economy and society through education, and engage with Government services and participate in democratic processes. It also help in raising standards across schools, improving the quality of life of young and old., promoting healthier communities, creating safer and stronger communities, transforming our local environment meeting and forecasting expenditure E-consultants provide dynamic learning experiences that energize and educate participants.

Key Word

II. Current training Procedures

Education and Training should be seen as a process for development of Urban Situations. A training methodology for doing so is outlined below. Broad objectives of this methodology are to understand that education is a process, not as a product. Another objective is also to generate a definition of education which defines a 'good' or 'quality' education. This method is geared towards devising a definition of education as a process to develop social, mental creative and ethical potential of human being.

There are certain techniques used for education of teachers. Five Indian states of Delhi, Madhya Pradesh, Rajasthan, Orissa and Tamil Nadu are utilizing e-consultancy and certain applied research programs for teachers. These programs include group discussions, demonstration of presentation skill and practices adopted while applying. An exercise can be conducted, which uses all these procedures.

1. **Group Discussions:** Group Discussions form a very integral part of training. We outline one such process that is designed to achieve the results effectively. The training can be initiated by:

    a. Informing the participants and guests about the organization responsible for the training.
    b. Articulating the training objectives.
    c. Narrating the training techniques which are going to be used for the training
    d. Making participants interact and know one another as co-trainees.
    e. Making them feel at home and relaxed.

2. **Pairing up:** After initial steps are complete, the participants will be paired up. Then we tell trainees to move around and find his/her partner. When partner is found, they must sit together for 10 minutes to find about the following things about one another:

    a. Name, Place, Family and Qualifications
    b. Work Experience
    c. Hobbies and Interest
    d. Special Skills

3. **Multiple rapid-fire questions:** In the field of education & training by e- consultation a teacher can have multiple options to educate by creating rapid fire questions. These questions can be generated by following methods:

    Creating multiple choice
    Freeform text entry
    Dropdown list question-timed question
    Question with reducible scoring
    Random steps & questions
    Restoring attempts

- Using on screen/printing
- Scoring creating and using objectives

4. **Competency based Education:** Human potential can be linked with age-appropriate subject matter for developing a level of potential called competency.
    - All normal children can learn well.
    - Some require more time & guidance.
    - Subject matter and potential are graded.
    - Advancement from one level to next is after demonstration to educate at the on going level.

Give participants on experience of this model of education by making them learn a lesson on English Grammar

- Online support

5. **Visual Illustrations:** Visual illustrations can be a great method of teaching. These can be conducted with the help of e-consultancy (using computers) or traditional kit in classrooms like blackboards. The objectives are:
    - To make the lessons visually attractive & impressive
    - To stimulate the sense of sight which leaves a lasting impact on a child's mind
    - To enable a learner to visualize accurately & learn faster

Certain teaching processes work best with the help of a visual illustration. The most common shapes like the rectangle and circle are transformed into various figures and forms, which are easy for a child to co-relate to the figures, are made with the help of simple strokes and curves. One such method could be:

- Give participant a modeling practice with rectangle, circle and cylinder shapes to convert in to figure.
- Give the participants individually the sheets to draw as many figures as possible.
- Display participant's work.
- Discuss the advantages of visuals in Education and Training.

III. YUVA (Youth) scheme:

Recently a YUVA Scheme has been launched, which is aimed at making learning joyful, interesting and relevant. It is designed to:

- Cover ways to better understand other people
- To help become assertive
- To listen to others.
- Develop international relationship and effective communication.

YUVA will help to not only attract children to school but also retain them, and increase academic levels. As par of YUVA program, yoga classes are conducted in schools. One yoga exercise (for micro-muscle development) is done in three ways

- With breathing
- Concentration of muscles
- Visualization

YUVA training program emphasizes the capacity building of teachers and focuses on their skill development, personality growth and empowerment. Teachers are recognized as the pivot of the school system and the government is aware of the enormous role that Teachers play as agents of social change. The current training therefore covers important social and developmental issues also such as female feticide. The goal of this programmed is to equip Teachers with the skills to handle every day situations be it stress or depression or the challenges that modern life and development throw up. The Training of Teachers program covers:

1. Scholastic and Career issues including methods to study better, time management, the need to balance work with play and sports and games, and setting short and long term goals.
2. Generic Life Skills covering all the ten core Life Skills identified by the WHO Regional Framework. Life Skills are a group of psychosocial competencies and interpersonal skills that help people make informed decisions, solve problems, think critically and creatively, communicate effectively, build healthy relationships, empathize with others, and cope with and manage their lives in a healthy and productive manner.

3. Growing Up, and Health and Hygiene, including issues related to puberty and body mapping.
4. Body Image such as concepts of self worth and self esteem.
5. Nutrition and the crucial need for adequate and correct nutrition at all ages.

6. Mental Health issues, ranging from how to face and manage change and difficult situations, management of stress and depression to the need to always remain motivated and fly high the kite of hope.
7. Dangers of Substance abuse such as alcohol and drugs.
8. Adolescent and Sexual Reproductive issues covering gender roles, abuse, responsible behavior, and myths and misconceptions.
9. HIV/AIDS and STD awareness and how they can be avoided.
10. Yoga, Meditation and Laughter Therapy.

The training program involves a wide range of methodologies such as role plays, motivational games, project work, discussions, brainstorming and watching and analyzing important films which have had positive learning experiences.

Teachers will also update themselves on the features of the school system such as the Mid-day Meal Program, On-line admissions, Web-based monitoring of out of school children in bridge courses, and to bring all children to school, the decision to allow students to reappear in their final exams to curb the drop out rate, the provision of free text books and uniforms, stipends to students, and also recent initiatives of the department under YUVA including self security whereby self-defense training is compulsory for all girls from Standard 1 and above. The program also includes "Culture Quest" which brings students of schools into contact with students in other countries, and Cartoons which has converted (the curriculum into animated cartoons for truly, joyful learning).

IV. Potential impact of e-consultancy in India:

Here's to the coming of e-age of India. A latest survey reveals that India figures among the Top 10 nations with the highest population of Internet

users above the age of 15. With an online population of 16.713 million users, India is ranked tenth – behind countries like US, China, Japan and South Korea.

According to the survey, four Asian nations – China, Japan, India and South Korea – represent nearly 25% of the worldwide online population.

But considering India's population of 1.1 billion, the Internet penetration is still among the lowest in the world. The government, over the past couple of years, has been pushing hard to spread Internet and broadband so that e-governance, e-commerce and distance learning pick up, especially in smaller towns.

"Today, the online audience in the US represents less than a quarter of Internet users across the globe, versus 10 years ago when it accounted for two-thirds of the global audience," says COM Score Media Matrix CEO Peter Daboll.

Third on the list was Japan with 52.10 million users, followed by Germany (31.81 million) and Britain (30.19 million). In the sixth place was South Korea (24.64 million) followed by France (23.88 million), Canada (18.99 million), Italy (16.83 million) and India (16.71 million).

Rounding out the top 15 countries were Brazil (13.18 million), Spain (12.45 million) Spain (12.45 million), Netherlands (10.96 million), Russia (10.83 million) and Australia (9.73 million).

In terms on most time spent online, Israel led the list, with the average user spending 57.5 hours online during the month – twice as much time compared to the average person in the United States. Among the top websites worldwide, Microsoft's MSN sites headed the list with 538.6 million global users, followed by Google.

In this era where new technologies are becoming an indispensable part of educational systems, the success in expanding use of improved technologies in teacher education are likely to benefit Education for All. Particular focus of the teacher training is placed on the development of policy guidelines and strategies to help member bodies integrate appropriate technologies and distance education both in classroom activities and in teachers' professional development.

It will eventually build a database on capabilities of half a billion students in the country. There is an educational and training programmed online. Will help sitting at home or school, a student will not only be able to hone her knowledge in a particular subject but could also seriously purpose areas of interest outside the curriculum. For instance, a student interested in music, writing or art could use the portal for sharing ideas, techniques and pooling knowledge resources in that area.

Since the database would also have information on the age, health, academic record, extra-curricular interests et al of students, it would continually track changes in the user's profile. For instance, says an official, the portal would identify who has dropped out and whose area of interest has changed; even the common health problems among different age groups.

In India the HRD educational portal would conduct tests; give out certificates of attainment and even monthly scholarships. Sources say since students of all age groups – class I to XII and beyond – will have access to the portal, there will be no need for any talented student to apply for a scholarship. Through tests students would be handed out scholarships, the amount being credited electronically into the student's bank account. In case of users from the non-formal sector, the scholarship would be to support her talent.

The ministry plans to rope in various academic, literary and artistic bodies to give out certification. It would work like this: A student with exceptional writing talent can get certified that she has attained the PG level in creative writing. A user from the non-formal sector with talent for tabla playing or singing can be certified as a top-grade tabla player or singer.

For this, experts could be asked to monitor the level of achievements of students in a few areas. This apart, the system would be such that 90% of workload is taken by computers and human intervention limited to 10%. An official said, "Certification would be such that it reflects a person's worth in the market. It would be based on a rigorous test like GRE. Students with certification would be called 'national resource'."

The ministry proposes to write to all schools in the country about the scheme. It also plans to rope in the department of telecommunication to give every accessible school in India bandwidth connection. In inaccessible areas, the ministry plans to take the help of Educates.

To begin with, the ministry plans to use results of class X and XII to create its first database. Every CBSE examinee would be automatically provide an email account and a personal profile enabling her to access the system. Later, this facility would be expanded to cover all classes in schools and colleges.

Dropouts and those in the non-formal system would not keep out. Working on the premise that every individual has some talent, the portal would help those outside the formal system to show their skills, upgrade their knowledge and by taking tests and certification make a mark for them.

V. Conclusion

The quality of good education and training is must be with the help of e-consultations or e-learning Today we are in need of qualitative rather than quantity in education. With the help of e-consultation, users can learn, at their own pace. This advantage can not be under estimated. Training occurs in small parcels hardly 10 or 15 minutes on a particular topic .it delivers information & the topic can be revised as many times as you like, as fast or slow as you like till you understand.

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T-Learning with Convergence of Interactive Television and Mobile Technology

Buay Kee Tay
Section Head/ Info-Communications Technology Department
ITE College West (Balestier Campus)
114 Balestier Road, Singapore 329679
Singapore
taybk@ite.edu.sg

and

Tse Yew Lee
Lecturer/ Info-Communications Technology Department
ITE College West (Balestier Campus)
114 Balestier Road Singapore 329679
Singapore
lee_tse_yew@ite.edu.sg

ABSTRACT

Humans are always fascinated by technology. Decades ago, no one would dreamed one day we would be looking at a big box that displays images real time and a small box that we can talk into with friends. All these technology comes from ideas.

Would ideas ever run out? No. We can always build on existing ones. A television's purpose is not just to display images or video. A mobile phone purpose is not just to chat. Right now an emerging technology is Interactive television. Sending messages with the mobile phone is a current and still rising trend. Now we can interact with the television using our mobile phones and see our reply messages broadcasted on TV in Real-time.

In the Info-Communications Technology Department of ITE College West in Singapore, we have created several applications that make use of interactive television technology, together with mobile messaging feedback. Applications include a mini quiz that students can message in their answers with their mobile phones, an announcement panel so lecturers can message in any changes in location of classes, a feedback survey on education videos being shown on the television, an interactive tour of facilities of the school for new students and a voting system that keep track of how popular candidates are for a game or variety show. More applications can be developed based on the technology on hand.

The applications are only limited by the ideas. And human beings have no lack of ideas. That is what enables us to improve and develop more ground breaking technology that would make executing tasks more convenient and our life easier. Technology is powered by humans. Humans are the source for technology to happen.

INTRODUCTION

Humans are always fascinated by technology. Technology has helped each one of us in one way or another to make our life easier. The youth of today uses technology all the time, from making calls on hand phones to watching television and playing games on the television.

When Philo Farnsworth invented the first television in 1923 [(2) Esorrtment, 2002], he didn’t expect that his device would be as common as a toilet in every household today. Television nowadays is not just displaying TV programs. When companies came out with Teletext, it enabled people to interact with their television at home. Then along came in-built TV games and linking up a computer to a television to view.

When Alexandra Graham Bell invented the first telephone in 1875 [(3) About, Inc, 2006], he didn’t expect that it would be found in every home and become wireless (the hand phone). People use hand phones everyday to SMS and make phone calls. Some people have gotten so used to a handphone that if they forget to bring out their hand phone to work or school, they would be worried and wondering if anyone has SMS-ed or called them in the day.

All these technology comes from ideas and human beings are full of ideas. An idea can be thought of from scratch, or combining several ideas together or modifying an idea.

Every year, the number of patents the United States Patent and Trademark Office receives is a staggering 400,000 and above. [(4) Patent Authority, 2006]

The hardest part of an idea is making it into a reality. But once an idea is transformed into a working device or concept, it is another step for mankind and technology.

EMERGING TECHNOLOGY

The current new technology deployed by Mediacorps for our local TV programme on Singapore Idols enables viewers to SMS in and vote for their favourite singers. The votes would be computed and the results announced.

T-Learning is a new possibility with the convergence of Interactive Television and Mobile Technology. It is Television Learning via Digital Television and interactive access to video-rich learning materials primarily within the home, through a television. [(5) Dosi, A., Prario B, 2004]

In comparison to e-Learning, T-Learning has the advantage that more people can take part because television is more common in homes than computers. Also television is generally cheaper and they are virus free. It is easier to learn how to use the remote of the Television than to navigate around using the computer and the loading time for the Television application is faster. As for the aging population, the screen of the Television is bigger than a computer's monitor so that most people would not need to strain their eyes.

Television has been used for learning purposes with cooking programs or yoga courses, etc. But the audience is just taking a passive role. Now with interactivity, the audience can take a more active role.

Throw in the ability to communicate with the Television application via a normal hand phone SMS together with the television remote, T-Learning is the next big thing.

DEVELOPMENT OF APPLICATIONS

In Info-Communications Technology Department, ITE College West, we have created several applications that include the followings:

- ❖ A Mini Quiz. Students can message in their answers with their mobile phones. The first person with the correct answer gets a point. This will involve the whole class and the adrenaline rush for the students will ensure their attention they will remember the question and the answer better. [Fig 1]

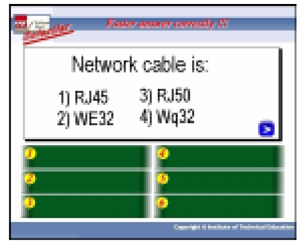

Fig 1: Mini Quiz

- ❖ Student Feedback System. Educational videos are shown on the Television. Students can SMS in and their SMS feedback will be displayed on the television for the rest of the students to see. [Fig 2]

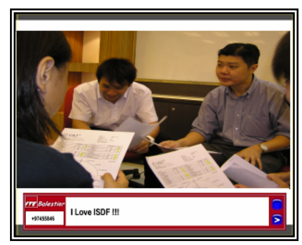

Fig 2: Student Feedback System

- ❖ Subjects can be taught using the television to display simple information about a particular topic and students can play a mini educational game or practice to enforce their understanding of the topic.

- ❖ T-Forum. Students can SMS in their views to a particular topic's question in a debate environment.

- ❖ Information Kiosk. An interactive virtual tour of the facilities of the school and information on the courses can be displayed for new students to navigate using the remote control. [Fig 3]

Fig 3: Information Kiosk

- ❖ Voting Feedback Systems. Examples are voting for a model student [Fig 4]. A few students' pictures are displayed on the television. Voting students SMS in their vote and the television will update immediately his/her vote on the television.

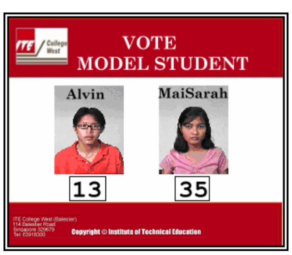

Fig 4: Voting Feedback Systems

- ❖ An Announcement Panel. Lecturers can SMS in any changes in location of classes and the message will be shown immediately on the Television positioned in the administration office or at the labs. Other announcements can be about Core Curriculum Activities or information about talks held in the auditorium. [Fig 5]

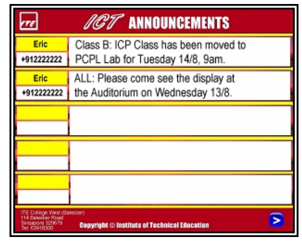

Fig 5: An Announcement Panel

More applications can be developed based on the technology on hand.

THE TECHNOLOGY

All applications are created using Java MHP Programming. The application classes are then uploaded into a Server at the Broadcasting Station. Any television with a configured setup box is able to receive the application and display it.

We have completed a simple broadcasting setup [Fig 6] at our campus consisting of a Main Database Server, Broadcaster Server and a Modulator. Any TV connected via cable with a setup box would be able to receive the application and video. The audience will then use the application with the setup box remote control to navigate his/ her way through the application. Messages sent from viewers via their hand phones would be forwarded by the GSM network, captured by the GSM Modem and stored in the Main Database Server. The Broadcaster Server polls the Main Database Server at a regular interval to display these messages from the viewers on TV.

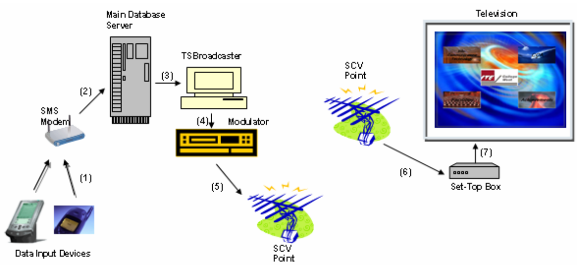

Fig 6: Interactive TV System with SMS Gateway

THE NEXT PHASE

The Interactive Television can have many uses, depending on the application being displayed on the television at the particular timing and location.

We have proposed to use it in the Second Regional Campus of ITE (Institute of Technical Education) located at Chua Chu Kang in Singapore.

It could be situated in the library or administration office to display announcements; in the canteen to display surveys for students to participate in; in the classroom for group participation in the forum and quiz, and many more uses.

If we were to broadcast our content over the country, students can even T-Learn from the comfort of their home.

With MediaCorp broadcasting Channel 5, Channel 8 and ChannelNewsAsia in digital signals, together with trail runs of their interactive games on their setup boxes, it will not be long before Interactive Television will be as popular as when SMS was first incorporated into hand phones.

The applications are only limited by the ideas. And human beings have no lack of ideas. That is what enables us to improve and develop more ground breaking educational technologies that would make teaching and learning more interesting and effective.

Technology is powered by humans. Humans are the source for technology to happen.

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A Tale of Two Classes: Polemic, Confluence and Discovery in a Traditional and On-line Media Studies Class

Marvin Williams
Professor Communications and Performing Arts, Kingsborough Community College
2001 Oriental Blvd. Brooklyn, New York 11235, United States

ABSTRACT

The teaching of a media studies course in an urban commuter college in a scholastic environment where there are over 40 languages spoken and 150 countries represented is a unique challenge. Discussing social and academic issues of media ethics, regulation and social position are as diverse as the multi-cultural and multi-national population within the college. Introducing a completely on-line version of the same course raised an equally large number of dissimilar challenges.
The realization of an on-line course within a closed education community gives a unique view into the life of a non-traditional course in an atypical education environment. The segmentation of students was not drawn from a professional or typical non-traditional student population, but from the very same population of the college. This, in all actuality, made for a perfect case study of *traditional v online* class comparison. This paper will chronicle and address a number of the aforementioned challenges as they relate to issues of pedagogy, assessment, and implementation in the e-learning environment.

Keywords: Internet-Based Teaching, Distance Learning, E-Learning, Integrating E-Learning and Classroom Learning, Online Teaching and Learning, Internet-Based Learning Tools, Internet-Based Adult Learning, Virtual Classroom

INTRODUCTION

The teaching of a media studies course in an urban community college in an environment where there are over 78 languages spoken and 180 countries represented is a unique challenge. Discussing social and academic issues of media ethics, regulation and social position are as diverse as the multi-cultural and multi-national population within the college. The introduction of a completely on-line version of the same course raised an equally large number of dissimilar challenges.

The realization of an on-line course within a closed education community gives a unique view into the life of a non-traditional course in an atypical education environment. The subsequent segmentation of students was not drawn from a professional or typical non-traditional student population, but from the very same population of the college that participates in the traditional courses. This, in all actuality, made for a perfect case study of *traditional v online* class comparison.

This is a brief chronicle and addressing a number of select challenges as they relate to issues of pedagogy, assessment, and implementation in the e-learning environment. In addition, it is an anecdotal correlative look at an additional bounded group will give a service perspective addressing some global needs of disenfranchised students in the lower undergraduate ranks. Comparatively, examinations within the upper undergraduate and graduate ranks may yield interesting didactic material by comparing the responses of a group more secure with navigating academic bureaucracy and more independent in nature. The latter of this narrative is at the heart of my interest in examining this methodology and its effect of the former.

THE POLEMIC REVEALED

The course examined is *Introduction to Mass Media*. The examination is over a three-semester period. During each semester there was a concurrent running of an on-line and traditional class. The commonality of programmed course content was as follows:

Two short papers
One final, staged research paper
Weekly writing assignments
(2) Quizzes
(1) Midterm
(1) Final

The dissimilar content could be addressed in the following manner:

On-Line: Weekly Discussion Board
Traditional: Flash Papers

Online: Single Personal BLOG Spot
Traditional: In Class Participation

On-line: Posted Research Findings
Traditional: Roundtable Sessions

On-Line: Email or Chat Exchange
Traditional: Office Hour Counseling

What is perhaps most immediately apparent in the context of the on-line course are the self-management skills needed to survive within the on-line environment. What often occurs in the first weeks of the course are email exchanges regarding timeline and course material management. First time students often speak of the disconcerting nature of having to teach oneself during the course of a semester. Perhaps the actual challenge is developing the language and terminology necessary to navigate course material. This may create that initial speed bump in student development.

A challenge to initial learning curve development necessary to establish a secure foundation beginning a course may cause a delayed optimization of student performance. To address this factor early in the first time on-line student, initial assignments include simple tasks designed to familiarize the students with the technology and develop the skill set needed to participate in the asynchronous environment. Sample assignments include:

1. Email a picture (preferably a headshot) in .jpg format
2. Email a document attachment in MSWord (usually copying some material from the text, a brief diary entry of "What I hope to learn in this course" or "What is Media?")
3. Enter a Discussion Board posting with a hyperlink to an open source article you intend to use as evidence to support a position on a topic

These simple tasks provide an easy low stakes entry point into course material and build confidence to address the latter tasks. However, the ultimate goal of a staged module from low to high stakes material is to recreate the measured environment of the traditional class as best as possible. Among the various reasons for this method, primary is the need to address the aforementioned issue of time management. Lack of time management often creates an effect of Delayed or Compressed[1] participation and results in below standard work consequently creating, for many students, an untenable barrier to the core material and course goals. When addressed early, within the first three weeks of a course, students have been able to re-enter the module assignment segment with minimum distraction, or momentum alteration, and catch up with the cohort that is on schedule. The consequent Discussion Board and Paper assessments show an increased attention to course content detail and more integrated responses to questions[2]. Thus the Discussion Board participation becomes a key component for measuring actual development.

CONFLUENCE

Factors of course confluence at this point of the semester include:

1. The 1st short paper completion and its revision
2. Professorate and Student agreement on an original final paper topic and initial literature review
3. 1st quiz completion
4. Midterm Completion

Despite the differences of their construction within the class settings, the core elements of community, including, *History, Identity, Mutuality, Plurality, Autonomy, Participation, and Integration*, can serve as a shared framework[3]. These elements address the need for a group to be centralized in some shared macro methodology in order to achieve success on the micro level. Establishing these markers in the on-line environment may seem less natural, given the non-contact nature of the course, but it is paramount in establishing the connection to the course material needed to optimize the students' opportunity for success. However, because of the lack of observable contact, this on-line community building may face other challenges.

In the on-line course, despite the aforementioned pictures and personal Blog spots, there are a number of students who are unaware of the racial, ethnic or gender makeup of the class. The subsequent exchanges have produced the first negative outcomes; the first need to remove postings that are non-collegial, and the first direct intervention between students to keep the class character positive. In the traditional class it is obviously easier to see this behavior building up over the course of a module; it seems to simply appear in the asynchronous environment of postings. For this a student venting spot may be

[1] Delayed Participation – increased student participation at the end of a module's deadline, often to catch up on missed assignments. Compressed Participation – students complete multiple modules within a short time to get ahead or caught up in assignments.

[2] Aggregate scores of DB and Papers increased 2.5 out of 5 and 7 out of 15 respectively to 4 and 13 between the third and sixth week of course

[3] Selznik 1996

appropriate to help alleviate stress and solve another problem.

The typical feeling of anomie in an asynchronous environment cannot be avoided, despite the best-laid plans of picture posting and personal Blog spots. For many, the suspension of belief, if for only a fewhours, presents a different set of challenges. There is no immediate measure of progress. Many students feel the need to know how they are measuring up to their peers. Though not completely without merit, this thought process cannot be satisfied when placed in context to the anomic environment of an on-line class. The nature of the semi-self paced course is just that, self-paced, and for those who express sentiments of displeasure, this isolation is a significant part of their reasoning. However a side effect of this type of participation became a benefit.

The constant nature of writing for every assignment, in every module, creates a culture of absolute written communication, in which the student more quickly develops in order to maintain a passing grade index. This evolutionary process, the development of writing skills to offset their lack of verbal interaction, is an unintended circumstance that pays dividends in the papers produced in the latter stages of the course. Introducing this into the traditional classroom setting was a challenge of balance.

THE HYBRID COURSE AND CONFLUENCE II

Using the hybrid model, splitting assignments between in-class and on-line environments, the issue of balance could be addressed. In the traditional class I generally set aside at least two and one half full weeks (or eight sessions) for on-line class development and participation. During this time the content focus was on student writing and research methods development. Lecture notes, an added reading, are used to supplement any text material and keeps the student in touch with my "voice" as we move through this section of the course.

This pedagogical approach, *interactive distance education*, focuses on connection, interaction, exploration, and discovery, rather than the transmission of information[4]. This step introduces an autonomous learning environment to the traditional class. Consequently, it places a wrinkle in the established continuity of the classroom environment.

The need for a consistent environment is important for all students. Once a stable momentum is achieved, to alter it drastically could be detrimental to a student's progress. If the challenges of beginning an on-line course, as mentioned earlier, are immense, beginning a new course delivery method halfway through another is unspeakable. It is here the face-to-face time of the traditional course can be used to address and reinforce the asynchronous section of the semester, and eases the academic wrenching a student may experience. Leading up to the on-line section of the traditional course, assignments that require on-line participation matched with some in-class debriefing type exercise is one way to ease this process.

With five to six weeks of some established familiarity between students, the subsequent postings have an immediate personal nature. Postings often come with the layers interpersonal exchanges that have occurred in the class. Students that have already exchanged discussion in the class, usually adapt more quickly to the on-line format. With this assessment it appears participation is participation, regardless of environment. The students that are on the fringes of the class at this point of the semester are usually at a loss and in need of constant direction. Here their Delayed participation has given way to Compressed participation.

This is usually the next point of confluence for the on-line and traditional course with the following assessment pieces completed:

1. A Final Literature Review for Final paper
2. First draft of Final Paper Outline
3. Second Short paper topic selection and draft
4. Midterm

During this point of the semester students are receiving their second academic review. Current grades and potential semester grades are given as a progress marker. In both classes students often share this information to see where they are in respect to the class as a whole. This shared behavior gives students another feeling of connection relieving the anomic nature of not only the on-line classes but the introductory experience of college.

AGENCY AND DISCOVERY

Though the technology may be extremely common place to the contemporary college student, the issue of self management is not. As mentioned here, this challenge has been the greatest to overcome for many of the students who do not successfully complete an on-line course. Students' constant connection via text messaging, downloading streaming media content of programs and music, even selective internet

[4] Peters 2000

access has created a culture that seems to address the immediate without consequences of the next step.

These issues are certainly not culturally specific to Internet-based tools, however, there is one feature which is present in most of these tools: they are inherently distributed. This feature gives a boost to educational practices which were underdeveloped in distance education. Previous distance education technologies such as paper mail, television and video tapes have a bias towards straightforward teaching. At the opposite, [decentralized] tools create the potential for new forms of interaction among learners[5]. It is the level of literacy that causes this decentralization to be a hindrance in the education process.

Search engines that seem to have the official looking enough answers to topics for papers, have replaced the research methods professor often seem haplessly attempting to teach. The immediate response, or interactive event, has captured any extended focus that could be given to a paper, article or text reading, adding the barrier of comprehension to course material. It is in the assumption, however false, of student and professor that the freedom of the asynchronous course will make for the best environment for development. The resulting polemical relationship between expectations and outcomes can be the ultimate failing of an on-line course when not addressed.

Professor : Students can work on their own pace
Student: I don't have to go to class

Professor: Assignments are self explanatory
Student: What does this mean? Who can I ask for help?

Professor: The syllabus will make all the deadlines clear
Student: I can start the assignments anytime

Professor: The postings need be relevant to readings
Student: I can write what I think

Professor: Papers and assignments need have clarity of thought
Student: I have until time X to post what sounds good

The resulting imbalance, proactively and aggressively addressed, can become the teaching moment for academic communication needed to help most students take that step from being users of technology, and subsequently used by it, into a realm of controlling the technology, thus making it the tool serving their education. Measuring and eliminating the possible feeling of anomie in this neutral environment may serve the entire academic community when placing it in another seemingly desperate context.

In measuring the effect of neutrality, and agency, in the on-line environment on participation as explored by gender, race or other institutional data markers and comparing them to the performance of the aforementioned groups, many of the outcomes around these markers tend to take the same shape. These markers, though reductive in nature and detached from the immediate needs of students, may help identify and limit factors that may cause barriers to students' progress and development. The situation of the disenfranchised on-line student may appear to be very similar in nature to that of another group facing systemic challenges in the current academic construct of the United States. In an anecdotal synopsis examining two sessions of a target student initiative addressing a group of the very students mentioned, a correlative pattern began to surface.

The implementation of on-line sections during a Men's Leadership Institute[6] session yielded a noticeable drop in participation and performance. Students could not seem to navigate the material without coaching or respond with relevant answers to questions posted. This question of the Technological versus Information Divide did not seem to address the issues raised by this empirical experience. For me, thinking of the issues faced in my on-line and traditional courses, the question seemed to return to some subject of literacy.

Not literacy in the traditional sense, but that of technological application. The students in the program were quite capable of doing the very things their counterparts were (i.e texting, communicating through their phones, etc…). However for many students in this group the limited access to Internet usage, limited or none at home or work, and subsequent lowered sense of personal relevance for the Internet as a tool, combined for a lack of application awareness, hence the lowered literacy.

This was manifested in their inability to do even the most simple of research tasks using the public search engines (e.g. Google®, Yahoo™,

[5] Waddups & Howell 2002.

[6] This is directive of the Black Male Initiative program designed to recruit, retain, and successfully matriculate the underrepresented group through the undergraduate ranks onto graduate programs. This directive is a result of studies indicating the immense failure rate of young black men in the University system.

Alta Vista™, etc…). The critical thinking needed to devise search parameters and applicatory devices were only a part of the larger gap in the students' literacy base in navigating any data environment. To delineate a thesis or topic (e.g. *Discuss factors around Jazz and Social Mobility during the early 1900's*) and create a contextual set to answer each part of the question before addressing the whole proves to be an exercise too involved because the student is oft looking for the expected ubiquitous answer. This type of challenge, appearing on multiple fronts, raises other issues for these students.

Many of these students were more apt to call, or randomly appear at the office door, than email any question they may have. The subsequent lack of a constant supportive presence, given the nature of academic schedules, occurring during a time of perceived extreme personal challenge, often leads to students feeling left alone and unable to cope. This feeling of anomie is much like that of the lost on-line student who simply stops participating because there is no connection to the course.

"*In the case of a virtual community, participation, both social and academic, is integral. Without active participation in discussions and other class activities, the learner Is not part of the community; indeed, the learner does not "exist." This is one core distinction between being a passive member of a physical community where you are seen and presence is noted and registered in the mind of others. In a virtual community, you must make a concerted effort to communicate with others in order to exist. At the same time allowances must be made for learners to shape the participation, both in structure (number/kind of postings) and in content (managing the discussion of subjects interesting to them)*[7]."

CONCLUSION

From the onset of the on-line class, the question should not be whether the students would be able to adapt to the on-line environment, but whether they would be able to self-manage within an asynchronous class setting without the traditional support mechanisms. However, the adaptive methodology of independence needed to navigate this type of course has a significant effect on the learner and creates a considerable motivational ramp into academic independence.

The self-discovery many students experience within the on-line environment has been termed as "more satisfying." Perhaps this is because many feel their accomplishment is truly from their doing as opposed to some osmotic shared learning process within the measured class, or group, knowledge. The initial feeling of anomie is replaced by a strong sense of agency and determination.

The apparent neutrality of the asynchronous academic environment, much like its far more commercial counterpart of MySpace™ or some other Simms environment, takes on the space of safe haven where the engaged student can participate with some feeling of anonymity and safety in their development progress. Subsequent examination of this as it may apply to groups that are underrepresented, or disenfranchised by the current college data performance sets, may prove engaging when addressing the various paradigms of performance.

Key factors in this service may be summed by doing the following as early in the course module as possible:

Help the student establish a connection to the course

This connection can be in the form of a face to face orientation, or meeting, with the professor or other students, if possible. For many beginning on-line students who have only experienced the traditional classroom this goes a long way in establishing a solid identity needed to create the internal environment needed to succeed.

Encourage a student-to-student dialog

Casual conversation questions, Personal Blog Spots, and other non-stakes participation may give the perception of freedom needed to help the student identify not only with the course but their classmates as well. This introductory dialog will become more course content centered as the students follow their nature and seek out each other first for clarification so as not to appear inept to the authority figure, or professor. Students may not have the same personal schedule, hence a motivation to pursue the asynchronous option, to participate in a Chat Room scenario, however, the safety of posting thoughts and sharing ideas without the immediate probability of rejection provides another safe level of involvement within the module.

Provide ample options allowing the student to "see" ahead in order to help them plan their participation schedule

Having the assessment pieces already posted in the Gradebook section of a course, gives a nice marker for the student gage their performance and scheduling. Reminders (emails, announcement postings of non-performance, etc…) may be

[7] Selznik 1996

negatively received by the new college student and consequentially may result in similar performance. Helping the student create their own course outline, check in points for staged material like papers, quizzes and the like, in the early stages may yield the agentic behavior sought.

Maintain an approachable presence within the module

Create some of the announcement, discussion board and lecture note material in a semi-formal conversational voice. This will allow the students to feel more at least with their language as they reach into the cyber-class room. This is not to lower academic standards, but to make the door into course material a little more user friendly as they need to understand it in order to succeed in this environment. Remember they are "hearing" much of what you are sharing for the first time and they do not have a buffer between you and them to soften the blow of invasive foreign material as they try to establish some level of comprehension, functionality and navigability without anyone really there to guide them. Among all the considerations given to on-line courses, the thought that the technology used is of the time of many of our students, and in some cases behind given the bureaucratic of institutional purchasing, this is perhaps the least of the issues needed to be dealt with. The need to navigate and function within a class environment that consists of nothing more than your own scheduling is perhaps the largest hurdle students' face in this new academic environment. The skill sets we can help students develop as we examine their patterns and behaviors in the on-line environment may also go to serve the academy's development of more best and sustainable pedagogical practice. Much like the ancient academies evolved to remain current with the World in which they examined and served the delivery methods of today must adapt to address the needs of today's age.

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Marvin Williams is currently a lecturer in Communications and Performing Arts at Kingsborough Community College in Brooklyn, New York where he also serves as Director of the Gospel Choir and Assistant Men's Basketball Coach. He is a Marketing PhD student at Northcentral University.

Email: Marvin.Williams@Kingsborough.edu

Education Of Digital Libraries For The Developing World

Professor Dr. Ahmad Bakeri Abu Bakar
Department of Library and Information Science
Faculty of Information and Communication Technology
International Islamic University Malaysia,
Kuala Lumpur , Malaysia.

ABSTRACT

This paper attempts to determine the current state of digital library education in academic institutions of the Developing World. Towards this end a survey of the library and information science programmes in the developing countries was undertaken. Only programmes that are able to be accessed through the open web were analysed based on the course titles and synopsis. Analysis was performed on the basis of two limiting criteria. Firstly it should be in a language comprehended by the author and using the phrase "digital library" or "digital libraries"; secondly the programmes should be at postgraduate level.

Keywords: digital library, library education, developing countries, curriculum development, library and information science.

INTRODUCTION

The term "digital library" may mean different things to different scholars and groups. In the first book on this topic the author, Lesk (1997) defined it as "organized collections of digital information. They combine the structure and gathering of information, which libraries and archives have always done, with the digital representation that computers have made possible." Another slant of this definition was given by Arms (2000) in a later textbook, who stated the definition as a "managed collection of information, with associated services, where information is stored in digital formats and accessible over a network." On the other hand the Digital Libraries Federation (DLF) attributed the digital libraries as "organizations that provide the resources, including the specialized staff, to select, structure, offer intellectual access to, interpret, distribute, preserve the integrity of, and ensure the persistence over time of collections of digital works so that they are readily and economically available for use by a defined community or set of communities." Although the term is used as recently as in the early 1990s but it does appear in the scholarly literature as early as 1988 in a document by the Corporation for (NSF) Digital Library Initiative that the principles, concepts and applications of digital libraries caught the attention of the researchers and practitioners alike.

According to Saracevic (2001) there are several trends that may explain for the digital library growing importance. The digital and networked technology reached a certain level of maturity and spread rapidly, which provided for more involved, varied, broader opportunities and problems at the same time. In most, if not in all fields, the nature of scholarly communication changed drastically, creating the exploration for new approaches and sustaining it. Substantive funding became available for research and for practical developments and explorations on a variety of solutions to these problems. More funds and efforts are spent on digital libraries not only in United States of America but also in other developed countries. This is primarily due to the fact that advanced societies in the Western world are bent towards changing into a new form of society called knowledge society. As a result of this transformation managing knowledge records became more important and problems of the transformed society especially the unabated growth of knowledge records kept increasing..

The extra efforts spent on digital libraries have culminated in producing a large number of practical developments, a considerable amount of professional experiences, a number of best practices and standards , a sampling of new methodologies, more research to solve complex problems , a pool of scholarly literature and of course many new techno-based applications. Most of these developments may or may not occur in the Developing World as funds and commitments are not easily forthcoming from the concerned authorities.

However, these developments seem not to be the catalyst for curriculum development in the library and information science programmes. Saracevic (2001) asserted that "education has had little direct or organized connection with any of these rapid and substantive developments. There was little or no funding for education in digital libraries, as related to any of the multitude of the diverse activities…
Overall, education is not a leader by any stretch of imagination, but a follower in digital libraries. Mostly the existing rationale for digital library education, if offered at all, is reactive, meaning that education reacts with a time lag to both research and practical developments in digital libraries."
It can be argued here that the million dollars invested in digital library research will go to nothing if there is no parallel investment in education related to digital libraries. We need to invest in human capital development as the success of any digital library development depends wholly on the competencies of

those who are involved in building operational digital libraries, their maintenance and operations, and providing services to users. We do not want to reach a situation in which the developers of the digital libraries designing software that is not interoperable and compatible with the system in use simply because the developers are not aware of the efficient and effective techniques to be adopted, and the key determinants of success.

What is happening in the Western world related to digital libraries is also replicated, perhaps at a much worst level, in the Developing World. It is heartening to note that during the last few years some of the Library and Information Science schools in the Developing world have taken the bold steps to react positively to the prevailing situation. They have started to view education in digital librarianship to be critical in the development of any types of libraries in their countries. This is in line with the view that library and information science education should be aligned with whatever changes happening in the information environment. As such the library and information science departments should revise the structure of their curriculum to befit the changing needs as well as integrate education programmes with global activities in the field and develop pedagogical guidelines for related practical tasks, with the objectives to produce digital qualified information professionals. There is a belief among the practitioners that the rate of survival of library and information science programmes will depend largely on the extent of willingness of the library and information science educators to integrate the digital environment into the curricula and create relationship with what is happening in the real library environments.

In order to understand closely the extent of incorporation of the digital components in the curricula of the Library and Information Science (LIS) schools in the Developing world a survey of the LIS syllabi might be pertinent. It was pointed out by Pomerantz (2006) that in the USA there is currently one formal degree programme in digital librarianship: a pilot programme at Indiana University and the University of Illinois at Urbana-Champaign, supported with funding from the Institute for Museum and Library Services. In the Developing world there is also one formal programme at the Master level offering digital librarianship. The National Chiao Tung University in Taiwan has been offering a Master programme on Digital Libraries for the past few years.

There are several surveys already conducted in the USA related to the education of librarians. As a result there have been a steady number of studies of LIS curricula over the years. However, none of the existing studies on LIS curricula have been related to courses on digital libraries. Only recently there were studies that try to address the issue of digital library education. Saracevic (2001) and Pomerantz (2006) studied the state of the art in digital library education in Library and Information Science programmes. Saracevic presented the results from a survey on the current state of digital library education in academic institutions while Pomerantz presented the results from a survey on the readings that are assigned in digital library courses and the topics of these readings. In the Developing world there has not been any attempt yet to survey the digital library education in academic institutions as well as to identify the type of courses that have the components of digital libraries. Conducting research on somewhat global level would be fraught with difficulties especially the language barriers that confronted any researcher. Consequently, the survey conducted on digital library education for this paper has the weakness of not being able to encompass all the academic institutions in the Developing world. It is delimited by the language of the countries under study.

METHODOLOGY

The methods for this study were based from those used by Joudrey (2002). The list of course offerings in Library and Information Science programmes were viewd on the open web, and courses on the topic of digital libraries were identified based on their titles and course descriptions. Syllabi were selected for courses in which the phrase "digital library" were used in either the course titles or course synopsis. Syllabi were collected from the open web, as many programmes' websites have links to course syllabi. It is pertinent to state here that syllabi were selected only from programmes and courses at the graduate level. Limiting the syllabi to those courses and programmes at graduate level was a somewhat arbitrary decision, but it was necessary in order that this study can be accomplished within the limited time frame.

Analysis of the Course Offerings

The academic institutions of the developing countries were first identified through several web sources. Each of the institution was examined for the postgraduate programme in library and information science as well as the digital library courses offered by the institution. In the examination of the digital library courses there were two criteria that was applied to the identified digital library courses. The first criterion was to group together those digital library courses that are offered as independent or full blown courses. The second criterion was to group together those digital library courses that are offered on the basis of course integration in which digital library topics are integrated in other topics. For example, the University of Technology MARA in Malaysia has integrated digital library topics with that of multimedia. As shown in Table 1 there are only six countries that are offering independent digital library courses through their academic institutions, namely Indonesia, South Korea, Kuwait, Malaysia, Hong Kong and Taiwan. Only in Malaysia and Taiwan you find the number of academic institutions offering theses courses is more than one.

Table 1. Independent digital library courses

INDONESIA: Universitas Indonesia	Management of digital libraries
SOUTH KOREA : Yonsei University	Digital libraries
KUWAIT : Kuwait University	Digital library
MALAYSIA : University of Malaya International Islamic University Malaysia	Digital libraries Digital libraries
TAIWAN : Shih Hsin university National Chung Hsing University National Chiao Tung University	Issues in Digital libraries Digital reference services Master programme of digital libraries
HONG KONG : University of Hong Kong	Digital libraries : concept and applcations

As shown in Table 2 the number of academic institutions offering integrated digital library courses is small, much smaller than those offered as independent courses. There are only three countries that offer this type of programme, namely Malaysia, Singapore and Taiwan. The range of integration of content includes multimedia, information portals and digital archives.

Table 2. Digital library content integrated with other courses

MALAYSIA : University of Technology MARA	Digital library and multimedia
SINGAPORE : Nangyang Technology University	Digital libraries and information portals
TAIWAN : National Taiwan Normal University	Study in digital archives and digital libraries

CONCLUSIONS

It is obvious from the survey that the number of academic institutions that are offering digital library education in the Developing world are really few as compared to their number globally. It can be concluded that countries that have reached a certain economic level are inspired to offering digital library education. Some of the countries such as Singapore, South Korea and Taiwan are technically considered as developed nations. It will not be out of context judging from the results of this study that there is a relationship between level of ICT development in a country with the willingness to offer digital library education.

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From Retention to Age Gap: Challenges of Younger Faculty in Academia

Karla Alvarado* and Ali Mehrabian*
* Engineering Technology Department, University of Central Florida
Orlando, FL 32816, USA

and

Isabelina Nahmens
Industrial Engineering and Management Systems, University of Central Florida
Orlando, FL 32816, USA

and

Saeid Moslehpour
Department of Electrical & Computer Engineering, University of Hartford
West Hartford, CT 06117, USA

ABSTRACT

In this paper we encapsulate some of the challenges that a younger faculty member may face in academia. We mainly draw on some of our own empirical observations, and in some cases, on experience of others in addressing some of these challenges that are, in many cases, difficult to dispute. The authors discuss some general but essential challenges, and present that the younger faculty members are expected to produce much more that their senior colleagues. This poses some critical issues that are difficult for many younger faculties to surmount. Without the appropriate level of experience, the lack of networking capacity, and the lack of a strong research infrastructure, it is difficult for younger faculties to attract research funding. Nevertheless, many academic institutions and colleges have their younger faculties independently leading their own research programs. This paper also contains some discussions on faculty retention issues. Some remedial actions are suggested to increase the efficiency and robustness of the faculty retention process. These actions are practical, transparent, and cost-effective. Furthermore, the authors share their first-hand observations of the effects of professor/student age gap on faculty/undergraduate student interactions according to the students' accounts. On this issue students exhibit mixed feelings about their younger professors.

Keywords: Younger faculty, Age gap, Retention, Engineering Student, Academic Institution, Research.

1. INTRODUCTION

Traditionally, academic environments are defined as centers for excellence and innovations for professors, students, and the community at large. There is an imperative moral to make academic institutions to contain a superb and inclusive climate that makes it possible for their faculty members and students to succeed and thrive.

However, if we do not figure out or improve how to attract and keep highly talented younger faculty, academic institutions will turn into centers for less excellence and less innovation. In an environment where the battle over talented faculty can resemble a free agent sports market, some academic institutions achieve success. They are not only attracting talent, but keeping their players from signing elsewhere. Following this direction, it is difficult to dispute that there are challenges to address and discuss.

While some of these challenges are considered as “hidden” and or perhaps could be called “implied,” the purpose of this paper is to address and discuss these challenges openly. We draw on some of our own empirical observations, and experience of others, in addressing some of these challenges that are, in many cases, difficult to dispute. First the authors discuss some general but essential issues. This includes the expectations from younger faculties to be more productive than their senior colleagues in many professional aspects, including research. We observed that it is often difficult for younger faculties to attract funding and to produce independent research. None the less, many academic institutions and colleges have younger faculties independently leading their own research programs and groups. Second, the authors discuss some research funding systems and their drawbacks. Furthermore, we present some retention issues and suggest some remedial actions. Finally, authors share their personal experiences of the professor/student age gap and its effect on faculty/student interaction.

2. COMMON CHALLENGES

Senior faculty members are typically defined as those who have achieved full professorship rank. In many occasions, academic institutions count on their senior faculty members to recruit and mentor new faculty members. many vital features of academic organizations also depend on them, such as leadership, maintenance of a cohesive culture, and a maintaining and encouraging positive climate. Often the role of mentoring a new faculty member is assigned to a senior faculty member. Mentors can play important roles in the maturation of newer faculty by fostering research and teaching, and encouraging service. The senior faculty members shall take their mentoring roles very seriously, and shall be recognized and rewarded for their efforts. Providing some evaluation and reward systems may be influential in this process.

Working with younger faculty members, it is our observation that many of them learn how to be research mentors "on the job." There are faculty members hired by research intensive academic institutions directly upon completing some years of postdoctoral study in which the main focus of their work is demonstrating independent research productivity. In engineering, this means that in this case a new, younger faculty member has less likely been exposed to any management training classes, or to have any real practical training in attracting external funding and running an independent research group. It is also more likely that younger faculty members model their own management practices according to their own experiences.

Whether a conception or a misconception, our empirical observations indicate that younger faculty members are expected to be more productive than their senior colleagues It is sometimes very difficult for younger faculty members to produce independent research without establishing a network, a challenge that faces many younger faculty members today. Nevertheless, currently many academic institutions and colleges have their younger faculty members independently leading their own research groups. This is due to many interrelated factors such as networking, research capacity building, excessive personal efforts, etc.

There are also many advantages of recruiting younger faculty members to academic institutions, some of which are only mentioned here. Younger faculty members are relatively easier to recruit. They also draw smaller salaries in many cases, and let colleges to build or restructure from the ground up. While there are exceptions, younger faculty members tend to be more into research, be more familiar with new technology, and show more zeal for their career. Again, we draw on our own experiences to conclude that it is more likely that the newer, younger faculty members are more up-to-date with the latest theories and developments in their field. This is particularly applicable in many engineering fields where advances are at a faster pace. There is a willingness among some faculties to be more experimental with their teaching techniques in the classrooms. There is more "one-on-one" time spent with students with more time spent grading and critiquing papers, projects, etc. Part of that is due to professional passion and the enthusiasm that originates from finally working and building a career after a long period of training. Part of it is due to the desire to make it through tenured-earning process, if it applies. Younger faculties tend to strive to be good teachers. They also desire to build a strong scholarship portfolio. Some younger faculty members are driven by goals they wish to achieve, and others by the desire to proof their abilities to themselves and to others, gaining the confidence and respect of their peers.

3. RESEARCH FUNDING

Traditionally, majority of research funding went to senior faculty members. Funding agencies like to see previous track records and portfolios. It is assumed that the senior faculties could oversee research projects. This assumption is ambivalent if their exposure level is low, unrelated to their fields, and is difficult to establish. Recently, some funding programs have begun to directly support individual younger researchers, with some funds dispersed directly to students for research. However, these systems require more supervision. Some believe that these newer systems are perhaps more effective for younger researchers to work on innovative efforts. Current distribution of research funds by the key funding agencies in the USA and Canada is based on the idea of selectivity. In this process, not all the applicants acquire funding. Berezin (1997) indicates that this policy is superficially justified by the peer review quality control. However, in practice it is invariably tends to favor research along well established lines and discourages real innovation and risk taking (Berezin 1997). This is a major challenge to younger faculty members for generating funding opportunities for their new research programs. More efforts, particularly at research intensive institutions, should be concentrated on this part. Other issues include unavailability of the research infrastructure and resources, lack of business skills, business ethical issues, and legal issues.

4. YOUNGER FACULTY RETENTION

In order to maintain a stable pool of faculty, academic institutions must engage in retention activities and have a strategic plan for replacement of their retired faculty. We observe that many institutions don't have strong such plans. First, institutions should focus on recruiting and hiring the right candidates, and then channel their resources to retain them. The faculty replacement and hiring process costs tend to be much higher than retention costs. Among other factors, there are two simple but essential factors that play a role in younger faculty retention: i) enhancing the work environment and ii) supporting the faculty. Academic institutions could turn to a variety of resources to enhance the work environment. Some suggestions are: providing periodic salary adjustments, encouraging team-teaching assignments, providing reduced teaching loads, providing or increasing funding for professional development, and increasing the research support. A supportive environment is critical for the professional growth of a younger faculty. Academic institutions would want to foster an environment where younger faculties grow in their areas of teaching, research and services.

While these retention tactics may be more effective for younger faculty members, they should be applied to all faculties, regardless of their position and years of service. Retention efforts applied to all disciplines and all faculty members can greatly improve the general work climate and can lead to better productivity and professional satisfaction.

There is a new current of thoughts that identifies faculty engagement as the main tactic for younger faculty retention. Faculty engagement is the level of commitment and involvement a faculty member has towards the institution and its values. A younger faculty is engaged if he/she speaks positively about the institution to peers and students, and if he/she has a strong desire to be part of the institution and exert extra effort to contribute to the institution's success. Engaged faculty will stay with the institution, will become advocate of the institution, and promotes its values. Usually an engaged faculty performs better and is highly motivated.

5. PROFESSOR/STUDENT AGE GAP

Some of our experiences with the professor/student age gap and its effect on faculty/student interaction are briefly indicated below. We only focus here on undergraduate students.

Undergraduate Students express mixed feelings about the age and experience of their professors and its effect on their interactions with them. They indicate that their younger professors are more flexible and more "connected" to their students. However, in many instances, they are still trying to learn the ropes. The students also report that they are more comfortable with a generation of faculty closer to their age group. There are personal evidences suggesting that students interact more with the faculty members who have incorporated relevant and recent developments in their field into their courses taught. Students like a faculty member that is "energetic," "positive" and "upbeat." Some students suggest that they think highly of their faculty because of the number and quality of publications, presentations, etc. Some younger engineering students feel more connected and comfortable with their younger professors who are "highly computer literate" professors. Nevertheless, there are some other students suggesting that they are more comfortable with their "older" professors that have more "signs of wisdom."

6. CONCLUSIONS

In this paper we encapsulate some of the challenges that a younger faculty may face in academia. We mainly draw on some of our own practical observations and in some cases, the experience of others in addressing some of these challenges. These challenges are, in many cases, difficult to dispute. The authors discuss some general but essential challenges and present that the younger faculty members are expected to produce much more that their senior colleagues. This poses some critical issues that are difficult for many younger faculties to conquer. Without appropriate level of experience and the lack of networking capacity, it is difficult for younger faculties to attract funding to perform independent research. Nevertheless, many academic institutions and colleges have their younger faculties independently leading their own research programs. This paper also contains discussions on some faculty retention issues and challenges. We suggest some remedial actions to increase the efficiency and robustness of the faculty retention process. These actions are practical, transparent, and cost-effective. Finally, the authors share their first-hand and practical observations of the effects of professor/student age gap on faculty/undergraduate student interactions according to the students. On this issue students exhibit mixed feelings about their younger professors.

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EMERGENT MATHEMATICAL ENVIRONMENTS USING ELECTRONIC BOARD GAMES

Veronica HOYOS & Guadalupe RODRIGUEZ
CAEMTIC, Universidad Pedagogica Nacional
Mexico City, D.F., Mexico

ABSTRACT

This contribution presents the results of an exploratory study into the functionality of the Domino digital board game for the development of mathematical thought. In particular, we present the emergence of mathematical strategies and consecutive refining strategies observed when children were playing. This exploration try to advance knowledge of how use of these artifacts in the Math class mediate or promote the development of mathematical thought among middle school students.

Keywords: Digital Board Games, Mathematical Environments, Development of Mathematical Thought.

1. ANTECEDENTS

From a practical standpoint the majority of games released are not the kind of games that educators will find valuable in using as part of their teaching, and, while a recent report [1] describes some of the issues reported by teachers, it also points to a pressing need to establish a better understanding of the value of games in school environments and the difficulties faced by teachers when using them [4]. According to Wijekumar et al. [7], it is still necessary to work moving students from a game affordance of a computer to a learning mode.

Trying to go forward in this direction, we present here some results of the instrumentation of a digital board game into two mathematical classrooms at middle school. The original version of the Domino board game used in this investigation was in cardboard, and it was designed by the University of Nottingham's Shell Centre for Mathematical Education (1984) as one of the O Level materials they used in their research on solving problems with patterns and numbers.

Domino is a geometric strategy game appropriate for students entering seventh grade (12-13 years of age). The original version has a board and chips for two players. The board measures eight spaces by eight spaces, arranged in a grid drawn on cardboard. There are thirty-two cardboard or paper playing pieces, which are rectangles with dimensions equal to 1 space by 2 spaces.

The game has just two rules.

- Each player in his or her turn places a piece (a domino) on the board to occupy two spaces.
- The winner is the player who places the last piece.

The normal central aim in a game of strategy is the search for winning strategies.

One contribution of the work we are introducing here was to achieve a digital version of the Domino game [3] to accomplish the exploratory study presented here. This digital version was designed unlike the cardboard original, because the virtual version of the game may be played solitaire against the computer program, named Robi, as well as against a fellow human player. The goal remains the same as in the original version: the underlying mathematical intended structure in this game is symmetry.

This is to say that when two opponents are playing, a winning strategy is to place your dominos symmetrically opposite the opponent's placements[i]. This computer game was introduced in two Math classes as an exploratory material. Each student had to initially play against Robi. The task asked of them was to find a way to beat Robi or, if Robi won, to try to explain why Robi was able to beat them. Figure 1 shows the screen the game displays.

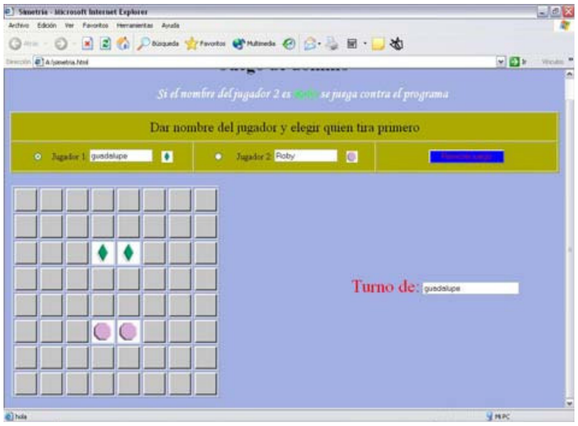

Figure 1: Image of the Domino playing board screen

2. THEORETICAL FRAME

Strategy Games and Emerging Mathematical Environments

Saxe and Bermudez [5] are among the Math educators who have constructed important theoretical elements that allow for analysis of child activity during games of strategy. They used four parameters of analysis to observe children during play: structure of the activity, prior understanding, artifacts and conventions, and social interactions. These authors pointed out that, even though there is an intended game structure in a strategy game, another actual structure emerges as children play. More than that, a mathematical environment is built by the constructions the child executes in interaction with the tools or materials available. This environment allow children to carry out goals and sub-goals, which may be elementary such as counting a collection of objects, or relatively sophisticated as in creating a geometric proof. One basic hypothesis advanced by Saxe and Bermudez [5] is that goals are not fixed or static constructs, but they take shape and move as children involve themselves in practice. In this process, goals are necessarily interwoven with cognitive and socio-cultural facets of children's functions.

The Nature of Artifact and its Influence on Cognitive Development

According to Verillon and Rabardel [6], an artifact's structure and function will foster certain knowledge or effect in cognitive development. In other words, the introduction and use of instruments, whether material or psychological (language, computational means, symbols, diagrams, maps, and so on,), leads to consummating many structural and functional changes in learner cognition. These authors understand development to be the result of an extensive artificial process in which the acquisition of instruments plays a central role. Thus it is not so much the instrument in itself which determines growth, but rather the functional reorganization and deployment that their acquisition and use impose onto innate mechanisms at distinct levels: sensory-motor, perceptive, mnemonic, representational, etc. [5: 82].

3. METHODOLOGY

The Domino computer game was introduced in two middle school Math classes of seventh and eight grade students, each with approximately 25 students. Each class performed three work sessions with the game; each session lasted 50 minutes. These sessions were video-recorded, as were some of the instructor-student interviews at the conclusion of play. These interviews aimed to record student hypotheses, conjectures, and explanations of the possible winning strategies.

It should be highlighted that when the game was first shown to the seventh graders, the theme of symmetry had not yet been presented in their coursework. Such was not the case with eighth graders,[ii] who had had symmetry presented to them the year before.

4. ANALYSIS AND RESULTS

Structure of Activities and Previous Understandings

During play, the children transformed the intended structure into another external way of how to play to win, one that operates according to its own rules, values, and routines, as can be appreciated in the following dialogue among the instructor (I) and two seventh grade students, Omar (O) and Gabriel (G). O and G start a new game, but have already played against each other. In this game, G goes first. It appears that O lets G go first because, when O played against Robi, O always went second and won. G takes his first turn.

> G: Omar is going to win, teacher!
> I: [Tell me,] why is Omar going to win?
> G: Because the one who goes first looses.
> …
> I: And you went first?
> G: Yes.

O and G continue playing, and the game ends a few seconds later. They are able to see on the board in the screen two empty spaces that are distant from each other, as well as the indication that G has won.

> I: Gabriel [won].
> O: Yes, Gabriel won.
> I: You won… so….
> O: What?
> I: [To O] you say that he started first?
> G: Yes.
> I: And [he] won? So, Isn't it [true] that whoever goes first looses?
> O: Yes, [that is right, if] all the spaces are filled in right. Since two weren't [filled in], the turns got reversed. It's like I'd started, cause two [spaces] weren't filled in.

Here we may appreciate the fact that G won even though he went first, (contrary to his hypothesis,) and O was able to develop a new strategy based on counting the empty spaces, a strategy he would later employ to beat his classmates. This same strategy, but expressed more complexly, is illustrated in the next sequence between Andres (A) and Leizer (L).

> I: Are you done? … Let's see, who won?
> L: Me.
> A: Leizer.
> I: Aha! … And who started the game?
> L: Me.
> I: [To Leizer] and you, why do you think you won?
> A: Yes, [I lost, because] here he… What he did to win was to cover two holes. And me like him [me too], covered two, [with the result that] four were covered. Cause he went first, I had to cover two [more] so there were eight and were got even again. I [that way] I'd win. Isn't that right?
> I: Ah! Really? Can you explain that again, a bit slower?
> A: Since there are two, four, six spaces hanging [he points to six blank spaces on the board in the screen]… He could win because there are six spaces hanging, if I could've left other two uncovered [he points to two more blank spaces], probably I would've beat him.

The Strategy A and L used was not to play their pieces symmetrically, but rather to leave empty spaces. They counted concretely regardless of who went second. In this strategy they implemented what is important is the number of blank spaces left. Remember that each piece occupies two spaces, like a domino. Then, the first player will always win provided there are an odd number of dominos that can not be placed, and the second player will always win provided there is an even number of dominos that can not be placed.

The role of artifacts and social interactions

Artifacts constitute contextual factors central to cognitive functioning. Thus, one of the advantages to materialization of the Domino game in a computer is that it afforded to students the possibility to reflect on its underlying mathematical structure, providing the feedback the students received when Robi (the computer) took its turn to play. Nonetheless, although the intended mathematical structure (symmetry) was apparently perceived by eighth grade students, and displayed in the strategies they initially put into practice, these strategies were also reformulated, in light of the interactions between classmates and the new elements they contributed to the game. This dynamic was observable in the case of Saraday (S) that we show in the next transcription. After S played several games against classmate Luis, the instructor[iii] (I) asked S about how she won. This conversation takes place just after S had changed to a new partner, Mitzi (M).

> I: Saraday won [against Luis]?
> S: Yes.
> I: What strategy did you use?
> S: What I did was… if he played over here I played on the opposite side, like in the games I played against Robi. [S refers to how, in the games against Robi, she perceived that a winning strategy was to play symmetrically against the opponent's move.]
> I: Oh! [Observes how M's move is an attempt to block S's spaces, and S responds with the same type of move] How is that?
> S: And I left… [points to an empty space in the board].
> I: Like Luis's strategy?
> S: Yes. If, for instance, he went like this, I went like that [indicates the board in the screen, where Luis had moved and she had moved, and we could observe a blank space that was visible between to two moves]. I tried to leave a space so he wouldn't try to make another pair.
> I: Let's see. Tell me that again. How does that go?
> S: If he played, for example, like this, [points to the board in the screen with her finger, in a horizontal move,] and I like this [points on the screen a move below the previous one, which together form a 2x2 square on the board]. I tried to leave this space [indicates a blank space left beside these two moves; the game is finished and she notices on the board in the screen that precisely three blank spaces remained] so that he couldn't do another.
> I: So, you nearly used his strategy, and also your own?
> S: Aha! I put 'em together!

In sum, in this dialogue appeared how, in the act of playing against M, S began to make symmetric moves against her adversary. However, when M attempts to block spaces (one of the emerging winning strategies), S responds by making identical moves (blocking spaces). Therefore, in the end her way of playing becomes a mixture of two strategies, symmetric moves and space blocking.

5. CONCLUSIONS

The main rule of the Domino digital board game is the search for winning strategies that allow the winner to activate the last two consecutive squares on the game board. The intended structure of the game is symmetry, yet the actual (mathematical) structure defines a potential organization that the children concretize in different ways once they are engaged in the task [5]. For example, a result of seventh graders playing against Robi was a rapid turn toward a different winning strategy, one which consisted of trying to leave blank spaces, and counting out how many were necessary according to which turn they had. Among eighth grade students, it is likely that the structure and function of the artifact employed (the virtual Domino) have fostered cognitive development [6], since it was observed that when students used a strategy that they believed to be a winning one, they continued to deploy it and perfected it as long as it was functional.

Moreover, a winning opponent's strategy was cause for reflection and reformulation, or construction of a new winning strategy, as we showed in the case of Saraday. This performance is a heuristic for problem solving that appeared during the task, in the competition situation of the game, corresponding to an action pattern analogous to the display of general heuristics for solving math problems, such as those mentioned by Polya [2]. Although the potential this type of psychological instrument has is yet to be determined in solving specific math problems, it is likely that the kind of performance described could be recreated within other specific contexts, and may constitute a model for the activity students should display in Math class.

The results from seventh graders showed that they did not even recognize symmetry in Robi's way of playing or winning. Rather, they developed another winning strategy, based on counting and building inaccessible spaces on the screen board. In fact, they attained a general complex counting strategy. Note that in the formulation of their winning rule, they made no reference to a fixed number of blank spaces at the end of any game. From this case we could conclude that a convenient approach to building upon that which seventh graders have achieved so far would be to advance toward the formulation and proof of some general properties of numbers.

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[i] Please note that Domino may be played by one student against Robi (the computer), or between pairs of students. In fact, the procedure in this study was for students to play against Robi a few times first, then to play a few games between themselves.

[ii] The topic of symmetry is part of the curriculum for seventh graders; thus eighth grade students should have encountered this topic the previous year. In fact, a diagnostic test on symmetry for each student was included as part of the research to collect concrete evidence on how much they knew prior to engagement with Domino. Then, application in eighth grade revealed that many of them were quick to notice that one way to beat Robi was to symmetrically mirror the opponent's moves.

[iii] The instructor has just noticed that Saraday was who won the last games, and not precisely following the same strategy always.

Participatory Design Studio (PDS) – Inquiry-based Collaborative Design Studio

Katsuhiko Muramoto, Associate Professor
325 Stuckeman Family Building, Department of Architecture
Pennsylvania State University, University Park, PA 16802
kxm15@psu.edu, (814) 863-0793

Michael Jemtrud, Associate Professor
4212 Visualization-Simulation Building*, School of Architecture, Carleton University*
Ottawa, Canada K1S 5B6
mjemtrud@ccs.carleton.ca, (613) 520-2600 ext.2875

Danielle Wiley
4212 Visualization-Simulation Building*, School of Architecture, Carleton University*
Ottawa, Canada K1S 5B6
daniellewiley@hotmail.com, (613) 520-2600 ext.2875

Sonali Kumar
128 Stuckeman Family Building, Department of Architecture
Pennsylvania State University, University Park, PA 16802
suk189@psu.edu, (814) 865-4209

Abstract:

The research project investigates the use of immersive visualization systems through which student teams in multiple locations collaborate via simultaneous access to project data, visualization, modeling, simulation and multimodal interpersonal communication tools.

As a preliminary report on a proof-of-concept design studio conducted during the spring semester of 2007 between the Immersive Environment Laboratory (IEL) at Pennsylvania State University and the Carleton Immersive Media Studio (CIMS) at Carleton University in Ottawa, the paper first describes the implementation of a network-centric collaborative design platform. The report articulates the "staging" of the conditions of possibility for a dynamic interplay between technological mediation and the reality of making, then compares the use of high bandwidth technology with customized symmetrical toolsets in the tele-collaborative educational environment, versus commercial toolsets deployed over moderate bandwidth connections. In each setting, the collaborative environment is assessed according to issues encountered by students and design outcomes. The effectiveness of the digitally mediated collaborative studio is also gauged in terms of student reaction to the learning process via feedback surveys and questionnaires.

Keywords: collaboration, tele-presence, visualization, broadband

1.0 INTRODUCTION

The process of making a building is inherently collaborative due to the diversity of design, engineering, informational and construction professionals involved. The rapid globalization of the building industry in the 1990's, in conjunction with the rise of the Internet, resulted in digitally mediated collaboration. Geographically distributed and digitally mediated work environments exacerbate the complexity of the design process but simultaneously provide immense opportunities. Recent improvements in visualization and communication technologies challenge traditional location-dependent partnerships and open up new possibilities for rich modes of creative activity and collaboration.

During the spring semester of 2007, student teams in two locations participated in a collaborative digital architecture studio, between the Immersive Environment Laboratory (IEL) at Pennsylvania State University and the Carleton Immersive Media Studio (CIMS) at Carleton University, Canada. The experimental design studio investigated the use of a tele-collaborative educational environment in which immersive digital visualization systems, high-performance rendering resources, broadband data networks and supporting multimedia applications would be integrated into the design workflow. The objective of the tele-collaborative environment was to create an immersive, information and communications rich environment for dialogue, group problem solving and the shared experience of participatory design. Our research agenda is to build upon previous research conducted at the IEL on Human Computer Interface (HCI), and to investigate how digitally mediated design mediums can facilitate the collaborative design process in 'real-world scenarios'.

This "proof-of-concept" and "capacity building" phase of Participatory Design Studio (PDS), was implemented through a series of collaborative design environments, each of which comprised a loose assemblage of geographically distributed platforms (or "scenes"), including traditional architecture studios at both Penn State and Carleton, immersive media labs, FTP sites, and multiple communications and visualization technologies. We approached each collaborative design environment as a "staging" that introduced unique conditions for a dynamic interplay between technological mediation and making.

2.0 BACKGROUND ON DIGITALLY MEDIATED COLLABORATIVE DESIGN STUDIO

The notion of the technologically mediated collaboration has been around since the mid-1990's as communication technologies evolved and became available to the masses. Due to the lack of available collaboration technologies, they had to rely heavily on asynchronous communications such as e-mail, message bulletin boards (later came to known as "digital pinup boards"), FTP, and the Internet. Insufficient bandwidth and insufficiently powerful and crudely coordinated tolls resulted in distributed task-based modes of collaboration that did not allow full participation by members of the distributed design teams. As a result of asynchronous communications, participation was reduced to "simply submitting and giving oneself over" to the process and other participants (Vaitkus, 1991). Currently the digitally mediated design studio has been employed in various forms by various disciplines including AEC, industrial design, and the automotive industry.

Although the recent development of synthesized networking and media technologies has led to significant progress in enhancing collaborative environments in academic settings, truly collaborative work is still rare. Little research has been done to validate how such improvements let groups collaborate and communicate, particularly with regard to long-term use in natural settings (Viégas and Wattenberg, 2006). Furthermore, there is hardly any research done to speculate on how such a paradigm shift in the world of architecture brought by the recent development in visualization and communication technology opens up different modes of collaboration. (Maver and Petric, 2001; Marher, 2006).

3.0 VIRTUAL REALITY AS AN IDEAL MEDIUM FOR COLLABORATION

The primary goal of the PDS is to allow students at multiple locations to collaborate in real-time by sharing computational resources, geometry datasets, and multimedia content. Design collaboration is to 'work together in a meaningful way, not just working together efficiently, but stimulating each other to contribute to the design task…toward mutual understanding and maximizing outcomes that satisfy not only own respective goals, but also those of other participants" (Achten, 2002). Thus, in order for collaboration to be successful, its environment needs to foster a sense of presence among the participants and to enable transparent conversation, and sharing of ideas and thoughts. Within this information rich communications context, we believe that large-scale projection based Virtual Reality (VR) systems can provide an immersive medium for dialogue and group problem solving, through the opportunity to *share* a design project among participants.

3.1 Facility

The IEL at the School of Architecture and Landscape Architecture at Penn Sylvania State University offers a three six-by-eight-foot, panoramic, passive stereoscopic VR display and is supported by a cluster of graphics workstations and software to allow VR-like display of student designs. Conceived as a lower-cost VR alternative to then first-generation CAVE and like systems (Muramoto, 2002), the IEL has evolved to support and reflect student work habits (Kalisperis et al., 2002), in which VR capabilities often are used with other modeling, multi-media or presentation applications within an immersive information environment, in addition to the anticipated use purely as an immersive VR display.

Current specification of the IEL includes:

- Windows Workstation
  - IBM Intellistation A Pro workstation
  - nVidia Quadro FX 4500 PCI Express video adapter
  - 2x AMD Opteron 256 3.0GHz processors
  - 4GB RAM
- Projectors
  - 6x Dell 5100MP
  - 3300 lumen DLP technology
  - SXGA+ resolution
- Sound System
  - ClearOne RAV 900 conferencing system
  - 2x loudspeakers
  - 3x ambient microphones
  - M-Audio Audiphile Firewire external audio interface
- Video capture and processing
  - Sony EVI-D100 remote camera
  - Winnov Videum 4400 video capture card

Sony HDR-FX1 High Definition DV camcorder
Blackmagic Multibridge Pro media bridge
Pleora Ethercast Video IP System

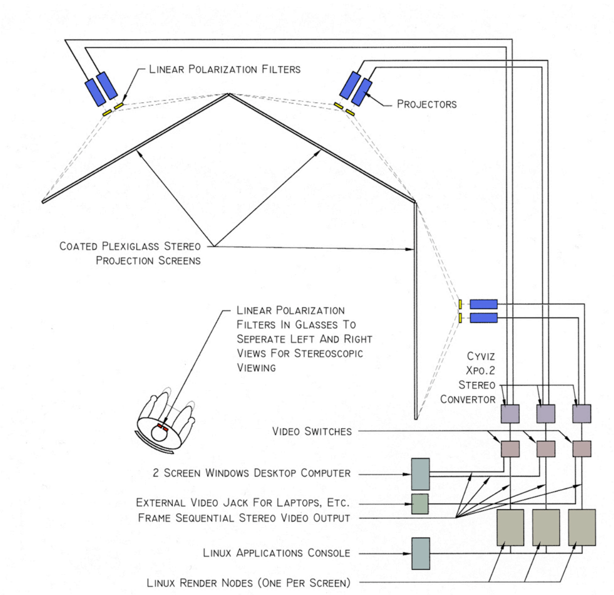

Fig. 1: Diagram of the projection system at the IEL (previous version)

The user pattern at the IEL suggested that an integrated multimodal platform would best serve at the evaluative stage during the design process, especially in a collaborative setting (Balakrishnan et al., 2006). The CIMS lab at Carleton University, on the other hand, was intentionally set up to resemble conventional board room setting, with long table and a large plasma screen at the end.

3.2 Participants

Total of 32 students (16 from each institution) participated for this project. They were all enrolled in the third year of five-year professional degree in architecture at the respective institutions. Participants were all under 25 years of age, and four participants were non-native speakers. The software used during the projects ranged from PowerPoint, PhotoShop, Form•Z, 3D Max, Maya AutoCAD, and other modeling software. The PSU students had intermediate level skill on Form•Z, while the CU students had entry level skills. Many CU students had substantial skill with 3D Max.

3.3 Projects

Total of two collaborative design projects were given during the semester; a small helicopter museum at Penn State (VLM), duration of 6 weeks and an addition and renovation to the School of Architecture at Carleton University (SoA), 8 weeks. The students were organized into groups of 4, with 2 students from each school for the VLM. For the SoA, some groups were combined or reorganized, resulting in a variety of group size (4, 6 and 8). The VLM utilized Access Grid, while SoA exploited the potential of the National LamdaRail (PacketNet with one-gigabits connection) and CA*net 4 (Canadian broadband network) allowing Standard Definition videoconference, Web Service with dashboard and utilization of Remote Visual Networking (RVN).

4.0 STAGINGS OF THE DIGITALY MEDIATED ENVIRONMENT

The goal in "staging" a digitally mediated environment is to achieve "smoothness." In a "smooth" digital environment, the technological interface ceases to be a hindrance to collaboration and begins to facilitate the communication, creation and representation of an architectural idea. In the context of the PDS, components from network and middleware to the physical environments are considered as a 'staging'.

The stagings, however, are identified reflexively, as they were not wholly determinable *a priori* to the implementation of the studio. While we began with a basic approach for a network-centric collaborative platform, this platform had to remain open to the emerging requirements of the student participants, to the inevitable logistical barriers and to the integration of new technologies as they became available through the course of the semester. Each of the stagings thus developed, through improvisation and adaptation, into a loose ecology of technologies, locations, facilities and communication protocols.

4.1 Project 1 (VLM – PSU local site) with Access Grid

Since the proposed project was located at PSU, the Penn State students took responsibility for documenting the existing condition of the building and its existing context, then transmitted those to CU students via FTP sites. The information conveyed consisted of Form•Z digital models, pictures of existing conditions, conventional architectural drawings in PDF format (site plans, building plans, elevations and sections) and video documentation.

This first staging was comprised of;

- PSU and CU "conventional" architecture studios
- IEL (Sony EVI-D100 remote camera, ClearOne RAV 900 conferencing system with loudspeakers and 3 ambient microphones) and CIMS Lab (Sony HDR-FX1 HD DV camcorder and UB1204FX Audio Mixcer)
- A broad range of supplementary pair-to-pair communications, including AOL, MSN, email, phone
- and FTP sites.

Fig. 2: Access Grid Collaborative Session at the IEL

Scheduled videoconferences were held once a week for the first three weeks and twice a week for the rest of the project. After the initial meeting session, the students communicated their design intentions via Access Grid conferences, using primarily PDF format with images from Form-Z models and scanned hand drawings, as well as some AutoCAD and other modeling software. The Access Grid conference was easy to operate and robust enough to serve for productive conversation and exchange of concepts and critiquing, thus contributing to the establishment of a common ground for the projects. Most of the design collaboration on the projects, however, was task-based collaboration and happened asynchronously for the duration of the project.

4.1a Observations from Project 1

The focus-group study at the end of semester indicated that audio delay prevented team members from fully experiencing spontaneous idea exchange and generation. In addition, the digital media presentation tools such as PowerPoint leave much to be desired. It was helpful in explaining each other' ideas, but did not allow participants to think and act together. As it is acknowledged in the previous studies on the differences between remote sketching and computer modeling software during the design process (Maher, 2005 &2006), most of criticisms were that computer-based presentations tend to be formal and rigid, not allowing spontaneous exchange of ideas and interpretations necessary between participants, especially at the early stage of the design process.

4.2 Project 2 (SoA Project – CU local site) with National LamdaRail PacketNet

The PSU and CU students thus reversed positions, in that CU students would now be responsible for communicating the unique existing conditions of a complex building, site remote to the PSU students. Similar to the first part of the term, this staging included previously listed items as well as:

- IEL (Sony HDR-FX1 HD DV camcorder)
- remote sketching programs (Open Canvas)
- and TeamSpot (although this was implemented towards the end of the project that it was not fully utilized)

The connection between IEL and CIMS was switched to the National LamdaRail PacketNet and CAnet4, allowing Standard Definition videoconference. This PDS project is considered to be the first 'in the wild' real-life deployment of the components developed in Eucalyptus (Jemtrud et al., 2006) by CIMS and the Institute for Information Technology at the National Research Council Canada.

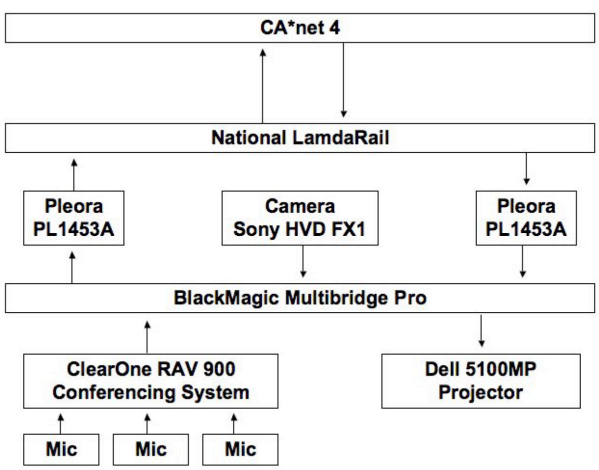

Fig. 3: Diagram of the hardware setting in the IEL

Due to the PacketNet' 1 Gb/s connection at PSU side, we could not exploit the Eucalyptus' potential to the fullest extent, but were able to deploy:

- Uncompressed Standard-Definition (SD) Video using Pleora Technologies' EtherCast;

Fig. 4: Conceptual Diagram of the Dashboard

- PDS Web Service and Dashboard;
  Originally developed jointly by CIMS, the PDS dashboard is a flexible, customizable Graphic User Interface (GIF) composed of floating interfaces for function such as video conferencing.
- and RVN.

Fig. 5: Standard Definition Videoconferencing Session using one screen as Video feed at the IEL

4.3 IEL and CIMS Configuration

During the duration of studio projects, we have experimented with several different configurations to examine the effectiveness of 'staging'.

Fig. 6: Standard Definition Videoconferencing Session at CIMS

5. OBSERVATIONS

The difference between the two settings was apparent. Dramatic changes were observed in students' supplementary communications, as well as their creative use and appropriation of the tele-collaborative environment.

5.1 Videoconference

The quality of video feed was crucial to the collaborative work sessions as they contribute greatly to the ways that people can relate to each other and build a foundation of shared understanding. Although we could not utilize High-Definition (HD) Video for this experiment, SD video signal was more than sufficient for team members to observe each other's expressions. Compared with the Access Grid conferencing which was limited to conversation only, students quickly took advantage of the quality of video feed by using physical models to explain their ideas and intentions and even quickly sketched their ideas on paper and showed it to partners during the conference.

The audio delay observed during the Access Grid sessions was hardly noticeable. However, even the utilization of the National LamdaRail, slight delay caused the audio echo on PSU side since CIMS Lab's lack of hardware echo canceling capacity. It is interesting to note that CIMS never had echo problems in their experiments between Ottawa and Montreal.

5.2 PDS Web Service and Dashboard

Previously, there was no work being done to integrate and make the technology transparent, easy to use, and on-demand for the end users without large support and technical staff. The PDS Web Service and Dashboard brought different tool sets that encompass and streamline almost all stages of the digitally mediated process. The Dashboard is flexible, robust and relatively transparent to users and will become a powerful multi-disciplinary collaboration enabler as more 'Widgets' are incorporated.

5.3 RVN and "Deep Computing Visualization"

The discipline of architecture is dominated by digitally mediated tools and processes that are primarily 3D and time-based, and require sharing of computational resources, large geometrical data sets and multimedia content. Although available software at this point was limited to Maya, RVN immediately became an important element in our collaborative effort. Students were able to share 3D models of projects and examine and discuss design issues together. Manipulations of 3D models from either end were flawless even though the file was fairly hefty. Again, the potential benefit of DCV in a collaborative environment was proven. CIMS and IBM are currently working on the inclusion of Form•Z, AutoCAD and Revit.

6. OVERALL OBSERVATIONS

By the outcome of the focus-group study conducted at the end of semester, the potential of the PDS promises to provide us with ideal 'collaborative work space'; first and foremost interactive, occurs in real-time, and in three-dimensions which potentially allows for an expansive repurposing of assets in the organizing, sharing, transferring, and displaying of content in a more fluid, comprehensive, efficient, and effective manner. Collaborative design is an argumentative process in which designers create an environment for a design dialogue (Simon, 1981) where the project is advanced in a team environment. Schematic implementation of the proof of concept supported a free-flowing, multi-user, participation scenario based around the presentation and manipulation of rich visual design media, and as a result project emerged through a series of interactions between the members of the design team negotiating for a shared understanding via the aforementioned digitally mediated environment.

7. RESEARCH DIRECTIONS

This research, in addition to our interest in the impact of high bandwidth connections on design collaboration, also illustrates our interest in the social and psychological aspects of this collaboration. In order to study computer-mediated communication from a social-psychological perspective, it is important to understand the importance of "presence" (Gunawardena & Zittle, 1997). The concept of presence is relevant for the development and evaluation of a broad range of media systems and as such is important for this study as well. Kim and Biocca (1997) define presence as the subjective experience of "being there" at a mediated place. Conceptualizations of presence across disciplines deal with humans as subjects. Lombard and Ditton (1997) identify six different conceptualizations of presence: presence as social richness, presence as realism, presence as transportation, presence as immersion, presence as social actor within a medium and presence as medium as social actor. They identify the "perceptual illusion of non-mediation" as the common thread among these conceptualizations, which vary widely. This can occur in two distinct ways, either the medium appears transparent or when it transforms into something more than a medium becoming social entity (Lombard & Ditton, 1997).

In a mediated social environment such as ours, presence can be conceptualized as a sense of "being together" or "co-existence" a rather than as "being there" (Greef & IJsselsteijn, 2001; Nass & Lee, 2003). This sense of social presence, i.e. of 'being together', is operationalized as the extent to which other beings are seen to exist in the virtual world and respond to the subject. Social presence is generally thought to positively correlate with improved task performance in collaborative virtual environments. In our research, we adapted questionnaires from Nowak and Biocca (2003), Schroeder et al. (2001) and Basdogan et al. (2000) to measure social presence.

We have gathered substantial data in this proof of concept stage of the project (field observations, video tapes of sessions, students' weekly journals with logs and records of communications that took place), the review of which is not completed at the time of publication of this paper. The analysis will be broadly based on

1) User interface and 'staging'
   Analysis on how tools are used, ease of use and feasibility of implementing those tools in a digitally mediated environment;
2) Collaboration in the Design process;

It will be performed using INTERACT.

8. FUTURE PLANS

We are planning to up-grade our connection at PSU to 5 Gb/s connection next academic year (CIMS already has a 10 Gb/s connection capability). This will allow us to experiment with "User Controlled Light Path" (UCLP) technology allowing participants to configure high-speed point-to-point network connections through Web Services to establish stable and low latency connections. A beta version of this application has been developed by CIMS and the next PDS project will offer an intensive "real world" application for its further refinement.

In addition, research in 'staging' of digitally mediated environment will continue by acknowledging the multi-stage architectural design process: program development, schematic design, preliminary design, design development, contract drawings, shop drawings, and construction (Laseau, 1980). Each stage necessitates various requirements and different kinds of collaboration, thus different "staging' and communication scenarios needs to be studied and evaluated.

We believe that further work and experimentation in exporting key elements of immersive visualization experiences will produce a new immersive collaboration paradigm, widening the audience for both collaborative and immersive visualization technologies. It is urgent that we need to use opportunities to find inherent aspects of the media, rather than simulating what is possible in face-to-face interaction.

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A Multidisciplinary Learning Experience through Animatronics

Arif SIRINTERLIKCI
Department of Engineering, Robert Morris University
Moon Township, PA 15108, USA

ABSTRACT

This paper presents author's efforts for stimulating and maintaining interest of secondary school students in STEM driven (Science, Technology, Engineering, and Mathematics) fields such as electronics, robotics, Computer-Aided Engineering through a multi-disciplinary learning experience in developing animatronic toys and robots. Product development methodology is employed to facilitate learning of fundamental engineering concepts and IT (Information Technology) related fields. Students design and construct simple animatronic toys or programmable animatronic robots. Emphasis on IT related fields such as electronics, controllers, programming, and utilization of e-resources for e-research is crucial for the success of this effort. Complex problem solving and creativity are promoted through conceptualization, design and construction of animatronic toys and robots providing a fun learning atmosphere in individualized and team environments. With the successful completion of the experience, students are exposed to a wide span of areas such as art in concept design, biomechanics of animals, material science and manufacturing processes in selecting materials, making and assembling parts, realizing mechanisms as armatures, wiring electronics circuits in sensing and controls, and programming of microcontrollers. This paper elaborates on various formats/ activities of this initiative. Results from previous programs, continuing development efforts and possible future work are presented. The paper also includes strategies in dealing with different levels of students, learning styles, gender differences, and recruitment.

Keywords: Animatronics, Robotics, Toy and Entertainment Design, Product Development and Multidisciplinary Curriculum

1. INTRODUCTION

Animatronics

Animatronics is the art of bringing inanimate objects to life through hand puppetry, cable control, remote control, radio control, and computer technology. A major pioneer in animatronics was the Jim Henson Company [1]. Animatronics was a popular way of entertainment that proved itself in theme parks, museums, and cinematography industry [2]. In the last two decades, many animatronic structures have been replaced by computer animations. With the emergence of animatronics in the toy industry, through such toys as Furby and FurReal pets, animatronics is making a comeback. There have been many examples of mechatronics education at engineering and secondary education levels. These examples had multidisciplinary education aspirations as well [3]. However, utilization of animatronics has been rare. These included Woolard's Ph.D. thesis entitled "Animatronics: The Development of a Facial Sensing System to Enhance Performance Control" [4] and a master's thesis entitled "Design and Development of an Expressive Animatronic Face" by Nowakowski [5]. Unlike biomimetics, animatronics is not purely based on science and engineering, and art is an important component leading to creativity through open-ended design projects. In reality, involvement of art in animatronics and toy design elevates the multidisciplinary engineering experience to a cross-disciplinary one.

Educational Concept and Development Efforts

The idea of using Animatronics as an educational tool came about while the author was looking for a subject to revive student interest in robotics in his previous college teaching assignment and saw a show on Animatronics on cable TV in 2002. The literature review and the Internet scans revealed very little in the area returning a college level course and two previous graduate theses listed in the animatronics subsection above. Since then the author has developed a college honors course, conducted pilot studies for better preparation of workshops and camps, coached a toy design team to Sigma Xi National Toy Challenge finals, and successfully executed his workshops and camps.

The original concept was proposed to NSF (National Science Foundation). It was based on a youth-based project where author and his colleagues employed product development methodology to facilitate learning of fundamental concepts of engineering sciences and IT related fields [6]. Students were to design and fabricate animatronic toys with simple controls, and programmable robots. The main objective was to help students develop a strong knowledge base of STEM/IT and high confidence enabling their further development through life-long learning. The format of the original concept included a weekend program followed by a two-week summer capstone camp. During the initial development efforts emphasis was given to electronics, controllers, programming, multi-media design, and utilization of e-resources. Following is an introduction to each learning level targeted with the proposed program [6]:

<u>Middle School (Grades 7 and 8; Ages 13 and 14):</u> At this level, students start developing formal operation skills. The ability to engage in mental manipulations begins to replace the concrete operation. Students at this level inquire why and how the toys are developed. They gain experience by providing modifications to existing animatronic toys or robots. Reverse engineering methods is used to create the students' knowledge base. Students disassemble and inspect selected toys to understand their design and technology. The next step is to modify and build redesigned toys. Students also create simple hybrid structures which are built with the integration of LEGO system standard components, and parts designed by students. Standard LEGO components include motors, sensors, simple controllers (LEGO RCX), and mechanical elements.

<u>High School (Grades 9 through 12; Ages 15 to 18):</u> At this level, students' formal thought continues to develop and they start to understand abstractions. Students start with modifications of existing designs for improvements and then proceed to design,

construct and test toys or robots through open-ended design projects. By building upon reverse engineering practices, the experience is used to introduce students to a generation of new sounds, movements and actions in a very creative environment. Students are able to design their own computer controlled toys. Voice recording, playback, and activation circuits, powerful controllers (with MOTOROLA 68HC11 processor), state-of-the-art sensors, motors and other actuators, and higher-level programming are included to elevate this level from the previous one.

Neither of the groups is given kits, but standard components mixed in bins. This promotes creativity with fewer boundaries. Both groups will inquire through e-research and share through e-discussions [6].

The initial development efforts incorporated the critical workforce skills (determined by SCANS (Secretary's Commission on Achieving Necessary Skills)) such as computational literacy through design calculations of electrical circuit analysis, ability to apply knowledge through open-ended design projects, team work during laboratory and summer capstone experiences as well as discussions. Utilization of e-resources in the design process and programming of controllers also enhance students' IT and computational skills [7] [8]. While working on problem solving in complex systems, students assume individual responsibility, establish qualities such as self-esteem toward technological literacy, self-management, sociability, and integrity. The curriculum design was based on an inter-disciplinary approach across math, science, technology, and IT standards as well as SCANS. Students use science (of sensors), mathematics (in design of mechanisms) and technology (in selection of electric motors as actuators to drive the mechanisms). Content and information processing ability are gained. Students are challenged to apply these technologies in an effort to gain design and building skills while getting exposed to troubleshooting practices [9][10][11][12][13][14][15][16].

In the light of new educational research, gender differences in learning science and engineering were to be incorporated into curriculum as well [17][18].

Recruitment and Retention

The original intention was based on the idea of recruiting underrepresented students such as minorities and females as the main target audience. The author and his colleagues proposed aggressive recruitment of these populations with the promise of at least 50% of the participants being minorities and females. A limited number of secondary school teachers were also to be accepted as students. The target area of the original NSF proposal was within the 50-mile radius of Ada, Ohio including poor and rural counties and the inner city environment in Lima, Ohio [6].

The target population was to be reached by contacting respective STEM teachers/guidance counselors. The PI's of the proposal were to publicize this project through newspaper advertisements, TV and radio news segments and fliers at schools with the help of local contacts. Role of the Parent-Teacher Associations or Organizations (PTA/PTO's) was taken into consideration through the parent volunteer position for the project. Open-houses were to be organized for prospective students, their teachers, families, and guidance counselors. This activity was intended to bring students, their families and teachers and counselors to campus to further excite them with the educational opportunities and facilities of the university.

The admission to the program was based on student interest. Students were to be asked to fill a simple registration form with a section identifying their interests. Persons with matching interests to program objectives were to be selected while keeping quotas in mind. Students were to be asked to work with their STEM teachers/counselors in preparation of the application. Selected participants were to be notified one month before starting date and an orientation meeting was to be carried out a week before the initiation of the program.

As part of the completion of the capstone experience an exit interview was to be done. With the completion of the program, students were to display their works on RMU campus and receive a completion certification. Events were to be publicized and open to public as well. Teachers and guidance counselors were to be invited to the event, as well as the families of the participants. These events were also a part of the recruitment strategy. After completion of their program, the students were to be invited to continue participation through IT/Animatronics Clubs. Proposed activities of these clubs were the establishment of Animatronics/Robotics Competitions, Participation to Sigma Xi's National Toy Challenge, and more.

The teachers who were accepted as students to the program beside their own students were to magnify the programs outreach and impact by influencing more students at their schools, as they utilize the methods and technologies acquired through the project. In addition, they were to be asked to represent and promote the program in their school districts or simply act as ambassadors in coordination with guidance counselors and other fellow teachers. Student retention during the project was to be accomplished by observing the student and teacher progress and attitude as well as conducting interviews. A database of all participants was to be kept and quarterly follow-ups were to be made on each graduate of the program (who are not involved in IT/Animatronics Clubs) for a minimum of two years to monitor their progress and to encourage them to stay on course for college preparation.

After the successful completion of the NSF grant period, the PI's will replicate the program in a greater area within the States of Ohio, Indiana, and Michigan in collaboration with other higher educational institutions.

Additional Efforts

As the multiple submissions to NSF ended with no available funding, the author and his collaborators have continued to further develop the program and search for funding resources.

In the Summer of 2004 a group of five $8^{th}/9^{th}$ graders from Ada (Ohio) Exempted Village School's Gifted and Talented Program went through a subset of the initiative which included concept development, artistic, and industrial design of products, materials and manufacturing process components that led to design of movable toys with mechanisms.

Following the summer 2004's pilot study, four 8^{th} graders from Ada Exempted Village Schools worked with the author (and a mechanical engineering faculty member) and submitted the design and prototype of Mr. Money Monkey, an organ grinder monkey, that earned the Engineering Design Mention Award in the 2005 Sigma Xi's National Toy Challenge competition, held in Raleigh, North Carolina.

After a development stage that included proposal writing, executing pilot studies with gifted students, coaching them for a national toy design competition, the author developed a week-long summer study. It was offered for the first time during the 2005 SHI (Summer Honors Institute) sponsored by the Ohio Department of Education Office for Exceptional Children. It was a residential program for Ohio 10th and 11th grade students who are officially documented to be gifted. This program was based on the curriculum given below, but included a CAE (Computer-Aided Engineering) exercise where student used a simple FE (Finite Element) Code in designing toy baseball bats.

2. CURRICULUM

The Animatronics core curriculum encompassed the following subjects in the following sequence [6] [19]:

- Introduction to Animatronics and Robotics
- Introduction to Engineering, Product Design and Development
- Project Management and Team Work Basics
- Concept Development
- Artistic and Industrial Design of Products
- Materials and Manufacturing Process Selection
- Mechanism Design and Assembly
- Electricity and Electronics Basics
- Actuators, Sensors, Controls
- Controllers and Programming
- Costuming
- Future of animatronics in entertainment and daily life

While the subject matters are covered through mini-lessons and complementary laboratory exercises, an open ended-project caps the learning experience. This section will expand the major components of the core curriculum into some sophistication [19].

After a brief exposure to the past and current state of robotics and animatronics, students study the engineering design, and product design and development processes. The steps between concept design of a toy and prototyping/testing are covered in detail by use of videos of various case studies. Students also watch entertainment design case studies for unique animatronic design examples from movies and commercials. The differences between commercial toy and entertainment animatron development practices are emphasized. In the process, students discover the meaning and importance of subjects such as product life cycle, mass production, job shops, DFMA (design for manufacturing and assembly) or concurrent engineering, industrial or artistic design, human factors, and costing. Because students are going to work in a team environment and manage an open-ended design project, they are introduced to various aspects that relate to project management and team-based work. They are presented with a basic understanding of management of resources, scheduling, and control of their activities. They also learn about team dynamics, leadership, communications, conflict resolution, and other interpersonal skills. In the next step, the students are invited to brainstorm prospective project ideas, followed by the concept development stage. The students are expected to develop design briefs, including marketing targets in the case of the toy development process. Once the design briefs are completed, the students and the instructors discuss the feasibility issues. The students then realize the importance of factors such as scale, material selection, cost, and other physical restraints such as facilities and time. Make or buy decisions are also made at this stage. The students are asked to make a decision by choosing one of the design proposals. The ideas generated within the selected design brief are visualized by use of artistic tools, including blind contour drawings and action drawings leading to storyboards. *Figure 1* illustrates a sample concept picture of an animatronic polar bear with its dimensions and various poses. Three-dimensional models of the concepts are also generated by use of sculpting or rapid prototyping. Some of the models are later utilized as patterns for molding or casting processes. In this stage, students are exposed to polymer, earth, and oil-based clays and various plastics. *Figure 2* illustrates 3-D models generated from Sculpey, a polymer-based clay. The models shown in the figure are in green condition, waiting to be baked. The students move forward to the mold design and fabrication stage. Processes included here are sand casting, injection molding, push molding, and gravity-based molding utilizing materials such as plaster of Paris, urethane, or aluminum or bismuth alloys. *Figure 3(a)* illustrates fabrication of a two-piece, simple plaster mold around an earth-clay based model as a pattern. Other manufacturing processes are presented and experienced as shown in *Figure 3(b)*.

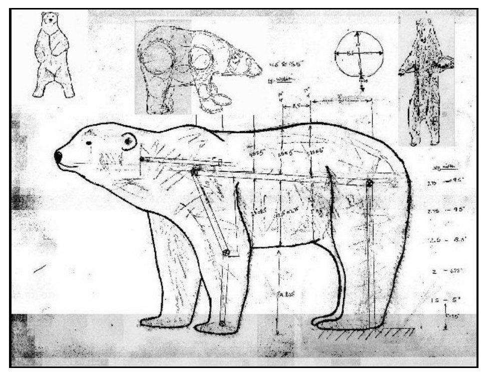

Figure 1
Concept Design

Figure 2
Modeling with Polymer-Based Clays

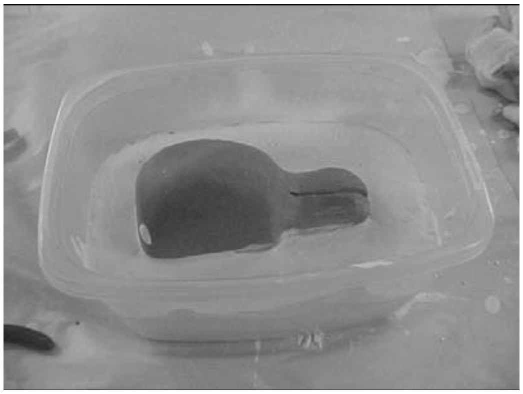

Figure 3(a)/(b)
Molding/Vacuum Forming

After completion of the mold design and molding stage, the students study mechanisms through joints (*Figure 4*), links, linkages, continuous and intermittent mechanism designs, power transmission, and related components such as drives and gears (*Figure 5*). Students also generate armatures for mechanisms and static structures or body parts through metal forming of wires, pipes, rods, or mesh structures, material removal, or NC laser cutting. The mechanism design and assembly stage is concluded with realization of subassemblies. A subassembly belonging to an animatronic animal project can be seen in *Figure 6*. The next step is to study the basics of electric circuits, switches, sensors, and actuators through RC, DC, servo, or stepper motors, radio controls, or microcontrollers and their simple programming language, Interactive C. Once these stages mentioned above are completed, structural parts, actuators, and sensors are ready to be assembled (*Figure 7*) and another important step, costuming, is conducted. Planning for the costuming that will cover the structure to make it look realistic or appealing is crucial. These costumes should not hinder the function of the animatrons while generating safe working conditions. The costuming stage involves soft plastics, fabrics, adhesives, or painting. This step is executed after the successful completion of the working prototype with controls. Examples of costumed student products can be seen in *Figures 8* and *9*. Various doll making and entertainment materials for eyes, hair, and coloring/makeup are utilized in costuming as well. The course curriculum is completed with the study of future of animatronics in entertainment and daily life through toys and robotic companions.

Figure 4
Study of Joints Using Reverse Engineering

Figure 5
Reverse Engineering of a Ladybug

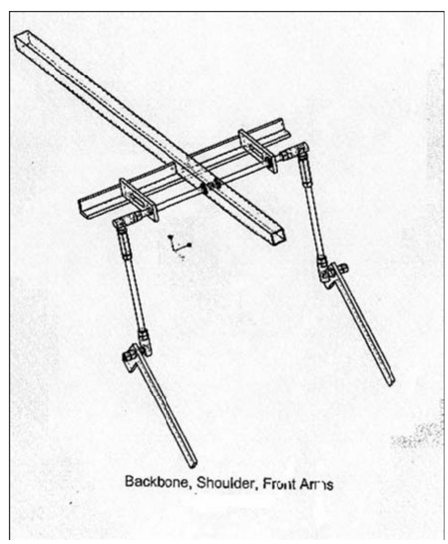

Figure 6
Mechanism Design for an Animatronic Polar Bear

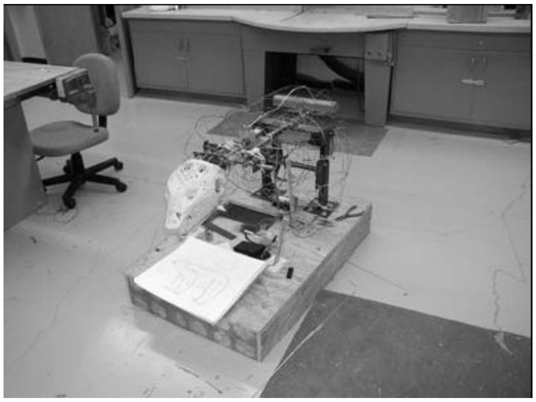

Figure 7
Integration

Delivery
Various instructional tools and delivery methods are utilized throughout the mini-lessons to enhance the learning experience and address various learning styles:

• PowerPoint presentations complemented with interesting handouts as reading assignments.
• Videos (*Figure 10*) and computer animations (*Figure 11*)
• Demonstrations of animatronic toys, working mechanisms (*Figure 12*), and material samples.

Laboratory demonstrations are used for procedures that cannot be included within the curriculum. These demonstrations include hot wire shaping of foam in armature fabrication and soft plastic skin generation with rubber latex. During the development stage, the author and his collaborators also worked with an art professor to strengthen the art component of the program. Art content was delivered by the art professor. With her help, new modeling and molding materials were purchased and are now being utilized.

Figure 8
Costumed Cow Toy

3. CONCLUSIONS AND FUTURE WORK

The experiences have been very rewarding due to the open-ended nature and creativity factor for both the author and his students. The student evaluations from various activities were among the best for the author. A result of the 2005 Ohio Department of Education SHI also showed very positive outcome as shown in *Figure 13*.

The approach employed here is based on following the actual product design and development sequence in a real cross-disciplinary setting. In the process, students, no matter what level they are, are exposed to the real-life experience of developing unique animatronic structures in a job-shop environment or encouraged to follow the product design process in toy making. Recruitment of college and secondary school students to the mechatronics and robotics fields is still the critical goal of this project. The project also assists in retaining students due to the fun, creativity, and realistic learning components. Designing a cross-disciplinary program with cohesive components is a difficult task. The transition between the subjects must be carried out smoothly as well. The author had to work hard to explain to the students that the critical components follow a sequence used by product developers. Basics of each critical component in the sequence were covered during the mini-lessons. The projects then become a good complementary capstone experience. At times, because the initiative was in its infancy, a hobbyist approach rather than the engineer's way was followed. Trial and error in cases of laser cutting of new materials or assembly processes also tightened the time constraints on the participants of the activities. However, problems were dealt with by simple, intelligent solutions, leading to an interesting learning environment.

Figure 9
Costumed Polar Bear

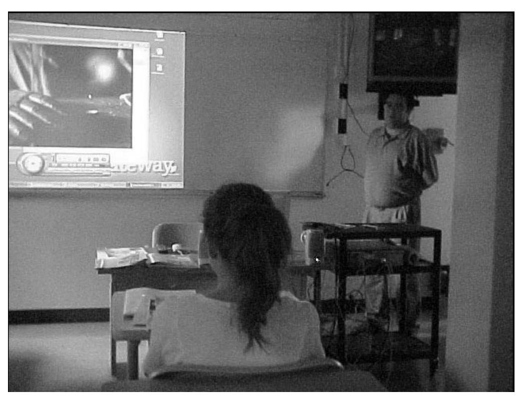

Figure 10
Case Studies - Videos

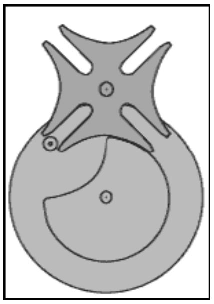

Figure 11
Computer Animation of an Intermittent Mechanism (Geneva Wheel)

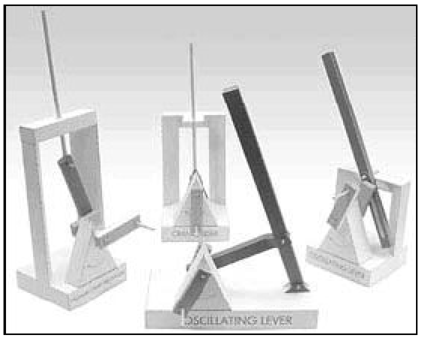

Figure 12
Working Models of Lever and Crank Mechanisms

A similar concept is now applied at Robert Morris University at the college level again. A pilot project was successfully executed by engineering students designing a PLC-driven walking penguin. Current interest in this methodology is high. Various school districts in Ohio and Pennsylvania and toy and entertainment companies from Maryland, California, and Philippines have shown interest in working with the author. A project proposal also has been prepared for a long-term relationship with two international companies, including joint project proposals for department store displays, museums, theme parks, and internships and permanent positions.

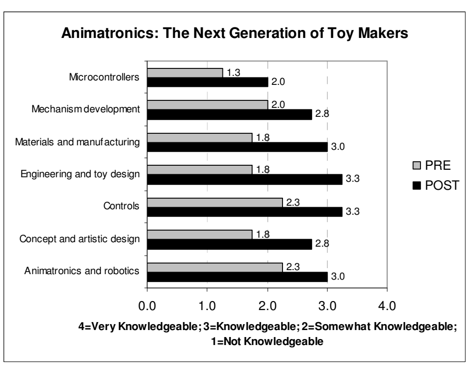

Figure 13
Pre and post-test comparisons for assessment

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Helping Students Test Programs That Have Graphical User Interfaces

Matthew Thornton, Stephen H. Edwards,
and Roy Patrick Tan
Dept. of Computer Science, Virginia Tech
660 McBryde Hall, Mail Stop 0106
Blacksburg, VA 24061, USA
+1 540 231 5723

{ thorntom, edwards, rtan}@cs.vt.edu

ABSTRACT

Within computer science education, many educators are incorporating software testing activities into regular programming assignments. Tools like JUnit and its relatives make software testing tasks much easier, bringing them into the realm of even introductory students. At the same time, many introductory programming courses are now including graphical interfaces as part of student assignments to improve student interest and engagement. Unfortunately, writing software tests for programs that have significant graphical user interfaces is beyond the skills of typical students (and many educators). This paper presents initial work at combining educationally oriented and open-source tools to create an infrastructure for writing tests for Java programs that have graphical user interfaces. Critically, these tools are intended to be appropriate for introductory (CS1/CS2) student use, and to dovetail with current teaching approaches that incorporate software testing in programming assignments. We also include in our findings our proposed approach to evaluating our techniques.

Keywords: on-line education, computer science, test-driven development, test-first coding, GUI, objectdraw, JUnit

1. INTRODUCTION

With the loss of productivity and system downtime caused by code defects, it is important for information technology students to learn how to test software. At the same time, however, lack of educational support for testing and quality assessment in university computer science curricula can result in students that are ill prepared for producing commercial-quality code. As a result, it is becoming more common for computer science educators to include software testing activities across multiple courses, often by adding software testing requirements to traditional programming assignments. Approaches include using explicit instructor-provided tests in assignment specifications, using instructor-provided tests for automatic grading, requiring students to write test plans and test cases, and even requiring students to practice test-driven development (TDD). Recent studies using test-driven development (TDD) in the classroom show that students produce higher quality code when they write their own tests, with a 28% reduction in the number of bugs per thousand lines of student-written code (KSLOC), on average [14]. In fact, when students were required to write their own tests and were graded on how well they did this using our techniques, the top 20% of students in our most recent experimental evaluation achieved defect rates of approximately 4 defects per KSLOC or better, which is comparable to most commercial-quality software written in the United States. Of the students in the control group who were not required to turn in their own tests and were not evaluated on their own testing behavior, none achieved this level of performance, with the best score reaching only 30 defects/KSLOC [14, 16]. Consequently, it has been demonstrated that test-driven development has some impact on the quality of student-written code.

Testing frameworks, such as JUnit for Java [3, 22] and similar XUnit frameworks for languages such as C++ [7] are a critical enabling factor in developing a curriculum around test driven development. Many educators have found that JUnit makes writing tests easy, even for introductory-level students. Most modern interactive development environments for Java, including those targeted at educational communities, offer student-friendly support for JUnit. The spread of JUnit as the de facto standard for writing unit-level tests in Java has provided a useful educational advantage in this regard.

At the same time, however, it is also becoming more common for introductory programming courses to include graphical user interface (GUI) aspects in assignments. GUIs are a common metaphor used in discussing object-oriented programming techniques [10]. GUIs also aid in explaining basic programming concepts, because activities such as implementing the "what happens next" response to a mouse click or what happens when you drag and drop an item into a bin can be quickly understood by beginning programmers. This, in addition to the proliferation of GUI frameworks available such as Swing [5] and objectdraw [11], makes teaching students to program GUIs a very inviting prospect for instructors. However, while there are a number of level-appropriate educational GUI frameworks to simplify teaching tasks, there is no level-appropriate support for *testing* GUI applications. This dilemma is illustrated in Figure 1. Consequently, it is necessary to develop a framework that allows introductory computer science students to develop test cases for their GUI-based programming assignments if one wishes to include software testing activities.

To address this problem, we are adapting an introductory GUI package called objectdraw [11], together with the Abbot GUI testing library [1, 13] (based on JUnit), to develop a student-friendly testing framework for GUI assignments. These tools can be extended to make student testing easier and can be inte-

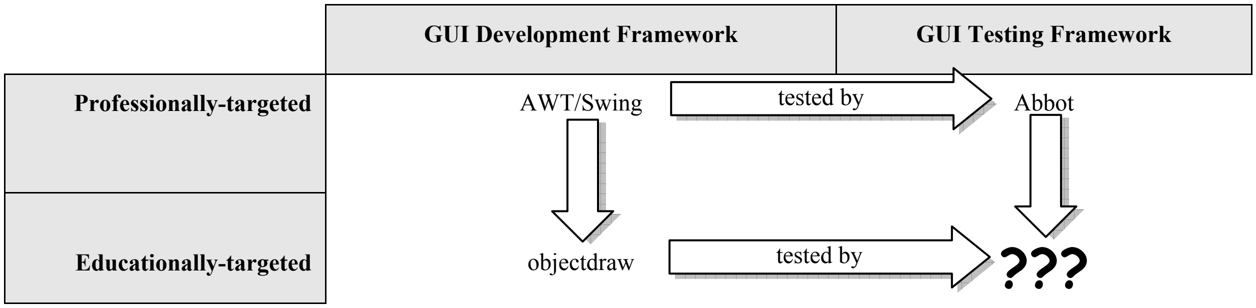

Figure 1: The goal is to create level-appropriate educational support for testing objectdraw-based applications, using Abbot as the underlying technology.

grated into existing software development and testing tools, such as BlueJ, Eclipse, and Web-CAT. Once students have been given a complete suite of frameworks and tools, we can then evaluate student performance at GUI-based software testing.

The rest of this paper discusses the work that is being developed in creating student-testable GUIs. Some of the previous work in the area of student software testing, GUI testing, and GUI frameworks will be discussed in the following section, followed by a discussion of how we are adapting those tools for student testing of GUIs in Section 3. We will follow this discussion with a brief summary of our initial observations from students and a proposal for formally evaluating these techniques.

2. RELATED WORK

Over the past 5 years, the idea of including software testing in student programming assignments across many courses has grown in popularity with many different results and observations being documented [14, 17, 18, 19]. Automated software evaluation tools such as Web-CAT have been widely documented in the literature as an approach to evaluating student performance in programming assignments and closed labs [14, 15, 16, 17, 18, 19]. However, prior to this work, Web-CAT has been unable to run tests on GUI-based programming assignments.

Kim Bruce's work on the objectdraw library [11, 10] is a way of simply abstracting the Swing library for Java to make writing GUIs easier on students. This package will be extended to provide students with a way to assert properties about particular shapes in their program. This technology will be the source for developing student assignments using GUIs and because it is based on Swing, it can make use of many additional packages that can test GUIs designed from Swing components.

Abbot is a mature, professional-level testing framework based on JUnit. It allows one to test partially-developed GUI code as well as entire GUI-driven applications [1, 13]. It is not necessary to have a complete, runnable program in order to write or execute Abbot-based tests. Abbot provides especially strong support for students who are using test-driven development [8, 9, 14, 15], where one rapidly cycles between adding new test cases and incrementally extending code. Abbot also supports comprehensive record-and-playback functionality, including a script editor called Costello for hand constructing or modifying recorded event sequences. However, it is different from many other GUI testing frameworks in its support for simple, clean, hand-written test cases targeted at code under development instead of complete applications.

Among educationally oriented interactive development environments (IDEs) for students learning to program, BlueJ is widely used by those learning Java. BlueJ provides particularly strong support for JUnit-based testing, because it allows students to directly create and interact with raw Java objects using only the mouse, and also interactively "record" these actions as a test case, even before one knows how to write JUnit-style test cases explicitly [2, 21]. Because BlueJ is so widely used in the educational community, we have chosen to explore supporting its interactive test case recording mechanism for use with GUI test cases, although the general GUI framework we describe here is applicable in all IDEs.

3. TOOL DEVELOPMENT FOR GUI TESTING

Two significant issues make it difficult to apply existing GUI testing tools in introductory computer science courses. First, existing GUI tools require extensive programming knowledge that introductory students do not possess. Second, these tools typically require a lot of work to setup and use. Consequently, developing GUI tests with such tools appears to students to be time-consuming busywork—that is, overhead in addition to actually completing the assignment—rather than a value-adding activity that makes assignments easier to complete. Consequently, changes and enhancements must be made at multiple levels of the student's development process to guarantee that these roadblocks can be removed.

3.1 The Objectdraw Library

The objectdraw library was originally designed to present a simplified, streamlined application programming interface (API) to students, making it easy for them to write simple but expressive GUI programs with just a few lines of code and no excess clutter. Objectdraw was not designed to support writing GUI-based tests, however. Most critically, it offers no support for writing *assertions* about the state of a program's graphical interface. Assertions are simple statements or claims about the state of an object or a collection of objects, and most test cases use some form of assertion to express the expected behavior or intended effect of a sequence of actions. If you want to express claims about the content of or changes in a program's GUI, you must be able to "talk about" the various pieces that make up the GUI. To this end, objectdraw must be extended to support assertions that are appropriate to a student's level of knowledge and performance. These assertions must be at a sufficiently introductory level while, at the same time, providing sufficient test cases that the students are able to create tests that are worthwhile to run.

Objectdraw provides a primary class from which main programs descend: the *FrameWindowController* class [4]. The FrameWindowController class manages what a student "sees" in the graphical user interface. It also includes the mouse events that can occur in a graphical user interface, including mouse clicks, mouse movement, leaving the window area, entering the window area, and pressing and releasing the mouse button. Many student assignments that use the objectdraw library [10] revolve around implementing an extension to the *FrameWindowController* class. Consequently, as a typical course progresses, students become very familiar with the behavior of this class.

In order to make assertions about the properties of shapes that are rendered on the *FrameWindowController*, we enhanced the *FrameWindowController* by creating a new subclass. The *TestableWindowController* class is a subclass of *FrameWindowController* that includes several primitive assertion operations. These primitive assertions allow one to express claims about the existence of the various kinds of 1- or 2-dimmensional shapes that can be created in the objectdraw library. There are also primitives that allow asserting that low-level shapes have specific properties (color, size, etc.). While these methods are simple, they provide a basic platform for writing assertions about the structure or content of a GUI.

At the same time, however, the primitive assertions in *TestableWindowController* are more detailed and more complex than we expect beginning students to use, especially when they first start out. As a result, we have added an additional layer of abstraction by creating a *StudentTestableWindowController* class. This class is a subclass of the *TestableWindowController* class and includes methods that are significantly simplified, including methods such as assertCanvasEmpty(), assertFramedRectangleExists(), and others. The methods in this second subclass require few or no parameters. This allows very basic assertions to be used by students, even if method parameters have not been discussed in the course at that point. Further, these methods dovetail nicely with the test recording apparatus provided by BlueJ, for example, so that students can interactively play out their test cases in a meaningful way, even before they have mastered programming.

The assertions that are included in both *TestableWindowController* and *StudentTestableWindowController* behave similarly to the standard assertions provided by JUnit, and are fully compatible with that testing framework.

The assertions that come in the *StudentTestableWindowController* class come in two varieties. One gorup of assertion methods in this class allows one to check the basic properties of an object at a particular screen location. Two parameters are included in the list of formal parameters that represent the x and y coordinates in the drawable area of the window. The student enters the coordinates and the assert method looks for an object at that location to see if an object exists at that location with the desired properties. The second group of assert methods instead take a reference to a specific GUI object, instead of the object's (x, y) coordinates. This can be especially useful when instructors wish to simulate real-world behavior by introducing randomness to an assignment or if a particular test requires that a very specific object on the canvas have a certain property. This is an opportunity for instructors to introduce accessor methods to the students and provides a mechanism for asserting behavior about the objects that are returned by those accessor methods.

```
public void testInitialCondition()
{
    x.onMouseMove(new Location(100, 100));

    x.assertFramedRectExistsAt(20, 100);
    x.assertFramedRectExistsAt(100, 100);
    x.assertFramedRectExistsAt(180, 100);
    x.assertTextExistsAt(35, 120);
    x.assertTextExistsAt(115, 120);
    x.assertTextExistsAt(195, 200);
    x.assertFilledRectExistsAt(60, 20);
    x.assertFramedRectExistsAt(60, 20);
    x.assertTextExistsAt(20, 200);
    x.assertTextExistsAt(100, 200);
    x.assertTextAt(35, 120, "whites");
    x.assertTextAt(115, 120, "darks");
    x.assertTextAt(195, 120, "colors");
    x.assertTextAt(20, 200, "correct = 0");
    x.assertTextAt(100, 200, "incorrect = 0");
    x.assertColorAt(60, 20, Color.white);
}
```

Figure 2: An example test case testing the initial state of a laundry sorting program. The x variable is an instance of the `LaundrySorter` class.

Figure 2 provides an example of a test case that students could write about the behavior of a program in its initial state. The assertions are provided simply by making assertion calls like you would make any other method call. The assertions provided here indicate information about the initial state of a "laundry sorter" application where a swatch is dropped in one of 3 different bins.

3.2 Testing GUI Applications with Abbot

Abbot is a professional-quality tool for testing Java graphical user interfaces. Unfortunately, it has several features that make it difficult for beginning students to understand, and that also make it difficult for beginning students to write GUI tests. First, creating a tester in Abbot requires more knowledge than most beginning computer science students have. Abbot makes heavy use of anonymous classes and listeners, and is geared toward developers using the full power of the Swing library rather than a simplified, educationally-oriented library. Second, there is a mismatch between the ways that certain low-level information is represented between objectdraw and Abbot, including the representation for locations within a GUI window.

Objectdraw provides a *Location* class that represents a location on the canvas. It is much like Java's *Point* class with additional methods included. Abbot uses native Java *Point* objects to specify locations, and then uses a "robot" to serve as an automated tester to interact with the program being tested. Crossing from *Location*s and *Point*s and back, especially with the high degree of similarity, imposes an unnecessary cognitive load on students, making them feel taxed and that they are just going through "administrative overhead."

To solve these problems, we have implemented a façade to the Abbot robot tester to perform all of the tasks that an introductory student would want to do. The *VTControllerTester* class is a wrapper class that encapsulates a lot of the functionality of a basic Abbot tester, but does so from the objectdraw perspective. The *VTControllerTester* class includes a constructor whereby instead of specifying a static name for the class like you do in the *ComponentTester* class in the Abbot package, you pass the specific instance of the object to be tested. Furthermore, mouseClick(), mousePress(), mouseRelease(), mouseMove(), and mouseDrag() methods are implemented that take a *Location* parameter rather than a *Point* parameter. As a result, students will be writing tests that are familiar to them in terms of the behavior of objectdraw, rather than the behavior of the Abbot package. This dramatically reduces the overhead of students having to "wade through" the mountain of code that was written for the Abbot package and focuses their attention on one class.

One of the issues with testing using Abbot and objectdraw is wading through the multithreading issues that occur between the two. Objectdraw has a model for how all of the objects are loaded in a window and when the window itself is opened. On the other hand, the Abbot library does not know anything about the specific timing constraints imposed by objectdraw, and it may begin its actions before the window is completely set up. Another problem involves testing in a multiwindow environment, particularly in Windows XP/2000. To solve these problems, the *VTControllerTester* attempts to manage the thread behavior so that the robot does not begin until the window is completely set up, and then the robot performs actions only when expected.

Figure 3 is an example of a test case that a student might write

```
public void testDragMode()
{
  prepareNewNonOverlappingSquareGame(x);

  tester.actionMousePress(new Location(10, 10));
  tester.actionMouseMove(new Location(25, 25));

  x.assertVisible(x.getSmallBox());
  x.assertVisible(x.getMediumBox());
  x.assertVisible(x.getLargeBox());

  tester.actionMouseRelease();

  x.assertInvisible(x.getSmallBox());
  x.assertInvisible(x.getMediumBox());
  x.assertInvisible(x.getLargeBox());
}
```

Figure 3: A test for mouse dragging in the Invisible-Game programming assignment. In this case, the mouse is pressed and then moved to simulate dragging. The game's invisible boxes must be visible during dragging, but then disappear once dragging is complete.

to test mouse movement in a program. This example uses the *VTControllerTester* class for a programming assignment called *InvisibleGame*. Students who are writing their own *InvisibleGame* are creating a simple GUI application that places three invisible boxes on the screen. The user attempts to click these boxes, getting "hot" or "cold" feedback about how close they are and racking up points for successful hits. In the assignment, the student is also asked to provide a "cheat mode" (or debug mode) that makes the three boxes visible whenever the mouse is dragged. In this case, the student has explicitly depressed the mouse button at some location on the screen, moved the mouse, and then released the mouse button. This behavior is easy for students to understand, since they drag the mouse on the screen every day.

The test case in Figure 3 shows what a student might do to simulate the click-drag-release action they would perform manually with the mouse. It also shows how one would make claims about the state of the GUI interleaved with the mouse actions.

3.3 BlueJ Development Environment

The test cases shown in Figures 2 and 3 could be written using any IDE. However, because BlueJ [2] is so widely used, and because it provides such strong support for unit testing even before students know how to write test cases, we are interested in exploring how the objectdraw and Abbot extensions we are developing can be used within that environment.

As a student writes small increments of code, they can immediately begin to write (and run) simple test cases that cover the behavior they have just implemented. In BlueJ, the student can instead *interactively record* test cases by directly manipulating live objects. The objectdraw extensions described here allow students to record test cases for GUI-based classes in the same way that they create and record a test case for any other class in BlueJ. Mouse events can be recorded by right-clicking on the program in BlueJ's ObjectBench and invoking the corresponding event method. A student can record which actions they wish to execute by referring to the *VTControllerTester* actions to perform actions and then assert that the program has the correct behavior using the methods available in the *StudentTestableWindowController* class. Because of the way that methods can be referenced in the object workbench, the mouse events can also be explicitly called by the tester, rather than making Abbot calls. This allows students to continue to test their methods and is a substitute for writing test cases using Abbot. Instructors, therefore, have the option of including the Abbot test cases or simply having the students test the behavior of their program by calling the mouse event methods like they would any other method.

At the same time, however, we are also interested in supporting direct, live recording of mouse interactions. This would mean that the student need only point, click, drag, etc., right in the program's main window itself, rather than go through BlueJ's ObjectBench. While this has not been fully implemented yet, it remains as a key aspect of future work.

3.4 Automatic Grading with Web-CAT

Web-CAT is an automated testing environment that allows students and instructors to test student submissions [14]. The system grades student submissions based on the successfulness of a student's program against their *own* tests (as well as the amount of their program was covered in the tests) as well as the instructor's tests. Web-CAT supports assignments written in virtually any programming language, but it is most heavily used by instructors teaching in Java. Until now, automatically grading GUI-based programs on Web-CAT was not feasible, since there was no effective way to write executable tests for such programs in a way that students (or instructors) could manage. However, the extensions to the objectdraw framework described here now allow instructors to write tests for GUI-based programs as easily as students can. The result is that Web-CAT has now been successfully used to automatically execute and evaluate both student-written and instructor-provided tests for GUI-based programming assignments.

4. INITIAL DEPLOYMENT AND FEEDBACK

Virginia Tech has deployed the GUI testing framework for its CS1 course. The framework includes the BlueJ IDE and the objectdraw and Abbot extensions. Web-CAT has been updated to include a submission profile that allows instructors to create GUI-based programming assignments and the types of assignments that have been developed include the following:

- *Square Lab*: A student creates a square on the screen that disappears when the mouse button is pressed and reappears when the mouse is released. This is just to get students acquainted with the environment.
- *Squares Lab*: A student can create multiple squares by clicking at different locations on the canvas. The squares change from an initial red color to blue once a new square has been created. This lab exposes students to writing classes with private members.
- *Laundry Sorter Lab*: The laundry sorter is a simulator where students drag and drop a differently-colored swatch into one of 3 bins and is given credit for a correct or incorrect selection, exposing students to conditionals, program “states” and more complex mouse behavior.
- *Bullseye Lab*: In the bullseye lab, students draw a bullseye *recursively*. The bullseye can then be moved around the screen and its size changes as the mouse moves “faster” or slower.
- *Invisible Squares Program*: This programming assignment tests everything students have done up until the Laundry Sorter lab by giving students a game to implement where they try to find invisible boxes by clicking on the screen. The program provides feedback with regards to how close the student has come to clicking the box.

Initial observations have led to several improvements to the design of the *StudentTestableWindowController* class (For example, breaking the assertions into multiple subclasses would reduce the number of assertions that students have to wade through in searching for a particular assertion) as well as the amount of detail that is needed for lab and programming assignment instructions.

5. PROPOSED EVALUATION

In order to gauge the effectiveness of incorporating GUI testing into assignments, we have prepared to do a large amount of analysis. On submitting all of these assignments to Web-CAT, we will have a large number of student submissions to do analysis on. Web-CAT keeps a large amount of data on each submission and with additional research that's being done on creating reports based on that data [6], there will be a very practical system from which we can get a great deal of useful information out of the student's submission results. These can include things like:

- An aggregate comparison of student submissions and grades this semester versus previous semesters.
- A comparison of the success of student tests versus the instructor reference tests.
- An analysis of how many tests students wrote based on how much a particular lab was completed.
- An analysis of which types of test cases were most commonly passed/failed.

There are, obviously other reports that can be run, as well and each of these types of reports can gain us additional information about how students perceive the work they are doing.

Additionally, at the end of the semester, students will participate in a round-table discussion with the instructors and teaching assistants to give us their feelings on what went right and what went wrong in the class. We will also get their feedback on their views on test driven development and whether or not the use of GUI-based programming assignments helped or hindered the process. This will be repeated over several semesters, since we have no prior coursework that emphasized GUI testing to compare against our results from this semester.

6. FUTURE WORK AND CONCLUSIONS

There are additional tasks that would be desirable to put this system together. The immediate desire is to get the current version of the extensions and tools into a more refined state and then work on improving the usability of the objectdraw extensions and the Abbot wrapper. Furthermore, with the information gathered from our evaluation process, the assignments and tools will be revised to improve the quality of the work being done. Subsequently, testing of these techniques in additional CS1 courses will give us more data and show how the system has improved over time.

A long-term goal is to provide students with the tools to test objectdraw programming assignments with test scripts that are even easier to understand than the current ones, allowing students to create tests with as little knowledge of programming as possible, thereby reducing further the cognitive load on students and improving their results on assignments.

With software bugs and defects being the major roadblocks to software development and with the loss of productivity as a result [12, 20], making our students better testers before they enter their exacting field of industry, it's necessary to guarantee that they are in a better mindset about the benefits of thoroughly testing their code and introducing them to test driven development with graphical user interfaces is a way of combining good testing techniques with a common metaphor for discussing the most commonly-taught paradigm of the time, object-oriented programming.

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The Effectiveness Of The Mind-Maps In The Courses Of Art Education In The Primary Schools

Assoc.Prof.Dr.H.Turgay Unalan

Anadolu University
Education Faculty, Fine art Department
Eskisehir, Turkey

The abilities of the improvement of creative attitude, the power of aesthetical and practical estimations, productivity and thinking with assets are acquired in the courses of art education in the primary schools. Also students are able to find self-expressing and self-identy opportinities in these courses.

The art education in the primary schools constitutes one of the most difficult fields to learn and instruct. There are two main viewpoints in the art education. One of them is education education by means applied model arising by visual components, an affective and sensitive experience. The other is mental and conceptual weighted model. The instruction of mental and conceptual weighted lessons of art education in the primary schools is consist of art historical, aesthical and critical field subjects. It is thought that there are inadequacies on effective and sufficient instraction of art historical, aesthetical and critical field subjects. Sufficient and effectiveness of mind-maps on learning must be studied.

The main purpose of this study is to determine the effectiveness of the use of mind-maps on the courses of art education in the primary schools. 7th grade students in the primary schools in the academic year of 2006-2007 constitute the universe of the study.

68 students in 7/A and 7/B of Kazım Karabekir Primary School, the county of Eskisehir constitutes the sample of the study.

Pre-test/post-test control model was used in this study and data were collected from the sample of the study by an oversee-test. The knowledge of students related to trends of modern art subject in the scope of art history was measured by this test including 30 questions. After pre-test and post-test points of the experiment and control groups were acquired, the average points and standard deviation were computed. "t test" was used on the comparasons between the groups and 0.05 confidence degree was taken as the significant degree. "SPSS 11 for Winows" software was used in all statistical analysis.

Keywords: Art education, concept maps.

PROBLEM

Education activities achieve the succes by gaining intended behaviours in levels of students' knowledge, abilities and attitudes, so actualize learning. It especially depends on pointedness of the learning-teaching process. Thus we are in information and technology age that intensely requires knowledge and learning, the most important factor is to have satisfactoriness of effective learning, to be successful both in school and after school learnings. The main part of effective learning is to learn, how to learn and the strategies included. (Ozcan, 2002, p.29)

In theoretical discussions about art education there are two thoughts have discussed all along. One of them is education by art; the pragmatist model which modelize the original artworks in art education and occures with the affective-intuitive experiences helped by visual elements. The other one is the models, attach importance to more mental and conceptual inclinations in educative fields, and have the characteristics of art product like measurability, controllability and triability. Since we are living in an information and technology age that increases and circulates information so fast, it's essential to explicate and update the mental processes, new concepts and definitions Art education, makes various warnings be held in the process of teaching consciously and guides the process. (San, 2004, p.121,122)

Concept maps, make more understandable the main ideas and relations between them, help to make significant connections among the previous and current informations, organize the comprehensive learning and considiration instead of memorizing. The aim is to explain what students know.

The usage of learning-teaching strategies of concept maps, can give such important advantages related consolidated-comprehensive art education includes aesthetics, art criticism, art history and art applications.

Of late years, "the usage of concept maps in teaching" is frequently revived in the researchs about the pointedness of learning-teaching process in education.

This study aims to solve the problem; if the 7th grade students who takes arts and crafts lesson in primary schools, gain the intended knowledge, ability and attitudes by using concept maps in art education.

PURPOSE

This study aims to specify the effects of improving basic knowledge, ability and attitudes of 7th grade students, related art education by using concept map strategy in historical, aesthetical and critical fields of art, in arts and crafts lessons in primary schools. Concept maps, thought effective in complicated learning which needed in our age that changes and evoluates constantly, give such important advantages about teaching principles and rules of art, depends on visual perception. Besides, concept maps make students more active in lessons, prevent memorizing, make more permanent and comprehensive learnings. Concept maps also give advantages in art applications about catching similar, opposite and common elements.

IMPORTANCE

In comparison with past, there are more researchs about art education today and these are include teaching processes especially in recent years. If conceptualize accepted as a process, it can said that concept is it's product. So, concept and concept teaching process can be seen as main object of the contemporary teaching methods. Researches and studies have focused on concept maps, either. For last 20 years, concept maps are being used as an evaluating and measurement tool in education. The idea has come about to remove the concept errors. Therefore, it's important to determine the pointedness of the concept maps in teaching.
It aimed with this study to determine the effects of improving basic knowledge, ability and attitudes of 7th grade students, related art education by using concept map strategy in historical, aesthetical and critical fields of art, in arts and crafts lessons in primary schools and to determine if it makes comprehensive learning.

LIMITATIONS

These are the limitations of this study;

1. This study limited with the students from 7-A and 7-B classrooms of the Kazım Karabekir Primary School in Eskişehir, in 2006-2007 teaching year. So, findings obtained from the study needed to be evaluated within this content.
2. The subject evaluated within art education and teaching art history.
3. To actualize the aims of this study, it limited with test to measure the learnings.

METHODOLOGY

Study Model

Pre-test and Last-test strategy with control group, was used to reach the aim of this study. According to this model, it was tried to describe by observing test, that if concept maps are effective in learnings, in arts and crafts lessons in primary schools by using information collected and checking over the sources.

Table 1. Symbolic Outlook Of The Study model

		Pre-test		Last-test
G_D	R	O_1	X	O_3
G_K	R	O_2		O_4

The meanings of the symbols used in the model can seen in below;
GQ: Experiment Group
GK: Control Group
R: Impartiality in generating groups
X: Independent Variant Level
O: Measurement
(Karasar, 2002, s. 94; Büyüköztürk,2001,s. 23).

UNIVERSE

The universe of this study consists of 7th grade students in the primary schools in Turkey, in 2006-2007 teaching year.

SAMPLE

Because it's difficult to reach the whole universe, sampling method has accepted for the study. Students from 7-A and 7-B classrooms of the Kazım Karabekir Primary School in Eskişehir, in 2006-2007 teaching year, accepted as the sample.
Related numeric information are given in table 2.

Groups	Select to Sampling	Attend to Resea	Excluding Research	Selected to Evaluation
7-A students	34	34	-----	34
7-B students	34	34	-----	34
Total students	68	68	-----	68

can be seen in the Table 2 that the sample consists 68 students and all of them have taken the observing test. So, the data used and evaluated in study which was collected from these 68 students.

COLLECTING DATA

Pre-test has given at 6 December 2006 and the Last-test has given at 7 January 2007 to the 7th grade students to determine the pointedness of concept maps in teaching chosen subject from art histoy; contemporary art movements. The experiment group GD symbolize 7-A students and the control group GK symbolize 7-B students.

Observing test has given to students as pre-test before begining of the study. So it makes possible to see their previous information about the subjects within this study.
The students included the study are in 7th grade, so it shows that they are equalized in education levels. But it must be shown that the students equialized in levels of information in arts and crafts lesson, too. So the test prepared for this, was given to experiment and control groups.

Table 3. Findings Related Pre-Test Scores of Groups

Groups	Number of Students (N)	Arithmetic Average (X)	Standard Deviation (SS)
Exp. Group	34	6,4	4,6
Control Group	34	5,4	4,3

There is a little difference between the arithmetic means of Pre-test scores in groups. One Way Anova Test (ANOVA), has used to see if it's significant

Table 4 Findings Related Variance Analysis Of Pre-Test Scores of Groups

Variance source	KT	Sd	KO	F	P
Between in groups	16,0	1	16,0	0,785	
In groups	1345,5	66	20,4		0,379
Total	1362,5	67			

According to the One Way Variance Analysis results, can seen in Table 4, F is calculated as 0.785 and found insignificant at 0.05 confidence degree. It shows that there isn't a significant difference between the arithmetic means of Pre-test scores. In other words, significant difference could not be observed at succes levels of the groups, that determined before begining to teach mentioned subjects in lesson. It means that groups were equal by the levels of dependent variant before the study. Also, it shows that the circumstance is suitable which required for interpretation about teaching activities applied for the study.

To reach the aim of study, Pre-test prepared about contemporary art movements, has given to experiment and control groups at 3 December 2006. Then, the subject teached experiment group by using concept maps. Teacher prepared a concept map, and taught the subject by using it. After that, teacher made all students create a new concept map together. So they learnt how to create and use a concept map. Then teacher wanted them to create their own concept maps to see their individual learnings. After they finished the contemporary art movements completely, teacher has made them create a comprehensive concept map, to see the whole subject, summerize and measure the learnings. But the subject teached control group with traditional methods. Finally Last-test has given both groups at 7 January 2007.

DATA ANALYSIS

Before analyse the data, tests given to students has examined particularly, given number for each of them, scores transfered to computer and then analyzed. The mean scores of groups and standart deviations have calculated. "t"test was used to compare the groups and 0.05 confidence degree accepted. All of the statistical analysis realized with the "SPSS 11 for Windows" software.

FINDINGS AND EXPLICATION

In this part of the study, findings obtained from data analysis and the explication of these findings are mentioned. The statistical process realized with using "SPSS 11 for Windows" software, used "t-test" and 0.05 confidence degree accepted. The Pre-test and Last-test scores obtained from experiment and control groups. Then it determined with the One Way Anova VarianceTest (ANOVA) if the arithmetic means were significant between the Pre-test and Last-test scores. Related findings were given in Table 5.

Table 5. Findings Related Pre-test and Last-test Scores of Experiment and Control Groups

	Experiment Group		Control Group	
	Pre-test	**Last-test**	**Pre-test**	**Last-test**
N	34	34	34	34
X	6,4	70,8	56,4	55,8
SS	4,6	18,7	4,3	23,4
XS-XO	64,4		50,3	
Sd	33		33	
t	2,738		2,738	
P	0,008		0,008	

The difference between the arithmetic means of Pre-test and Last-test scores in experiment group is 64.4 and the difference between the arithmetic means of Pre-test and Last-test scores in control group is 50.3. These numbers show that there is a significant difference in Last-test scores of the groups. ANOVA has used to analyse the differences and results show that the obtained "t" values were significant at the 0.05 confidence degree, for both groups.
It's examined if there is a significant difference between the the arithmetic means of Last-test in groups, to observe the effectiveness of the methods applied. Table 6 shows the findings related Last-test scores.

Table 6. Findings Related Last-Test Scores of Groups

Groups	Number of Students (N)	Arithmetic Average (X)	Standard Deviation (SS)
Exp. Group	34	70,8	18,8
Control Group	34	55,8	22,3

It's obvious in Table 6 that there are significant differences between the arithmetic means of Last-test scores in groups. The higher arithmetic mean is belong to experiment group which has teached by concept maps. The arithmetic mean of control group that teached by traditional methods is lower than the experiment group mean. ANOVA is used to determine if these differences are significant in statistical. Table 6 shows the results.

Table 7 Findings Related Variance Analysis Of Last-Test Scores of Groups

Variance source	KT	Sd	KO	F	P
Between in groups	3847,5	1	3847,5		
In groups	28544,9	66	432,4	8,896	0,004
Total	32392,4	67			

According to the One Way Variance Analysis results, can be seen in Table 7, F is calculated as 8.896 and found significant at 0.05 confidence degree. It shows that there is a significant difference between the arithmetic means of Last-test scores. So, significant difference observed at succes levels of the groups, by using concept maps in teaching mentioned subjects in lesson. The experiment group that used concept maps in teaching is more succesful than the control group that used traditional methods.

As a result of this study, it's obvious that the concept maps are more effective than the traditional methods about student succes and making comprehensive learnings.

CONCLUSION AND SUGGESTIONS

Conclusion

In this part, problem, methodology and findings parts summerized, result of these findings and suggestions about solution of the problem are given. This study aimed to determine the effects of improving basic knowledge, ability and attitudes of 7th grade students, related art education by using concept map strategy in historical, aesthetical and critical fields of art, in arts and crafts lessons in primary schools and to determine if it makes comprehensive learning. The findings of this study can be used as a source while in-service trainings prepared for arts and crafts teachers in primary schools. Also, it hoped that the results obtained from this study can lead the forthcoming studies. The universe consists of 7th grade students in the primary schools in Turkey, in 2006-2007 teaching year. And the sample consists of 7-A and 7-B students from the Kazım Karabekir Primary School in Eskişehir, in 2006-2007 teaching year.

The data collected by the observing test which prepared for this study. The test includes 30 questions and determines if the 7th grade students who takes arts and crafts lesson in primary schools, gain the intended knowledge, ability and attitudes by using concept maps in art education. Inputs given in"SPSS 11 for Windows" software and "t-test" used for data analyzing. These are the results reached from findings of this study;

- It occured that teaching with the concept map strategy in art lessons is more effective than traditional strategies.
- It determined that concept maps are quotable, specializable, flexible, synergistic, learning beings and they can be updated quickly. So they needed to be used frequently in education.
- The result of this study is "concept maps are effective in learning" and it is just parallel to the following researchs' results; "Bower 1969; Lambiotte and Dansereau 1992; Hail and Dansereau 1992; Demirel 1996; Sökmen, Bayram and Salan 1997; Gürdal and Kulaberoğlu 1996; Görgen 1997; Sünbül 1998; Talu 1997; Camperell and Reeves 1982; Berkovvitz 1986; Yenen and Arslan 2000" (Arslan, 2000, p. 53-58)
- This study shows that, concept maps can be used as an effective teaching tool in lessons and in historical field of art education. It also shows that concept maps can be used in other fields of art education because they are student centered, disscussable and they especially depends on visual perception.

Suggestions

Suggestions are given below which oriented the findings obtained on the aim of study:

- Using concept maps is a beneficial teaching strategy in primary schools, in art education especially in teaching activities except from the art applications. And it will speed up the learnings more than other strategies.
- Teachers should not teach the art history subjects by using constant rules. After he/she teach the subject in detailed with a concept map created by himself/herself, teacher make whole classroom create a new concept map together.
- In-service trainings must include concept map strategy in art education to make teachers informed about the pointedness of the concept map usage and improvements about it.
- Teaching staff from education faculties can organize symposiums in schools about using concept maps in art education.
- This subject should be given place in mass media to make teachers informed about improvements. Ministry of Education should publish some sources about using concept maps in art education, deliver them to teachers and support these sources with VCDs, slides, reproductions etc.
- Internet usage should be generalized in schools and make the famous art galleries or artworks more accessible by students.
- In Education Faculties, Art Education Departments should have concept teaching process, cognitive and mental processes in their curriculums just like art applications.
- It is possible to make new researches by using a new, wider sample.

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A Virtual Mathematics Learning Environment For Engineering Students

T. Sancho Vinuesa

Universitat Oberta de Catalunya (UOC)

Rambla del Poblenou 156, 08018 Barcelona (Spain)

tsancho@uoc.edu

R. Masià Fornos

Universitat Oberta de Catalunya (UOC)

rmasia@uoc.edu

C. Córcoles Briongos

Universitat Oberta de Catalunya (UOC)

ccorcoles@uoc.edu

Abstract

Teachers of the course *Introduction to Mathematics for Engineers* at the UOC, an online distance-learning university, have designed and produced online study materials which include basic pre-university mathematics, indications for correct follow-up of this content and recommendations for finding appropriate support and extension materials. Many different resources are used, depending on the characteristics of the area in question: Flash sequences, interactive applets, WIRIS calculators and PDF files.

The new study material has been piloted with 119 students. The academic results and student satisfaction have allowed us to outline and prioritise future lines of action.

Keywords virtual learning environment; learning mathematics; interactive resources; network technologies

Introduction: The Universitat Oberta de Catalunya (UOC)

The Universitat Oberta de Catalunya (http://www.uoc.edu) was founded in 1995 and is a pioneer in online higher education. It currently offers 23 official programmes in both pre-university and postgraduate education.

Teaching, research and university management activities are carried out through the Virtual Campus, an Internet-based communications environment. The UOC's organisational and educational model is based on an asynchronous, distance-learning approach, which solves the problem of travelling and enables adults to access the university by helping them overcome the difficulties of working schedules and family obligations.

The engineering courses offered by the UOC include IT Engineering and Telecommunications Engineering (Telematics). The academic results of the different programmes show that the teaching and learning process is not easy — particularly in mathematics: students' prior knowledge is often insufficient, they find the content hard to grasp, and their level of motivation is low. We have to make an effort to mitigate these factors and guarantee that students can eventually reach the level of knowledge required to successfully carry out their professional activities.

In order to ensure that students have the necessary preparation to follow the several courses in their studies, we propose a test to assess their level in basic mathematics. After evaluating their results, students can decide whether to register for the subjects in the first semester or whether it would be advisable to revise before doing so. In this case, we recommend they register for the *Introduction to Mathematics for Engineers* subject.

Main characteristics of the course on *Introduction to Mathematics for Engineers*

The main aim of the course is to prepare students to follow engineering courses with the mathematical knowledge and skills required. Specifically, it has a twofold objective: students should learn the fundamental terminology, techniques and concepts of Algebra and Mathematical Analysis, and should be able to apply this knowledge in practical cases.

The course methodology follows the UOC's pedagogical model in using didactic materials, teaching activities and continuous assessment as its main pillars. The work dynamic is based on guided study of the different topics, and carrying out the set activities.

The assessment system involves completing exercises that are handed in to the teacher on given dates established at the beginning of the semester (Continuous Assessment Tests). These exercises are then corrected and discussed to ensure students advance during the learning process.

Students communicate with teachers by posing a series of questions to them, preferably through the Classroom Forum (since this enriches classroom dynamics and creates an optimal learning environment). The Forum is a reference space which can be used to send queries, comments and suggestions; communication between students and teachers improves the learning process for a subject which might not initially be very interesting and which students might find hard to cope with. Students can also communicate with teachers by sending a private message to their personal mailbox.

Teaching innovation proposal

Our eight-year experience in this subject has led us to start a teaching innovation process in the mathematics area of engineering courses.

The main aim of the innovation project is to design and develop a virtual environment that facilitates the learning process of basic mathematical skills for future UOC engineering students.

A series of specific goals has been established to achieve this aim:

- establish a new pedagogical model based on the existing model
- design a virtual environment to teach basic pre-university mathematics content
- establish the final proposal for the *Introduction to Mathematics for Engineers* course
- create content
- develop the first version of the environment
- test the environment during the first semester of the 2006-2007 course
- analyse the obtained results, student satisfaction and the teacher's assessment of the course
- establish a set of upgrades that need to be implemented and any new elements to be developed

Evolution of the existing pedagogical model

The first step of the innovation process involves outlining the existing pedagogical model and clearly identifying its elements and evolution capacity [3]. The main pillars of the model, which is student-focused, are the didactic materials, teaching activities and continuous assessment [1], but we should also take into account a series of complementary elements outside the virtual classroom that place the student and learning process within the framework of a university institution: web-based spaces such as the virtual library, physical spaces such as support centres and a network of social relations. Even though it is important to have a global vision, our focus on the problem is based on a learning process for a specific topic in the classroom.

At the UOC, the virtual classroom is organised into four independent sections: *planning*, *communications*, *resources* and *assessment*. The *planning* section has a teaching plan and calendar for the term; the *communications* section can be used to access the notice board and forum, as well as the list of students; the *resources* section includes the materials of the subject; and the *assessment* section contains all the information related to the assessment process.

From our point of view and taking into account the fact that most students are adults with a series of family and professional duties, it is vital to integrate all elements of the learning process to make it more efficient. Therefore, we make use of information and communication technologies to create a learning environment for a specific subject which incorporates content, teacher's guidelines and communication between students and teachers.

Study materials: A new learning space

The second step involves the design and development of study materials that integrate the contents of basic pre-university mathematics, indications for correct follow-up of this content and recommendations for finding appropriate support and extension materials.

The final characteristics of the material have been designed taking into account teachers' experience with the old material, students' opinions and knowledge of the evolution of information and communication technologies in recent years as well as their educational applications

[2]. The conceptual principles that led us to establish the guidelines for these characteristics are shown below.

- All resources should be integrated within a single learning environment
- The material should cover the needs of all students on the course, some of whom have a very low level of mathematics, although others are more prepared
- The materials should meet a twofold objective: to act as specific material for a course and, at the same time, as reference material which can be used at any time
- Use more adequate formats taking into account content characteristics
- In addition to the previous point, we should say that all components of the material should comprise a unit that is clearly recognised by the student, both in terms of the content and the study sequence proposed

Obviously, the evolution of the information technology and communication concepts, as well as the constant update of the main Internet applications has been a determining factor in the establishment of content format and delivery. Therefore, the following basic principles have been taken into account: Universality, usability and online/local operation.

One of the most important handicaps in the implementation of the environment has been the election of storing formats. Fortunately research activity on this area is rising continuously [4]. Even so, we still have not achieved a point where we can talk about de facto standards for the communication of mathematical content on the web, even if we are approaching that point, and we still have to see widespread support for those standards in mainstream web browsers: Firefox has only recently supported MathML content, and that support is still not native in Internet Explorer. Luckily, support for multimedia content in the form of the Adobe Flash plug-in has been well above 90% for a long time now.

It is because of these current status that we have opted to forego the use of mathematical standards or protostandards, and the materials have thus been developed in the form of a web site using HTML and Flash for content, with a clear navigation system. This allows us to comply with the universality principle; all materials can be viewed from any of the most common browsers.

Description of the environment

The space for the study material on the screen is divided into five different areas with different functionalities (see Fig. 1).

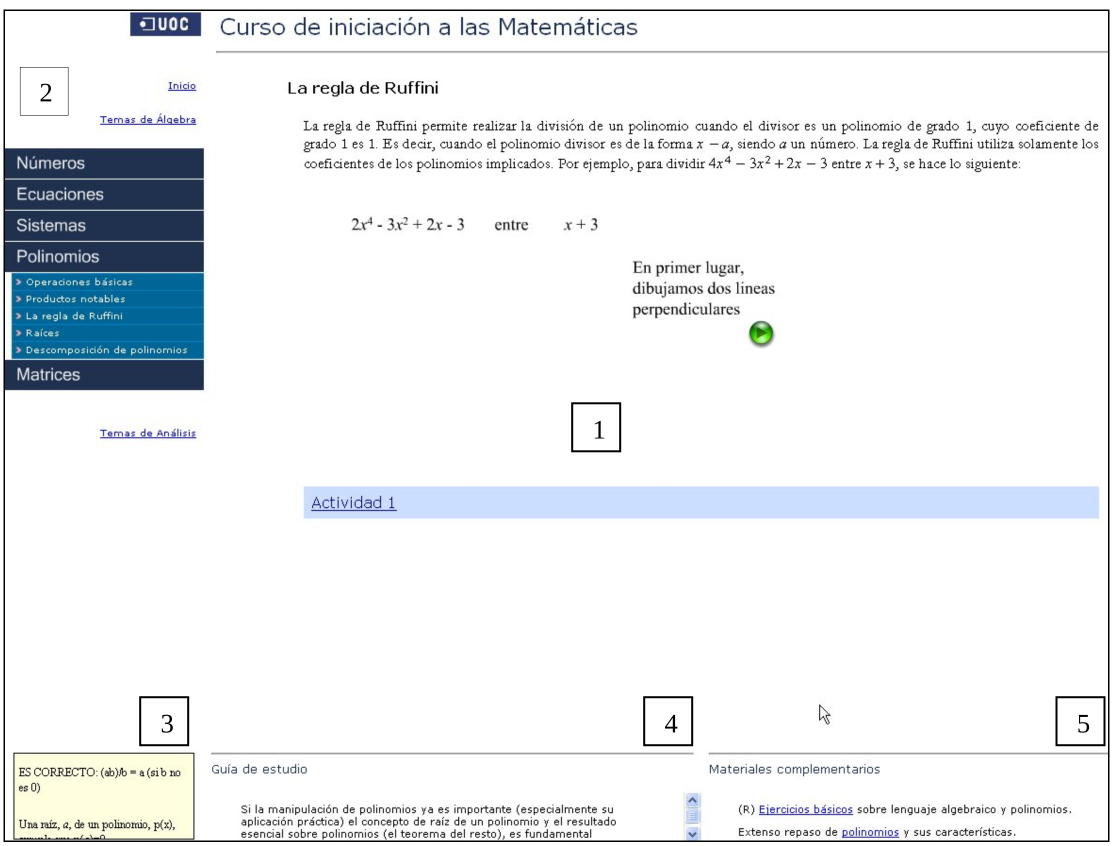

Fig. 1 Screenshot of one of the pages of the material

1. Central space, where the contents are presented, showing examples and activities.
2. A space reserved for the general menu, with three drop-down sections which can be selected by clicking on the name: home, algebra topics and topics for analysis.
3. This includes short news items on punctual issues and important matters which have already been addressed. The purpose of this space is to give students the opportunity to refresh the contents already studied in the form of a brief sentence.
4. The study guide will include the guidelines required to start each topic: specific guidelines will be provided about the work rate, giving the previous content that should be analysed before starting the topic, and providing the corresponding explanations and the depth to which the concept should be assimilated.
5. This space includes the reference to complementary support and extension materials, which are not required to follow the course but will be very useful for anyone who has problems following the course, as well as others who voluntarily wish to expand their knowledge on the course content.

Pilot test

Students' first contact with the materials was during the Autumn semester of 2006 (A2006). The percentage of students that followed the course is lower during this semester (66.1%) than the previous semester (73.3%), but slightly higher than the historical value (65.5%). Among those students who have followed the course, the rate of passes is more or less constant between 75%-80% and it seems that during the Spring semester (S2006) the grades were better than those in the historical data with more people who have followed the course, while during semester A2006 the historical values are very similar. The material does not seem to have had a positive or negative effect on the results of these identical questions.

A questionnaire was given at the end of the year to all students (answers were received from 40 of the 119 students registered) to find out more about their opinion on the different aspects related to the material. They were asked to give a score between 1 and 5. The aspects analysed were the following ones:

1. easy to use
2. easy to browse
3. contents are properly arranged
4. explanations are clear and complete
5. explanations in the material are sufficient to complete the set out activities
6. activities are sufficient to assimilate the contents and carry out the Continuous Assessment Tests
7. usefulness of complementary materials
8. giving a global score to the material

This is the cumulative frequency diagram for each aspect:

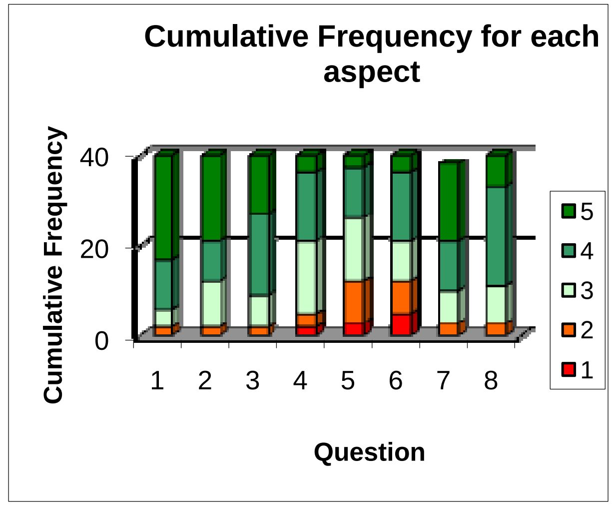

Fig. 9 Cumulative Frequency Diagram

Another aspect included in the questionnaire is the number of technical problems during installation and use of the material. In general, the responses to this aspect indicate that there has been a low level of problems with the installation and use of the material. In addition, these problems have had a low impact on the study: 4 out of the 40 people surveyed said that their studies have been quite or very negatively affected by these problems.

Therefore, we can state that most students are quite satisfied or very satisfied with the features of the material, except for the activities and list of activities with an evaluation process having a slightly lower score.

Conclusions and future lines of action

The first version of an environment used to learn basic mathematics at university has been designed, developed and tested.

From our experience we want to point out three relevant aspects:

a) There is a need of using effective and expressive mark-up elements to represent and structure mathematics education pages. Currently, that would imply the use of XHTML pages with mathematical mark-up in the form of MathML, MeML or some other XML schema. Current support in mainstream browsers, and the state of the existing authoring tools, makes it a hard proposition, although the field is evolving quickly towards the adoption of those technologies.

b) The convenience of in-depth mathematics education for adults in order to analyse the factors that may have an impact on results of different contents. That is, we should assess the suitability of the learning tools used in different types of content for future UOC engineering students.

c) The material does not seem to have had a positive or negative effect on the results. In any case, and given that it seems that the group of people who have followed the course during the P2006 semester were better prepared, we cannot conclude that the influence of the new material is negative in the assimilation of concepts. In fact, it should rather be the other way round.

More specifically, the online environment developed should evolve in different directions.

On the one hand, the graphical user interface should be analysed in order to improve the use of images and graphical objects that present the information and facilitate the lines of action available.

On the other hand, the way in which the communication between students and teachers on existing materials is integrated should be defined. During the first phase, different possibilities have been studied to add comments about a specific question, either privately or publicly, with the purpose of customising the material and sharing doubts, observations and comments.

In addition, we should assess the suitability of the learning tools used in different types of content for future UOC engineering students.

Finally, we should check the assessment system and decide upon the most adequate technology that should be implemented for this system.

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I-Observation: a web-based tool for the collaborative learning

Orlando DE PIETRO
Department of Economics and Statistics, University of Calabria
Via P. Bucci, cubo 1/C, 87036, Arcavacata di Rende – Italy
depietro@economia.unical.it

and

Maurizio DE ROSE
Department of Economics and Statistics, University of Calabria
Via P. Bucci, cubo 1/C, 87036, Arcavacata di Rende – Italy
mderose@economia.unical.it

ABSTRACT

In the present work, a web-based tool called *I-Observation* is described, that allows the optimal management of multimedia contents which, through their *appropriate* integration in a unique interface, allow to realize an environment of collaborative learning. Starting from an indexed video-lesson (*I-Lesson*), a series of *add-ons* have been elaborated able to prime a phase of supervision after the activities completed by the students, and able to come to forms of negotiation of the knowledge for the construction of the learning online in a collaborative way and in a constructivist point of view.

Keywords: e-learning, collaborative learning, cooperative learning, multimedia.

1. INTRODUCTION

The tool described in this work, called "*I-Observation*" is inserted in a context of web-based didactics in which the subjects who learn more and more play active roles, in the sense that they become integral part of the whole process of learning and they reach a central position in the training activities; besides, according to the proposed architecture (methodological-technological), the teacher or the support team constantly have the possibility to supervise the activities of the subjects, since they can intervene in the learning processes to make them more effective and in accordance with the behaviors and/or the cognitive styles of the students [15],[17].
More specifically, the *tool* has been experimented inside a *web based* environment of simulation to certify the acquisition of the competences in the university sphere and to be a support to the observation phase of a scholastic context from the part of the subjects involved (students-trainees). The starting point is represented by the possibility to use an indexed video-lesson (in our case a *video-observation*), according to the architecture of the *I-Lesson tool* which is postponed for close examinations [5],[7],[13], [14].
Besides the functionalities made available by *I-Lesson* during the use of the *video-observation* the trainee, through a special *link*, starts the automatic construction of an *'index-pointer'* in the video that considers the value assumed by the *timer* of the *video-streaming* from the moment the link is activated. All this totally occurs in an automatic way and in *background*, thanks to the opening of a *pop-up* window in which there is a *text-area* that allows the trainee to write and to forward his/her "observation"; this latter will be stored in real time in the database and will be associated to his/her user profile. Following the various requests forwarded by the trainees during the use of the video, the database will be little by little enriched by a series of observations, reported to every trainee and related to a specific part of the video. The various proposed observations are forwarded in an automatic way to the teacher and/or to the various subjects of the team-teacher who, through a special interface of administration (*back-office* system), will have the possibility to provide the relative answers to the observations made, besides a series of other functionalities useful for the following *retrieving* phases. In this way the subjects who learn/observe have to bring new knowledge sharing it among them and with the teacher. The role of this latter is however fundamental to guarantee validity and supervision of the formative activities, even if according to a new modality typical of the latest generation of FaD systems [1],[4]. With this organization, we arrive to a model in which are created situations where the involved actors play active and participating roles and are a support to the whole community of learning. Finally, more attention has also been given to the *retrieving* phases of the contents, in this case of the proposed observations and the relative answers/explanations provided by the teacher; such *retrieving*, on the basis of the requirements of the subject who learns, can occur according to different modalities [6].

2. THE I-OBSERVATION TOOL: DESCRIPTION OF THE WEB INTERFACE AND FUNCTIONALITY

As previously underlined, the basic idea of the tool in object is to create a "work Environment" in which learning springs from a dynamic and cooperative process, in which all the actors involved participate in the formative processes and where, on the base of everything, a process of sharing of the knowledge is established. According to the final result, represented in a last analysis by the web interface that will be subsequently described, there is clearly a process of planning and management of the contents from the teacher or his/her team, in the sense that the synchronization of the contents (audio, video, indexes, other resources) is however submitted to the experts of the contents. As regards this last aspect, however, we want to remind that some authoring tools that support such back-office activities exist and others are being studied to subsequently improve these activities, with the purpose to stimulate more and more the production activities of learning objects in e-learning contexts [22],[23].

The final web interface, usable from the student through a normal browser and the plug-in *Real Player* for the interpretation of the contents SMIL (*Synchronized Multimedia Integration Language*), is represented in the figure [16],[19],[21].

<u>Figure 1. Web interface of the I-Observation tool.</u>

The *superior* part of such interface derives from the I-Lesson tool, which is postponed for further close examinations[1]. What we really want to underline in this contribution, is represented by all the functionalities and tools available in the *inferior* part of the web page shown in fig. 1, that allow a continuous and dynamic interaction among the training subjects and between these latter and the teacher.

[1] De Pietro O., De Rose M., *I-Lesson - Learning and teaching: a tool for the WIS-Learning*, under review on conference ED-MEDIA 2007 - June 25- June 29, 2007, Vancouver, Canada.

Before starting the description of the functionalities made available, it is important to specify that such tool has been experimented within the observation of a scholastic context, from there the denomination I-Observation, i.e. indexed observation.

The mechanism at the base of the tool is represented by the fact that during the use of the tape (*video-observation*), the learner – in our case the trainee who observes the scholastic context – through a ***<u>link</u>*** visualized on purpose, has the possibility to send his/her "observation" that is stored in real time in the database. An aspect of great importance is given by the fact that this sent "observation", is filed together with the precise time (timer) related to the part of "current" tape in which the observation has been made. That is, the automatic construction of an *index-pointer* is set out to the video that considers the value assumed by the *timer* of the video-streaming in the moment in which such link is activated [2],[12]. This becomes fundamental for the following supervision activities from the teacher, but also and above all for the retrieving phases of the observations from the learners, since they will have the possibility to visualize not only all the sent observations but only those referring to a certain interval of the tape (index). The storage of the "observation" proposed by the trainee, totally occurs in an automatic way and in *background*, it is only necessary to write the observation (question, request, doubt etc.) in a form that will open inside a *Pop-Up* window (Fig. *3).* Together with the forwarded observations and the relative time associated to the current part of video-observation, the "*login*" of the trainee is also stored so as to trace a supervision a posteriori on his/her profile and to have a reference feedback for possible evaluations that, intersected with further evaluation tools will be able to contribute to a certification process of the knowledge/competences.

The use of the tape from the trainees, also in different moments and with notable flexibility space-time, in the course of time enriches the database and therefore increases the knowledge. This knowledge is effectively the fruit of the interventions of all the involved actors (students-teachers), that are also stimulated to intervene proposing their observations [3],[18]. It is in this occasion that the student really becomes an active part of the learning process, since he/she is aware that his/her observation will be really shared by the rest of the subjects and will also be evaluated by the teacher.

The remaining functionalities of the tool, substantially concern the retrieving activities of the "observations", therefore are conveyed in the consultation of these latter according to particular modalities. In fact, it does not deal with a simple monitor visualization of the observations stored in the course of time, but these consultations consider some logical dimensions of classification.

More specifically, as shown in Figure 1, the trainee has at his/her disposal a series of access modalities to the I-Observation catalog, on the basis of the classification typologies: *time, pushing, flat.*

According to the dimension of the *time*: the trainee, during the use of the video streaming, effecting a simple click can visualize, in a pop-up window, the set of Observations that refer to that part of video-lesson; the selection criterion of the Observations founds itself in this case on the indexed subdivision of the lesson operated from the teacher or from the experts of the contents; particularly all the *indexed observations* that fall on the indexed part that the trainee is visualizing in a given moment are extracted from the database.

According to the dimension *pushing*, which was previously mentioned, we refer to a form of pushing of the most meaningful Observations, selected from the teacher toward the trainees. What happens is therefore the presentation of a list of indexed observations that from the side of the teacher are considered particularly meaningful and therefore worthy of particular attention from the learning community. This "meaningfulness" is attributed by the teacher through the appropriated administration interface that will not be described here.

Finally, the dimension *flat* allows the trainee to accede to the complete catalog of the Observations, and to see the whole list to make his/her selection. In this case, in fact, the trainee has two choices at his/her disposal: visualizing all the observations inserted by the subjects or only those which an answer or however a comment to the forwarded observation have been provided by the teacher. It is obvious that in this last case, the observations assume a greater importance since they are sifted by the teacher.

The trainee besides the consultation of the filed observations, according to the modalities we have just described, has the possibility to activate, from the interface of the tool, the environment of simulation planned and implemented in accordance with the phase of observation, and by means of this has also the possibility to propose him/herself his/her own project hypothesis.

This environment (web-based) is visualized in a new window of the browser that will be opened from the appropriate link "Make your project Hypothesis", and the objective is set to complete the technological tools that will allow to come to a system able to certify the competences acquired by the learners.

3. THE ROLE OF TUTORBOT IN THE CONTEXT OF I-OBSERVATION

After having described and analyzed the main functionalities of the I-Observation tool, both as regards the front-end activities and the back-office ones, it remains to examine the role of the intelligent agent TutorBot contextualized inside the tool in object.

TutorBot is an intelligent agent that, using the AIML language (*Artificial Intelligence Markup Language*) for the structuring of the data, can be employed as an interface between student and knowledge base in an e-learning platform.

For a close examination on the technological, methodological and functional aspects of TutorBot, see the bibliographical references, while in this work the interaction and the contextualization of the agent is emphasized in the I-Observation system [8],[9],[10],[11].

Starting from the presupposition that in a distant learning environment, of latest generation also, it is not possible to guarantee forms of full time tutoring online, and that the student often needs information which can be retrieved for the most part only during a dialogue in natural language with another subject, the need to satisfy or however to carry out this requirement in an optimal way is set.

More specifically, therefore in the observation phase of the scholastic context from the part of the trainee who learns, this latter has different possibilities of interaction with the other subjects:

- interaction with the other trainees in asynchronous modality through a 'forum' integrated and synchronized on purpose in the tool (cf. I-Lesson tool);
- interaction with all the subjects who bring new knowledge through the I-Observation module, therefore thanks to the sent and stored observations that can be subsequently consulted and where the expert teacher of the contents also participates;
- real time interaction through the communication tool 'chat' directly with the teacher, in the moment in which this latter notifies his/her own presence that is automatically visualized in the interface web of the tool (cf. I-Lesson tool).

At this point, if none of the modalities we have just described succeeds in satisfying the requirements of the learner, there is a risk that this trainee, not knowing how to proceed, decides "to give up" the following learning phases. It is to avoid this, or to try to minimize such situations, that the intelligent agent TutorBot intervenes, giving support to the student through an interaction that simulates the one among human subjects. It is obvious that TutorBot must not be considered as a substitutive element of the human factor (teacher in this case), but as an element of support that through the forms of automatic updating of his/her own knowledge base, this objective of "tutor online" is more and more set.

The moment in which the interface of TutorBot is activated by the environment of the I-Observation tool and precisely from the link "Ask support to TutorBot", is shown in the following figure:

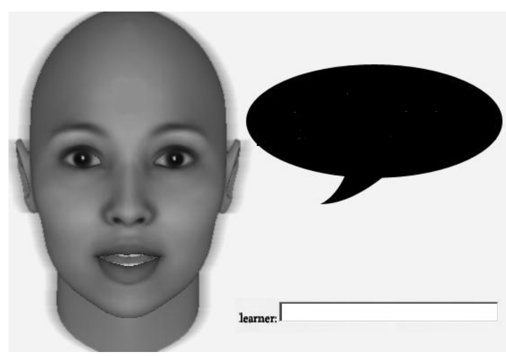

Figure 2. Web interface of TutorBot.

The subject, in his/her own natural language, interacts with the intelligent agent to perform the retrieving of the didactic contents and at the same time to receive "assistance", exactly as it does with a human tutor during a chat session. Let us not forget that, thanks to the AIML structure, it is also possible to manage multimedia contents and not only in text format, thus making the whole learning process more effective. Besides, TutorBot can interact with other informative systems present on the Web, so as to widen its own knowledge base and to

encourage the creation of wider Virtual Communities, that contribute to the sharing of the knowledge.
The intelligent agent TutorBot, therefore, must be considered and valued, not only from a technical point of view regarding the technology at the basis of it but also from a pedagogic-didactic point of view and of social interaction.
Insofar, we can state that TutorBot, introduces several dimensions, that contribute to the fulfilment of specific aims within a well defined model of training in a last analysis, as in the specific case the social-constructivist one. Particularly, as regards the benefits of TutorBot in a pedagogic point of view, it is necessary to focus the attention on the front-end activities available by the agent, therefore to the functionalities of the latter, that set the student in the center of the learning process.
This last aspect, that represents one of the primary factors at the basis of the present studies in e-learning environment, better known by the term "student-centered learning", is particularly guaranteed by the TutorBot system, and represents in fact, one of the main aspects of the social constructivism. It is not by chance that such a model of training has deeply modified the traditional model of the learning process, since it recognizes the importance of the processes put into effect by the student in the learning for which its active and participative role are valorized.
This "new" role, is of great importance in the interaction TutorBot-learner, since it is the student who, during the dialogue with the agent, builds his/her own learning path and contributes above all to enrich the knowledge base which is obtained from the artificial tutor, that will subsequently be shared by the other actors.
Finally, we need to underline how TutorBot contributes to the fulfillment of the other benefits in the center of the constructivist model: the just-in-time learning and the collaborative learning.
The first one is guaranteed by the fact that TutorBot, being a web-oriented agent, is always available for the users and its simple interface subsequently encourages its use. The second one, on the contrary, is guaranteed by the tools or developed additional modules, that allow a great sharing of the resources, to which all the actors and not only the teacher contribute, and that brings to a form of collaborative learning [11],[14].

4. THE ENRICHMENT OF THE KNOWLEDGE IN THE DATABASE

As it was previously mentioned, the I-Observation tool allows to reach a continuous updating and therefore enrichment of the knowledge, through the storage of all the information necessary in the database. The core of the system, therefore, is represented by the structure of the database, inside which all the necessary information meet, from the contents in a precise sense to the tracing of the student profile, up to the metadata necessary for the running of the whole system. In this context the database is not described in a formal way through a particular model, but it is rightful to illustrate the least information that are however stored, both as regards the front-end activities and for the back-office ones (Figure 3).

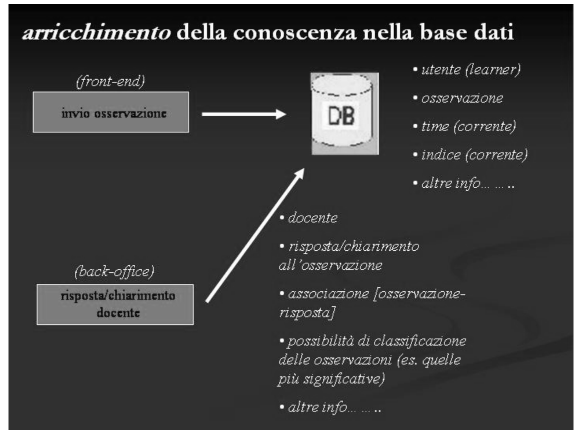

__Figure 3. Scheme of the information to be stored in the database.__

Let us precise that the scheme we have just illustrated, is only relative to the forms of enrichment of the knowledge that derive from the reported module to the sending of the observations and the following processes of elaboration, object of the present work. It is clear that in the same database, all the other information are also stored related to the forms of interactions available and described in the I-Lesson tool, as well as the connection to the knowledge base of the intelligent agent TutorBot.
In our case, on the contrary, we come to a continuous updating of the knowledge that is developed among the learning subjects and between these latter and the teacher or team-teacher. The student-trainee, after having performed the authentication phase, from the moment he/she forwards his/her observation, this latter will be filed in the database together with a series of information, many of which are "hidden" to the user since managed in an automatic way and in background. The main information concern:

- *user*
- *observation*
- *time (current)*
- *index (current)*
- *other information....*

Contrarily, after the following elaborations completed by the teacher on the observations forwarded by the students, using the appropriate interface of administration (not described in this work), the following information will be stored in the database:

- *teacher*
- *answer/explanation to the observation*
- *association [observation-answer]*
- *possibility of classification of the observations (ex. the most meaningful ones)*
- *other information....*

From the storage of all the information we have just listed, it is possible to reach forms of supervision of the developed activities and to have adequate feed-back on the latter. Insofar, we not only reach a collaborative learning in the front-end side, considering that all the training subjects have the possibility to use and to visualize the inserted and elaborated contents, but also in the back-office side and therefore, the teacher has the possibility of supervising the learning.

5. CONCLUSION

The present work has put in evidence how, having recourse to opportunely projected technologies and managed according to aims not only of technical nature but also and above all of *pedagogic* characteristic, it is possible to reach innovative forms of teaching-learning, able "to simulate" and to recreate real situations.

The described tool, in fact, has had as a central aim the "construction" of an environment able to recreate in a web-based context of teaching-learning, forms of interactions, also and above all of social type, that bring to the sharing of the knowledge among the actors.

In this direction, it is set as a support tool of the teacher and the tutors activities, according to the new orientations typical of the constructivist model, guaranteeing the transfer of autonomy and cognitive flexibility to the learners, rather than general notions and knowledge.

Finally, the integration of the intelligent agent *TutorBot*, allows through the management of the natural language, to establish even more forms of learning that set greater attention to the social relationships among the subjects, and allow to strengthen the paradigms of the *just-in-time learning* and of the c*ollaborative learning*.

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Design of a Competence Evaluation System for users of Communication and Information Technology (TIC´s)

Dr. Maria del Valle
Universidad de Concepción
Concepción Chile

and

Prof. Eduardo Mardones
Universidad de Concepción
Concepción Chile

Abstract

In the 2000 General Assembly of the United ations,specifically during the meeting period of the Economic and Social Council it was recognized that the Communication and Information Technologies (TIC´s) are fundamental for the new Economy development. Besides they highly contribute to the social development of countries. Due to their importance our country has as a State policy to implement the TIC´s and create opportunities for people to learn and use these resources because this is one of the most powerful tools for developing the competences that the current world demands, mainly in the working area. Thus the info centers have been created which are community spaces which have communication and information technologies to have access to or generate contents and serices relevant to the community where they are situated. The group of public and private infocenters constitutes the Infocenter National Network for the country. In them, wether they are public or private, users freely decide to which content they access directly and if it is needed with the support of a facilitator. In our city, Concepción for example, a digital alphabetization proccess is taking place carried out by the Chilean Goverment and which has as an objective to instruct 20.000 people who know nothing about the subject.

The use of TIC's promotes the development of cognitive competences, consequently to participate in the infocenters is an opportunity which allows the user to insert himself succesfully in the " Information Society". Then the creation of an instrument to assess such competences becomes a great help to make them evident. Thus it was decided to create a "Cognitive Competences Scheme" basing it on the Robert Gagne theory. In order to select the competences were considered all those related to economical activity; then a gruop of reactives was written for each one of the cognitive abilities which were validated by judges with the citerio of the 80% . These reactives, 108 in all conform the evaluation instrument created which is called " Superior Cognitive Abilities Test" (SCAT) which evaluates cognitive abilities in three dimensions or cognitie competences: a) Search for Information; b) Information Processing and c) Knowledge Extension. These dimensions are evaluated through 32, 48, and 28 items respectively.

The instrument was made in digital format and for this the 30 days Licence of the Question Perception Mark software was used. The application of this test to a sample of 21 subjects between 14 and 65 years old, all of them participants of the info center, allowed the empiric validation of the instrument which meant its optimization. Later on it was applied to 121 subjects with the same characteristics as the initial sample which allowed to establish that " to the more use and knowledge of computer tools the subjects exhibit more developed cognitive skills".

Keywords: Infocenters, TIC´s, Evaluation, Competences,

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Theoretical Frame

At the end of the sixties begins the technological revolution and it is characterized, as Castells (1) says, by three independent processes: The arrival of Information technology, new alignment of the economic and the flourishment of a new society and culture. Thus we are confronted to a new form of development in which the main source of productivity is the qualitative capacity to optimize the combination and the use of production factors based on the knowledge and the information. This constitutes the foundation of the so called Society of the Information.

The General Assembly of the United Nations of the year 2000 recognized that the Communication and Information Technology (TIC's) are fundamentals for the development of the new economy since they allow acceleration of the economy growth, to promote the sustainable development and to eradicate the poverty in the developing countries. Due to the former, our government has as an state policy the implementation of the Communication and Information Technology TCI's in this way creating instances for the people to learn and use these resources, because they are powerful tools for the development of competences that the current world demands, especially in the working and business fields.

The subject of this article and research is related to the new alineaments of the actual world in context of the Communication and Information Technology TIC's.

To integrate to this new society requires reprogramming of oneself to constant changing task in the production process, which means to vary the performance in order to adapt to the

demands of the context. This implies to handle tools to modify our culture. This is to use abilities, skills and cognitive competences.
We should ask what is the meaning of ability, skill and a cognitive competence.
Taking into account the common aspects that some authors present with regard to the definition of **Ability** we may point that an ability is an Innate Intellectual Potential, which is common to the most of the humans, which can be developed and then it may actually become real.

In the context of the society of information it is necessary to develop abilities like: to identify, to classify, to integrate, to define objectives, to use research strategies, etc. These abilities receive the name of Cognitive Abilities.

In spite of the agreement in the necessity to develop and to value the cognitive abilities, the different conceptions have been grouped in 3 main positions:

a) The Cognitive Abilities as a component of the intelligence.
b) Cognitive Abilities and the theories of the Information Processing.
c) The constructivist conceptions and the Cognitive Ability.

With regards to the skills, this concept is associated generally to the motor activity of the human being. However, the **Skill** is a set of logical operations, ordered, graduated which the thought of the subject carries out on the information or knowledge that he or she wants to acquire but always within a critical criteria. Also they maybe classify in motor, intellectual and interpersonal skills.

On the other hand the meaning of Competence is a concept that is generated from the New Society of Information for the new requirements to detect the conditions that display the people to apply to an specific working / or academic position.
That is to say, in order to be considered competent in any given discipline or work, we must present a set of knowledge that allows us to confront and to solve various situations.
Thus, for example The Intelligence is constitute by a set of competences that may be can be classified as: Cognitive, Psychomotor, Communication and Social Insertion.

The competences are permanent characteristics of a person. These manifested themselves when a task is executed or a job is carried out. They are related to the successful execution of an activity and it has a causal relation with the working performance and finally, the competences may be generalized to more than one activity. In addition, the competences may be real or be present as potentials, which may be developed through the learning process.

How many competences are there?

It is possible to clame without any fear to be wrong that there are as many competences as there are researches writing about them. It will state, as an example, the Competences dictionary of Richard Boyatsis who considers:

a) In the scope of the Action and the Obtaining of Results, Competences such as initiative, research of information, concern for order.
b) In the scope of the Help and Service to the community, Competences such as the interpersonal understanding and customer orientation.
c) In the scope of the impact and influences, Competences such as organizational awareness.
d) In the management scope, Competences such as to be assertive, team work ability and leadership.
e) In the cognitive scope, Competences such as analytical thinking and conceptual thought.
f) In the scope of the Personal Effectiveness, Competences such as self control, self-confidence, flexibility and organizational commitment

How can these Competences be cultivated?

Through education. Chile, aware of this important role of the education reformulated the educative system with the purpose of forming people who satisfy the new demands of society.
It came from a behaviorist approach to a cognitive one and due to this in this research it is considered that the subject learns by means of his/ her mental structure and the cognitive processes that take place. Hence the interest to focus the attention on the cognitive Competences the subjects may reach thought the Education Process.

It is difficult to establish what a cognitive Competence is, nevertheless we may reach this concept started from the concept of skill and ability. The abilities are a set of logical operation, ordered, graduated on which the thought of a subject carries out on the information or knowledge he or she wishes to acquire. A cognitive ability consists on acting on the available information starting from a mental process that acts upon this cognitive ability. When one or many abilities are interrelated and integrated through a common pattern, they receive the name of skills. From the former, we may establish that a cognitive Competence is made of a series of skills and associates abilities.

These mention concepts are fundamental for the purpose of this work. Since starting from the ideas of skills, abilities and cognitive competences it is possible to developed an scheme of cognitive competences which will allow to create an Evaluation System for the Competences to be Developed by the users of the TIC's.

SCHEME Of Cognitive Competences that will be use in this work:

This scheme is the following:

Competences	**Cognitive Skill**	**Cognitive Ability**
Finding Information	To plan To discriminate To verify	Specify questions To define objectives Research abilities
Information Processing	To perceive To identity: To give meaning. To codify To structure the	To pay attention To associate,to order, to integrate.group,

	Scheme To relate To store	
Extension of knowledge	To recuperate To use To sweep a group of To perfection	To compare To transmit

a)For the competence "research of information", it associate skills are: to plan, to discriminate and to verify. In the scope of planning, the associate abilities are to specify questions, to define objectives and to use finding strategies. For the scope of discriminating the associated abilities are to select and make a hierarchy. For the scope to verify, the associates abilities are: to specify questions related to the subject, to validate and pertinence.

The essence of these competences is the orientation which takes the person when he or she is giving the task. This corresponds essentially to the capacity that the individual has to undertake a subject, to have access to sources of information, to gather material, select it and to determine the value and suitability of this material.

The skill to plan is defined as the process of organization of the task to be carried out. This skill is related with the purpose and the way in which the search for information is carried out, that is to say it involves to establish objectives, to determine a sequence of main idea and to select the necessary resources to achieve them.

The cognitive abilities present in this skill are:

A1) To specify questions which is an ability that is related to formulate questions related to what type of information to look for and howto carry out this finding of information.

A2) To define objectives, ability that allows us to specify the subject that we are finding information for and to determine the steps to follow in this process.

A3) To use finding strategies, ability that implies to use a tecnic which will allow us to find the right information in a short period of time.

The skill to discriminate is defined as the stage where a person selects the already found material discarding the material which does not comply with the objective. It is an act in which a person, once he or she has fond several ways that may be an answer to his or her task chooses according to the stated objectives.

The abilities associated to this skill are:

To select information, ability which allows us to separate the relevant information from the irrelevant one , or redundant or confused information.

To be able to make a hierarchy according to levels of importance of the information according to the predetermined objective.

The skill of verifying is defined as the act of reproving the veracity of the selected document, including the pertinence for the reality in which he or she lives. It is said that a person is verifying when they ask themselves questions that check the validity and the pertinance of the document that he or she has selected.

The cognitive abilities associated to this skill are:

A5) Specify questions related to the subject, ie this ability is related with the capacity of formulating questions that will lead us to check if the gathered information comply with our requirements:

A6) To check the pertinence of the selected documents ability that implies to identify if the information is adequate to comply with our purposes;

A7) To verify the validity of the document ie to have the ability to check the origin of the document that contains the information, the prestige of the author or the reliability of the visited website.

B) For the competence "Information Processing " the associated skills are to attend , to perceive, to codify , to structure the scheme , and to store information. In he scope of to perceive , the abilities associated are to compare , to identify, and to give meaning. In the scope of to codify, the associated abilities are to relate, to associate , to classify to group together and to order or organize. In the scope of structuring the scheme, the associated abilities are, give meaning to make sense of and to integrate.

We will call " attention" the process of selection of some of the data available ie. It it the act in which a person decides to study a predetermined information as an answer to an stimuli he or she has detected. " to perceive" we will understand the perception of the first impressions which a given information has caused in the person. In other words the perceptions are the meanings which we give in the first instance to an information. The abilities associated to this skill are:

B1) To compare which is related to contrast the information that we are receiving with the one we have already stored.

B2) To identify what implies to recognize the main characteristics of the obtained information.

B3) To give meaning which allows us to determine meaning to the obtained information. To codify will be understood as the act through which we place the received information in our processing system and we prepare it to integrate it to the long term knowledge. To codify means to place the information in a meaningful context. The abilities associated to codify are:

B4) to elaborate which consists in identifying a piece of information according to its nature; to make sense which is related with achieving a conceptual orientation of the information; integrate which implies to unify concepts to an existing prototype. To structure an scheme it is understood to construct reorganize or to integrate blocks of information. The abilities present in this skill are

B5) to give meaning which consists of identifying a piece according to its nature; to make sense which is related to achieve a conceptual orientation of the information; to integrate which implies to unify concept s to an already existing prototype.

c)For the competence " extension of knowledge" , the associated skills are : to recuperate, to use, to improve, to enhance and to transmit. It is related to the capacity of updating our knowledge and or to contribute to the development of other people. We have only recognized abilities associated in the skill "to recuperate" and they are: to define an specific objective, to sweep a group of knowledge and to locate. The cognitive abilities associated to this skill are:

C1) To define an specific object which implies to state an idea which will help us to orientate the recuperation process.

C2) To sweep a group of knowledge ability that allows us to carry out a type of cleaning to recuperate those main elements.

According to Le Boterf (1996) , the competence is structured on the base of three fundamental components: to know to act, to want to act, and to be able to act.

To know to act is the group of factors which define the capacity inherent to the person to be able to do all the actions.
To want to act is related not only to the factor of motivation of intrinsic achievement of the person but also to the most situational and subjective condition which make the individual to decide effectively to go ahead and carry out an specific action.
To be able to act in many occasions the person knows how to act and has the wishes to do so, but the conditions are non existent in order to do whatever the person wants to do. Consequently the conditions of the context the means and resources condition strongly the effectiveness in the exercise of his or her actions.

Evaluation System of Cognitive Competences.

The evaluation process within the information society has been modified. We have moved from the qualifications or grades to a competence evaluation which establishes educational standards, which the majority of people may reach. Consequently when using this type of evaluation we find that different performances may reflect the same standards ie., we compare the performance which a person presents with the corresponding standard, which allows to cancel completely the comparism with another person. This contributes to that the evaluators may elaborate judgements on their performance.
Which are the methods to detect cognitive competences?
Taking into account what was said by Mayor (1993) there are different procedures and indirect systems of evaluation of the cognitive abilities, among which we may quote: interviews, observations and scales or observation instruments.
The interviews are verbal reports, consisting basically of asking the people what cognitive processes take place when they undertake cognitive tasks. This method may be applied in three moments: before, during or after a task is undertaken.
This type of report has several disadvantages but one of them is that it is unknown if what the person is saying is something the he or she has really thought or if the person is lying.
With regards to the observation of scenified situations, of the egocentric speech, of the out loud spoken thought, or of the execution of the task this adds information of the cognitive processes used by the subject; to use this method is useful when question forms and to do interviews is not possible.
In relation to the scales and evaluation instruments the researchers design in most cases their own evaluation instruments, among which we may quote: Evaluating Battery of Metamemory, Questionnaire on Metamemory and Ageing, Scale of Action Control and Inventory LASSI.
The Evaluating battery of Metamemory is used to determine the knowledge and cognitive abilities in "impulsive" and "reflexive" groups. This battery is made of 14 tests, where people are presented with hypothetical situations
And they are asked how they would act in front of determined situations.
The questionnaire on Metamemory an Ageing, (Dixon and Hultsch) was designed to examine the evolution that follow the Metanemic processes within adulthood. It is made of 206 elements conjugated in 8 dimensions which reflect everyday situations where the metacognitive functioning is manifested.
The scale of action control measures the "action control" which is a cognitive process responsible for organizing and controlling the cognitive operations as to generate coherence between the intention and the execution of the task. The action control suffers a variability with regards to the tendencies of the subjects, which are distributed along a continueun orientated to the action or the state. Khul has designed an scale to evaluate the orientation of the tendencies. This scale is formed by 3 subscales; that one related to the execution with the laws and the decisions in front of orientations towards the state; which has 20 items that specify a situation and 2 answers: one state orientated and the other orientated towards he action.
Finally the Inventory LASSI (Weinstein) is related to an inventory of cognitive abilities related to learning and to study. This inventory has 10 scales destined to evaluate different types of cognitive abilities among which we can quote, the processing of the information, to choose the main idea.
After analyzing the former instruments it has been considered pertinent to elaborate a test because it gathers information more accurate than the interview and aminorates the time used in the evaluation process in relation to the observation. Thus the test considers 108 reactives, which allow to measure 13 variables or cognitive skills developed in the use of the TICs.

The Investigation Process.

1 Objective. To design and validate an evaluation system of the cognitive competences developed by the TICs users.
2Investigation Design. Correlational Descriptive.
3Population. Subjects that attend the infocenters of the 8th region of Chile and which are administrated by government agencies where people are trained to use the IT and communication technology specifically the computer and internet.
4 Sample. Middle class and lower middle class people whose ages fluctuate between 14 and 65 years of age. The sampling procedure is non probabilistic since we need to have the will of the infocenters administrators and the people who attend them to participate in the investigation.
Also since we wanted to have the participation of every type of user 9 from cero level) which corresponds to people that have no knowledge of the computer going to the level 1 that includes people who do have knowledge of the operating system and or Microsoft Word and considering a level 2 which included people that apart from having knowledge of Microsoft Excel, internet navigation and use of some communication system it was considered pertinent to include "an experts level" who are people that use the computer and its tools to generate content and or spread it through the net, it was necessary to include students of higher years of Maths and Computer Science of the education faculty of the University of Concepcion.

5 Procedures for obtaining the information. Given that the objective of the work was to design and validate an evaluation system tomeasure cognitive competences that the TICc users developed the gathering of information procedures were directed to comply with such objective.

The scheme of cognitive competences was designed which has already been shown and then it was written a set of reactives for each cognitive skill , centering the attention on the cognitive abilities associated to each one of the competences. This set of reactives was validated by judges. The gathered information through this procedure was tabulated ans were selected the reactives which overcame the 80% of approval. The reactives which did not comply with this 80% approved standard were reformulated or were simply discarded. The total of reactives that are contained the Competences Evaluation instrument is made of 108 items in total and it was called " Superior Cognitive Ability Test" (SCAT), which evaluates cognitive skills grouped in 3 dimensions denominated: a) searching for the information 32 items b) information processing 48 items and c) knowledge extension 28 items.

The application of this instrument in the sample was coordinated with the people in charge of the infocenters of the city of Concepcion.

6) Statistical Analysis.

6.1) Content Validation: Since the validation instrument has as a main objective to detect the cognitive skills to a predeterminated group of people it must be established how far the sample of items that conform the instrument represent the universe of cognitive competences which are object of the evaluation. Thus we used what from the psicometric perspective is denominated Content Validation. With this purpose in mind the collaboration of expert evaluation academics was asked for this type of reactive. Once the opinions that they gave were checked , it was considered feasibly to use those items that had an 80% of approval from these judges.

6.2) Data Treatment: the information was tabulated in an excel worksheet where the columns represent the variables and the rows the sample units. After doing the validation it was proceeded to apply it to the instrument to the sample. Finally there were obtained 121 observations from which 30 belonged to the "o" level, 26 to the level "1" ,37 to the level "2" and 28 to level "3".

The variables were worked with in the following way:

Xo corresponds to the group which the person belongs to according to the computer knowledge.

X1 to X3 represent cognitive skills present in the competence " information search"

X1 represents discriminating.

X2 represents planning.

X3 represents verify.

X4 to X8 correspond to the competence "knowledge extension" which is related with the capacity of the person to update his or her knowledge and or contribute to the development of other people.

X4 corresponds to enhance.

X5 corresponds to improve.

X6 corresponds to recover.

X7 correspond to transmit.

X8 corresponds to use.

The variable X9 to X13 corresponds to the competence "Information Processing".

X9 corresponds to store.

X10 corresponds to pay attention

X11 corresponds to codify.

X12 corresponds to structure the scheme.

X13 corresponds to perceive.

6.3) Internal Consistence Analysis. Coefficient of a of Cronbach. The internal consistency is related with the degree of homogenous or existent coherence between the obtained results by those examinated in each item of an evaluation instrument and the total result of the same instrument.

Given the characteristics of the SCAT (Superior Cognitive Ability Test) the Cronbach coefficient was used. We must remember that the instrument that was designed measures 13 variables (from X1 toX13) due to which the value of the coefficient for each one of the items in order to verify if the items that evaluate do it in an homogenous manner. The value of the coefficient for the 13 skills were:

Skill	X1	X2	X3	X4	X5
X6	X7	X8	X9	X10	
a % 41	42	53	38	42	55
24	26	43	47		
	X11	X12	X13		
a %	75	54	63		

6.4) Correlational Analysis between Variables: the dates were entered to the statistic package "InfoStat" which allowed us to establish the correlation matrix between the 27 cognitive abilities. As an example are presented the correlation between variable X1 with all the other variables up to variable X10.

	X1 X6	X2 X7	X3 X8	X4 X9	X5 X10				
X1									
X2	0,87								
X3	0,45	0,47							
X4	0,79	0,82	0,44						
X5	0,28	0,22	0,28	0,30					
X6	0,75	0,78	0,43	0,68	0,34				
X7	0,37	0,37	0,25	0,48	0,43	0,43			
X8	0,59	0,65	0,38	0,61	0,28	0,58	0,41		
X9	0,44	0,41	0,38	0,49	0,22	0,28	0,24	0,42	
X10	0,16	0,13	0,18	0,22	0,29	0,25	0,25	0,21	0,42

To the former we can add other statistic analysis such as the Analysis Method by Principal Components and the Factorial Analysis. The latter allowed us to analyze deeper in the behavior of the items of the test.

6.5) Conclusions and Projections: the statistical analysis had as objective to study the validity of the instrument, denominated SCAT test. Each one of the analysis methods applied showed relevant information which allowed corroborating some of the observations perceived during the test application. Due to the former we state that the SCAT test must consider the following aspects to be transformed in an homogenous and reliable instrument:

a) The items that intend to evaluate the competence "Search of Information" must be reformulated;

b) The items that intend to evaluate the competence "Information Processing" must be reorganized in such a way that only the "codify" "structure schemes", "perceive" and "recover" skills are considered.

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A Case Study on the SSH Brute Force Dictionary Attack on Information Technology Labs

Tijjani MOHAMMED, Lee TODERICK, Erol OZAN, Phil LUNSFORD
Technology Systems, East Carolina University
Greenville, NC 27858, USA

ABSTRACT

This case study reviews the secure shell (SSH) brute force dictionary attack and its effect on educational courses that use SSH to access lab computers. Subtle differences exist between academic institution firewall requirements and those of industry. For example, students using SSH for the first time often produce the same log entries as a malicious brute force attack signature. Any reaction to brute force attacks must take into account the novice student. Also, students experimenting with SSH servers on their personal computers need to take adequate precautions against attacks, but may not know what tools are available. This case study is organized into several parts. The introduction discusses the problem and significance. Anatomy of attacks, the behavior characteristics of SSH brute force dictionary attacks, is then examined in depth. Common countermeasures are discussed, and we present several tools to protect hosts and networks from attacks. Our implementation of countermeasures for several on-line classes with secure remote labs is presented. Finally, a conclusion summarizes the threat and recommendations.

Keywords: Brute Force Attacks, Cyber Security, Dictionary Attacks, SSH

1. INTRODUCTION

Secure shell (SSH) is used by many organizations to provide encrypted connections between secure networks and external workstations. Linux operating systems normally use the open source equivalent to SSH, open-ssh [1]. In this document, SSH refers to open-ssh. The server feature of SSH permits students using the SSH client to connect using either a userid and password, or an authorized encrypted key. Each of our students is provided access to lab computers through assignment of a unique userid and a password. Within the delivery scope of our remote labs there are multiple SSH servers, but a representative sample of six are used for this case study.

In our application, SSH provides students with secure remote access to internal networks on well-known transmission control protocol (TCP) port 22. The internal networks typically consist of hardware such as computers, routers, and switches that students use to perform experiments in courses with lab components. Remote access provides students with around the clock lab availability (24 hours a day, seven days a week), without the need to come on campus for physical labs. These remotely accessible labs are integral components to student learning, and SSH is the vehicle students use to connect to the remote labs.

In our lab setup, current SSH log entries could be examined in */var/log/secure*. By default, four successively aged log files were retained, */var/log/secure*[1-4], and older files overwritten. It was during routine examination of these files that unexplained login attempts were discovered. Logs were full of unusual userids that were not remotely similar to student accounts. Furthermore, the source IP addresses emanated from countries where none students lived or visited. Finally, similar logs were found on computers that supported completely different classes. These characteristics signaled the possibility of brute force attacks, and sparked our interest in gaining more insight on the attacks, as well as utilize the opportunity in teaching and research.

Frequency of access attempts typically indicates the use of automated tools by attackers. Source code for a brute force dictionary attack tool against SSH servers was posted in August, 2004 [2] by the French Security Incident Response Team (FrSIRT). Variants of the program have been created to attempt accessing multiple system accounts including the root.

2. ANATOMY OF AN ATTACK

In our study, a set of six hosts with the SSH server enabled was used and log files collected from each between January 31, 2006 and February 27, 2006. Table 1 shows the computers, followed by the number of attack scans. Duplicate hosts on 55.116 are shown. This is because the firewall sends all SSH server traffic to an internal computer. The firewall host is configured for remote administration with SSH, but listens on port 21. This host logged no scans, and will be examined further in the implementation section.

Not all brute force attacks began with logged scans, although most did. A log file from one host showed only 3 of 57 attacks (or five percent), did not contain the initial SSH scan log: *"Did not receive an identification string from"*. This is important to note when constructing an adequate defense because some sort of stealth scan was employed. For example, defense can be tailored to detect an initial scan and block subsequent attacks; however, a certain percentage of attacks could be successful without additional defenses. Possible defense solutions will be examined later in this paper.

Table 1. Hosts vs. recorded attacks.

ECU host	Attack Scans
xxx.xxx.55.116	57
xxx.xxx.55.116	0*
xxx.xxx.55.123	56
xxx.xxx.55.128	55
xxx.xxx.55.129	56
xxx.xxx.57.81	57

How are SSH servers detected in an organization? Anecdotal evidence from our organization's egress firewall logs showed that the scan began on the first usable IP address, xxx.xxx.0.1, and continued through xxx.xxx.254.254. Once the network scan was completed, the targeted attacks began. Most attacks lasted under 15 minutes, excluding the initial scan. Figure 1 contains the transcript that shows atypical log entries in */var/log/secure*. Some of the output was omitted for brevity:

```
Feb 23 07:16:25 sshd[25119❶Did not receive identification string
from 128.164.159.93
Feb 23 07:26:40 sshd[25120❷Illegal user al from 128.164.159.93
Feb 23 07:26:40 sshd[25122]: Illegal user aiko from 128.164.159.93
<output omitted>
Feb 23 07:27:36 sshd[25412]: Illegal user tai from 128.164.159.93
Feb 23 07:27:39 sshd[25414❸Illegal user tu from 128.164.159.93
```

Figure 1. A sample transcript.

The numbers (1, 2, and 3) on figure 1 indicate the following:

1- *Initial scan with log scan signature, "Did not receive…"*
2- *First attack log of attempted login. Attacks typically follow scans by approximately 10 minutes, although some attacks begin sooner.*
3- *Last attempted login.*

In the transcript shown in figure 1, the entire attack lasted approximately 11 minutes, from scan to finish. The actual attack started at 07:26:40, and ended at 07:27:39. This is significantly shorter than normal, but there were still 148 illegal login attempts. With the speed of the login attempts, the attacking host is assumed to be on a high-speed Internet connection.

Table 2. Attack frequency.

Address	Length of Attack (h:mm)	Login Attempts	Userid root Attempts
203.194.147.248	2:26	4051	12
217.57.153.173	2:01	3698	718

However, there does appear to be a recent trend for attacks to be more frequent and last considerably longer. For example, two attacks shown in Table 2 lasted longer than 2 hours, and attempted a large number of unsuccessful logins.

It is reasonable to assume that given sufficient time, a brute force dictionary attack will eventually guess a correct password and compromise the host. For example, a computer, that was not part of this research, logged an attack that lasted fifteen hours and thirteen minutes, and had a total of 6,090 attempts at root login [3]. The attack originated from a US host, connected to the Internet through a cable-modem. Strong password protection, as well as disabling root login, is covered in the countermeasures section of this paper.

A total of 55 unique attack source IP addresses were checked against the respective national and regional Internet registries, and the countries of origin of the IP addresses were obtained. A high-level overview of IP address assignments [4] could lead to more specific searches at http://www.arin.net/whois. At the command line interface of a Linux host, similar information can be obtained with the command *whois -h whois.arin.net host_address*.

Table 3. Origins of the attacks.

Region	Country	Number of Attacks
AfriNIC	South Africa	1
APNIC	China	10
	Hong Kong	2
	India	1
	Japan	1
	Korea	3
	Malaysia	1
	Taiwan	3
	Thailand	1
ARIN	US	16
LACNIC	Chile	1
	Mexico	1
	Seychelles	1
RIPE	Bulgaria	1
	Estonia	1
	France	1
	Germany	2
	Great Britain	2
	Italy	2
	Norway	1
	Poland	1
	Romania	1
	Sweden	1

IP address assignments are delegated in a hierarchical fashion, by region and continent, and further subdivided [5]. Internet assigned numbers authority (IANA) regions are as follows: African network information center (AfriNIC), Africa region; Asia pacific network information center (APNIC), Asia / Pacific region; American registry for internet numbers (ARIN), North America; regional Latin-American and Caribbean IP address registry (LACNIC), Latin America and some Caribbean Islands; and Réseaux IP Européens (RIPE NCC), Europe, the Middle East, and Central Asia.

Table 3 shows the number of attacks for each region and country. While it was not possible to determine if the actual attack began from the logged IP addresses or from compromised computers, it can be said authoritatively that the attack on our host did originate from these computers. Anecdotally, most attacks are believed to originate from APNIC. As supported in the table, APNIC was responsible for 40 percent of the logged attacks. Sites from China were responsible for approximately 20 percent of overall attacks. LACNIC was responsible for 5 percent, the US was responsible for roughly 30 percent, and RIPE was responsible for 24 percent. The use of this information as a possible countermeasure with geographical location profiling is examined later in the countermeasures section.

An observation that has implications on countermeasure design is the time of attacks logged on different hosts within the same network and on the same subnet. Accordingly, a randomly selected source IP address logged as an attacker was chosen for detailed evaluation. This source IP address actually performed two attacks, and both were felt on five of the six computers used in this study. Table 4 shows the initial scan, and Table 5 shows the start of the attack. The attacks originated from Great Britain. The asterisk references adaptivefw, covered in the implementation section.

Table 4. Recorded initial scans.

ECU host	Scans	Scan 1	Scan 2
xxx.xxx.55.116	2	Feb 18 19:25:27	Feb 22 13:21:12
xxx.xxx.55.123	2	Feb 18 19:38:36	Feb 22 13:21:35
xxx.xxx.55.128	2	Feb 18 19:38:36	Feb 22 13:21:26
xxx.xxx.55.129	2	Feb 18 19:25:20	Feb 22 13:21:17
xxx.xxx.57.81	2	Feb 18 19:25:50	Feb 22 13:21:28

Table 5. Start of attacks.

ECU host	Attacks	Scan 1	Scan 2
xxx.xxx.55.116	2	Feb 18 19:29:33	Feb 22 13:25:10
xxx.xxx.55.123	2	*	*
xxx.xxx.55.128	2	*	*
xxx.xxx.55.129	2	Feb 18 19:29:25	Feb 22 13:25:06
xxx.xxx.57.81	2	*	*
* Attack blocked with adaptivefw (attack duration < 12 min)			

An obvious question for these brute force attacks is the code used. A mediocre source program written in C was posted in August, 2004, on the French Security Incident Response Team (FrSIRT) web site [2]. Recent attacks are more persistent, but follow the same methodology of simple brute force password guessing.

What are the possible sources of attacks, and what are the possible objectives? Bots and bot-nets, which are emerging new attack tools may provide an answer. A bot is a piece of software that is implemented on a remote machine and acts as an agent for a user or another automated system [6]. Hackers plant bots to target systems by a number of means including the access gained via brute force attacks. Once the attackers gain access to the victims' computers, the software automatically infects vulnerable computers. The bots then wait for commands from the attacker, who can control them and the compromised systems without the owners' knowledge. Large network of compromised systems (bot-nets) can be controlled remotely by the attackers and can be used for different purposes such as spam emails and identity theft. Some of the bots exploit weak passwords to gain access into other machines. It has been reported that bots "use a list of passwords and usernames to log on to remote shares and then drops its copy" [7].

A possible method of obtaining victim IP addresses and SSH authorized keys is suggested through SSH address-harvesting worms [8]. On compromised computers, the *~/.ssh/known_host* file provides IP addresses to other computers using SSH. The *authorized_keys* file contains encryption keys for key authentication.

3. COUNTERMEASURES AND DEFENSE TOOLS

Layered security defenses work well against this type of attack. Some security procedures mentioned here are applicable to any operating system, while others must be investigated for suitability. Also, the technical ability of the implementer may be prohibitive in adopting some defenses. Strong passwords, SSH server configuration, geographical profiling, adaptive firewalls, and port knocking techniques can be effective defenses.

The most important defense is the use of strong passwords or passphrases, memorable to the individual so they do not need to be written. Passwords should have a minimum length of six or eight characters, and contain a mix of uppercase and lowercase letters, numbers and symbols [9].

The SSH server uses a configuration file, */etc/ssh/sshd_config*, that can be tailored for specific security enhancements [10]. While offering robust security granularity, only three modifications to the default configuration are commented on here: disabling root login, changing the SSH server port number, and creating a legal warning that is displayed during login.

Perhaps the most important of the three methods is to deny root login. There is simply no effective argument or benefit to permit root to log into a session. If root access is required, users can change to root once connected. To disable root login, one can change line *"#PermitRootLogin yes"* to *"PermitRootLogin no"*, and then restart the *sshd* service.

The next configuration change will move the SSH server to a port other than 22. This deviation from standard port numbers can be extremely effective against brute force attacks, but may need to be clearly explained to students to avoid confusion. For example, to configure the SSH server to listen on unassigned port 755 [11], change line *"#Port 22"* to *"Port 755"* and restart the *sshd* service.

Finally, to provide a legal basis for prosecuting unauthorized access [12, 13], a terse warning about unauthorized access should be displayed during login. To enable this warning message, the phrase *"#Banner /some/path"* should be changed to *"Banner /etc/ssh/banner"*. Additionally, the file */etc/ssh/banner* should be edited to include a suitable warning. When finished, restart the *sshd* service. An example of a possible warning is shown later in the implementation section.

A locally written bash script, *adaptivefw,* performs SSH attack filtering in a manner similar to more complex log monitors, such as *swatch* (simple watcher) [14]. *adaptivefw* recognizes the attack scan and other abnormalities in the log file, and writes a rule to the firewall that blocks the attack for a pre-determined time.

Linux kernels can be configured with netfilter, which acts as a stateless filter for packets coming into, out of, or across the computer. Rules can be written to netfilter through the user space application, iptables. Iptables supports dynamic rate limiting of connections, which permits throttling of excessive connections from a single source while permitting other sources to pass. Referring to the syntax shown in figure 2, any new connections after two (hitcount 3) to port 22 from the same source (set), within a two minute period (seconds), will be dropped [15].

```
iptables -I INPUT -p tcp --dport 22 -m state \
  --state NEW -m recent --set

iptables -I INPUT -p tcp --dport 22 -m state \
   --state NEW -m recent --update --seconds 120 \
   --hitcount 3 -j DROP
```

Figure 2. Syntax that filters the data packets.

Our logs indicated that a significant portion of recorded attacks originated from outside of the U.S. Therefore, if the server is not supposed to have any active users that are located in a foreign country, the access can be blocked for connection requests that come from outside the U.S. In order to implement this protection layer, one has to have an automated and fast mechanism to identify the geographical location of IP addresses of the incoming data packets. A number of tools are available to be used for this purpose. For example, MaxMind GeoIP features free and paid databases to obtain IP address location information. GeoScope is another useful open-source Java toolkit that may be used to perform geographical analysis of IP addresses. Given IP address, GeoScope can accurately identify its geographic location [18]. There are other Java and ColdFusion libraries to lookup country code and language from IP address. Some of them use a local copy of the WHOIS database to perform efficient searches of country codes. Those tools can be adapted to be used in screening of the incoming connection requests.

Port knocking refers to the process of creating a connection to a computer with no scanable open ports [16]. Through a predetermined series of connection attempts, a firewall rule opens the port and communication is established. This technique is not supported on all operating systems, and is beyond the knowledge scope of new technology students.

4. OUR IMPLEMENTATION

A Linux firewall at 55.116 was configured to forward all port 22 traffic to an internal computer that listened on port 22. The firewall also had a SSH server configured to listen on port 21, but logged absolutely no attacks. While a port scanner would detect this subterfuge, the change is beyond the comprehension of the observed attacks. The logged attacks on 55.116, port 22, were actually forwarded to an internal computer, and not accepted by the firewall. Unfortunately, the concept is rather advanced for entry-level technology students to grasp. Therefore, our Linux hosts have only one computer with the SSH server port number changed.

On our SSH servers, root login was disabled. All attack logins as root were blocked by the SSH server, and did not get checked for proper password.

All SSH servers displayed a warning message during login, similar to the one shown in figure 3.

```
# cat /etc/ssh/banner

#######################################################################
# You are entering a secure ECU lab, intended for currently enrolled #
# students, or persons who have permission from the Department Chair.#
#                                                                     #
# Your source IP address has been logged.                             #
#                                                                     #
# Unauthorized access is prohibited and will be punishable to the    #
# full extent of the law.                                             #
#######################################################################
#
```

Figure 3. A sample warning message displayed by SSH servers.

Our password policy requires strong passwords for all users. Encrypted hashes of passwords were stored in a file accessible only by root, */etc/shadow*. Password aging was disabled for faculty.

On firewalls we used *adaptivefw*, a locally written bash script that monitors SSH log files for suspicious activity. At the beginning of the activity, a rule is written to the firewall that blocks the source IP address from access for several minutes. At the end of that time, the rule is automatically removed from the firewall. Blocked IP addresses are logged in the file */var/log/blocked_ip_addresses*. The date is formatted in Julian. Figure 4 shows the partial transcript of the output.

```
# less blocked_ip_addresses
002 14 54 57 Attack Did not receive from 70.22.153.239 with 1 attempts
<output omitted>
060 14 08 15 Attack Did not receive from  83.103.27.85 with 1 attempts
061 05 12 28 Attack root from  218.146.254.184 with 2 attempts
061 07 20 34 Attack root from  218.146.254.184 with 1 attempts
#
```

Figure 4. Partial transcript of *adaptivefw*'s output.

Querying the ARIN database will display the IP address country of origin, as well as contact information for abuse reports. If present, abuse contact information is contained in fields tech-c and admin-c. IP addresses from other regions will have that region's database uniform resource locator (URL). The following table shows a typical output of a web search for an IP address from Europe at http://www.ripe.net/whois for IP address 80.68.86.116. Note that a two-alpha character country code is used, which complies with the International Standards Organization (ISO) code 3166 [17]:

inetnum: 80.68.86.112 - 80.68.86.119
country: GB
admin-c: *contact-info*
tech-c: *contact-info*

The country GB refers to Great Britain, or the United Kingdom.

5. CONCLUSION

SSH brute force dictionary attacks have become more prevalent, persistent, and bold. Not enough is currently known about the exact purpose of the attack, although it can be surmised that compromised computers can be collected as bots and used to launch future attacks. Countermeasures have been effective so far, and once again a layered approach to security is the best defense.

Strong passwords are mandatory and the last line of defense, not the only defense. Passwords should be hash encrypted, and stored in a restricted file such as */etc/shadow*.

SSH server configuration is simple to implement, and can be highly effective. At a minimum, root login should be disabled. If possible, the SSH server port number should be changed. A login warning against unauthorized access should be implemented, as a foundation for any future legal action.

Finally, firewalls that adapt to attacks can be configured to limit attack persistence if supported in the operating system.

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Application of Technology in Project-Based Distance Learning

Ali Mehrabian*

and

Karla Alvarado*

* Engineering Technology Department, University of Central Florida
Orlando, FL 32816, USA

and

Isabelina Nahmens
Industrial Engineering and Management Systems, University of Central Florida
Orlando, FL 32816, USA

ABSTRACT

Present technology and the accessibility of internet have made distance learning easier, more efficient, and more convenient for students. This technology allows instructors and students to communicate asynchronously, at times and locations of their own choosing, by exchanging printed or electronic information. The use of project-based approach is being recognized in the literature as a potential component of courses in the faculties of engineering, science, and technology. Instructors may have to restructure their course differently to accommodate and facilitate the effectiveness of distance learning.

A project-based engineering course, traditionally taught in a classroom settings using live mode at the College of Engineering and Computer Sciences at the University of Central Florida (UCF) has been transformed to a distance course taught using distance modes. In this case, pedagogical transitions and adjustments are required, in particular for obtaining an optimal balance between the course material and the project work. Project collaboration in groups requires communication, which is possible with extensive utilization of new information and communication technology, such as virtual meetings. This paper discusses the course transition from live to distance modes and touches on some issues as they relate to the effectiveness of this methodology and the lessons learned from its application within different context. More specifically, this discussion includes the benefit of implementing project-based work in the domain of the distance learning courses.

Keywords: Distance Learning, Technology, Project-Based Learning, Asynchronously, Senior Design Project.

1. INTRODUCTION

Prior to the availability of computer technology used routinely today, distance learning was refered to as an individualized mode of learning only available through correspondence. Today, distance learning is commonly refered to as a field of education that studies pedagogical technologies and the design of advanced instructional systems used to deliver education remotely to students who are not physically present in the classrooms. Present technology and the accessibility of internet have made distance learning much more viable, and it evolved from traditional ways to robust, more efficient, and more convenient for students and instructors. Current technologies allow instructors and students to communicate asynchronously, at times and locations of their own choosing, by exchanging printed and or electronic information. New technology, such as WebCT, provides a more efficient and robust management system for remote classrooms. With this new trend in distance learning, the use of project-based approach is being recognized in the literature as a potential component for distance courses in the faculties of engineering, science, and technology. Faculties may have to develop new methodologies, and structure or restructure their course differently to accommodate and facilitate the effectiveness of distance learning. Some very recent studies documented the practicality and effectiveness of distance learning methodologies. (Mehrabian et al., 2007). Results from an early study of the desirability and feasibility of using project-based learning indicated that this teaching methodology has a useful role in distance learning (Macmillan, 1975). The case for employing project-based learning methods as opposed to more traditional teaching methods, where the learning path follows a carefully predetermined structure, has been argued elsewhere (Farnes, 1975).

In this paper, we briefly present our very recent experiences with the application of technology in project-based distance learning. This paper discusses the effectiveness of this methodology and the lessons learned from its application within different context. More specifically, this discussion includes the benefit of implementing project-based work in the domain of the distance learning courses. This paper includes lessons learned from the application of educational tools such as WebCT as a viable and efficient asynchronous remote classroom and document management system. We hope to gain invaluable insight by presenting our case and the lessons we have learned to the interested audience. We are very well receptive of exchanging ideas with the audience for new and improved methodologies and to increase the effectiveness of the methods presented here.

2. COURSE OVERVIEW

With a current estimate of enrollment of 100 students per annum, Senior Design Project is a required design course for all engineering technology majors taken during the last semester of their senior year at the University of Central Florida (UCF) in Orlando, USA. In this course students apply what they have learned throughout their college education in the form of a project. Thus, it is a “hands-on” course and required the students to design, build, and test an end product, commonly, a device. Students are also required to calculate the total cost of their projects, including the labor costs at a rate of $25 per hour. An estimate of the overall project cost including the total labor should be included in you final report. In most case, students work in teams of two to four members, and time is managed by team members approved by a faculty mentor with expertise in that particular area. It is the students' responsibility to schedule time each week for research, design, and fabrication of their project, a challenge to some students with poor time management skills. This course was traditionally taught in a live classroom settings using live modes. In 2006-07 academic year, this course has been transformed into a distance course taught using distance modes. In this transformation process pedagogical transitions and adjustments were required, in particular for communication facilitations and obtaining an optimal balance between the course material and the project work. Among many essential requirements, project collaboration in groups requires effective communication, which is encouraged and made possible with extensive utilization of new information and communication technologies, such as virtual meetings.

3. TECHNOLOGY AND TRANSITION

We utilize technologies such as WebCT, main types of freely available virtual meetings software (Yahoo Messenger and Windows Live Messenger), web-based cameras, microphones and other devices to make the transition from a live project-based class into a distance class. We also use Camtesia Studios and Tegrity as screen recorder for recording and editing high-quality lectures, and communication videos, presentations (including Microsoft PowerPoint) and screencasts to share online, as Flash, on CD-ROM, and on portable media devices, including iPod. During the transition process, we revised the syllabus and address many issues some of which are discussed here.

A) Electronics' Document Preparation and Posting: The Senior Design Project course must conform to the general guidelines outlined in a master document. There are also other required but informational documents called welcome document, class syllabus, and research methods handouts, etc. At the early stages of the transition, these documents are prepared in electronic format and posted on the class WebCT website. Students can access the class website and download these documents from anywhere at any time, asynchronously. Within three to four weeks, a written project proposal must be submitted by each group a posted deadline listed on the course website. This written proposal must be approved in advance by the group's faculty mentor. Approval will consist of an initialized electronics copy of the project's proposal and request for approval which should be attached to the electronic copy of the proposal. Through a time-saving and robust process, proposals and other documents are submitted by the students via course website. The instructor can easily and quickly access and download these documents for reviewing and grading purposes.

B) Conformation to Propose Standards and Specifications: An engineering project, device, etc. usually involves a set of specifications. Before starting the design process, and surely before any equipment is built and tested, a firm specification must be agreed upon by the customer and the engineer. Therefore, students start their projects by preparing a set of specifications that include the absolute minimum and maximum values of all crucial "design goals," "design objectives," and "design parameters." Students will not be graded on how well the final product meets the prepared specifications. They are graded to the depth to which the original specifications go and the extent to which it truly specifies the anticipated product as part of the design project. In other words, the final result of the project will be evaluated based on the project's proposal. Students must complete all of the goals and objectives that they outlined in their proposal. To align the project's outcome with the project's previously defined goals, objectives, and design parameters, WebCT is employed. This was achieved by using a novel approach in which under WebCT menu, an advanced electronic goal and objective-setting function was created. Each group input the project specifications accordingly and refer to them throughout the project. Accordingly, the function of the project's built end product was measured for consistency with the design parameters for project evaluation purposes.

C) Scheduling and Presentations: It is required that the final results and the final built device, including project demonstration, of the senior design project is presented in three formats: (a) presented orally by the students, (b) submitted as a written report prepared in accordance with the instructor's guidelines, and (c) presented in an electronic format saved on a CD-ROM. An electronic copy of the final report is submitted through the class WebCT site. Oral presentations will be "open to the public" and is scheduled during the last week of the semester. The Instructor can manage robustly many time management issues involved in scheduling and presentations. In this case they are managed by employing WebCT's communication tools such as discussion boards and electronics communication.

D) Collaboration Among Group Members: Collaboration among group members is a key issue in project-based distance learning in which students work in teams. In this process, communication among group members is facilitated through electronic communication via different modes. The students report that technology improved their collaboration ease and abilities, and it empowers them with more efficient, asynchronous collaboration skills. This is particularly applicable and very advantageous in our case. Due to geographic location of our institution and the scattered student population and urbanization in our state, the State of Florida, some group members live as far as 200 miles apart in some cases.

4. BENEFITS

Our experience in this case shows that while application of technology in project-based distance learning within the context of the senior design project might present some pedagogical challenges, it has the following substantial benefits. Due to the lack of space, we only present a few, but main benefits:

1. Time Saving: In an independent senior design project's distance learning environment, time is of an essence. Using WebCT as a class management tool saves time.

2. Student/faculty Interaction Rapidity: Unlike a live classroom settings in which faculty/student interaction is limited to live class time and perhaps office hours, utilization of technologies such as electronic mailing (E-Mailing), message boards utilization in WebCT, and instant messaging help with the rapidity of the student/faculty interaction. This is particularly applicable in project-based distance learning in which the students, many of them working adults, work in groups and require more rapid response due to a tight schedule between work and school.

3. Ease of Document Delivery: Unlike a live class in which the instructor shall make hard copies of the documents to be hand-delivered, electronics documents and file delivery and postings are much easier and faster. In our case, we utilized WebCT extensively to upload and post document files electronically and asynchronously.

4. Reduction in classroom occupation time: Due to the fast growth of our institution, any reduction in classroom occupation time is highly desirable and is beneficial to our department and college. The savings in classroom occupation time is directly translated to cost saving benefits.

5. *Cost Saving:* Considering the cost of learning and instructional time, document duplicating and delivery costs, and other costs such as classroom occupation time and costs, there are many cost saving benefits. In our case in which the educational physical space is limited, this process is highly desirable and cost-reductive.

5. CONCLUSIONS

In this paper, we discuss the application of technology in project-based distance learning within the context of an efficient and robust mode as it was applied to a senior design project course at the College of Engineering and Computer Science at the University of Central Florida in Orlando, USA. Current technology and the accessibility of internet have made distance learning easier, more efficient, and more convenient for students and for the faculty. This technology allows them to communicate asynchronously, at times and locations of their own choosing, by exchanging electronic and or printed information. Faculties of engineering and science may have to revamp and restructure their project-based courses differently to accommodate and facilitate utilization of effective modes of distance learning. In this case, pedagogical transitions and adjustments are required, in particular for obtaining an optimal balance between the course material and the project work. Project collaboration in groups requires communication, which is possible with extensive utilization of new information and communication technology, such as virtual meetings. This paper discusses the course transition from live to distance modes and touches on some issues as they relate to the effectiveness of this methodology and the lessons learned from its application within different context. More specifically, this discussion includes the benefits of implementing project-based work in the domain of the distance learning courses. They include but not limited to time-saving and cost-saving benefits.

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Bringing Logic to Programmers

Ken R. Riggs
Computer Information Science, Florida A&M University
Tallahassee, Florida, 32308, USA

ABSTRACT

We report the application of automated logic tools in a graduate level, introductory, Formal Methods of Software course. The tools used were a JAPE, a proof editor with Hoare Logic and Z/Eves, a Z editing and theorem proving system. Both tools require logical expertise. JAPE's Natural Deduction module was used to build this in students. We believe this essential skill is frequently in short supply among early graduate programming students.

To complement these tools, we built an elementary translator to compile JAPE's Hoare Logic into Java code. The translator works toward the goal of connecting programmers and logic. A small class survey suggests, using proof calculators and tightly binding logic to code seem to be powerful motivators and facilitators for students.

Keywords: formal methods education, Hoare Logic, Z specification, Proof editors

1. INTRODUCTION

A course in Formal Software Methods includes aspects of specification and of verification. A course might well contain Z or another method of formal specification, Hoare Logic (HL) for program verification and formal semantics in some guise. Our introductory graduate course uses Z and Hoare Logic (HL), and to a much lesser extent, Alloy and OCL. There are many other choices, but Z and HL expose the essential problems.

Whatever the choices for specific content, the primary challenge in such a course is helping students become fluent in logic. JAPE has proved an exceptional lead-in to the Z-Eves editor and theorem prover.

In the following we give a brief background on Z and Hoare logic with some comment on the problems associated with teaching them and opportunities provided by JAPE. We also report a small survey among our class. Finally, we present a nascent tool for translating JAPE Hoare Logic proofs to Java programs.

2. BACKGROUND

In this section we briefly discuss Z/Eves, Hoare Logic and the JAPE proof editor. We mean to establish the necessary logic abilities involved. We proceed in reverse chronology to presentation in the class. In the discussion of JAPE we consider not only JAPE but how we feel a proof editor such as JAPE addresses the concerns raised in the Z/Eves and Hoare Logic sections.

Z-Eves

Z is a formal specification language based on Zermelo-Frankel set theory and extended with a richly expressive set mathematical notations. It includes logical and set theoretical notations. This richness tests the skills of typical computer science students.

We originally approached that problem by adopting the Z/EVES [5] system which automatically checks both syntax and semantics. The Z/Eves system operates in a GUI that directly represents the symbol set of Z. More to our interest, it provides a proscriptive environment in which the student can safely experiment and receive immediate feedback.

We will not detail Z itself, but simply point out that many good Z specification references are available on- and off-line. [3]

As compilers check program correctness, Z/Eves check syntax and semantic consistency for Z specifications. It also presents Z in its natural orthography. The benefit is not small. In our first experience with Z/Eves, a few years ago, we discovered (minor) errors in an earlier master's thesis that used Z. However the automated formal manipulations carried out by Z/Eves are opaque to the normal student.

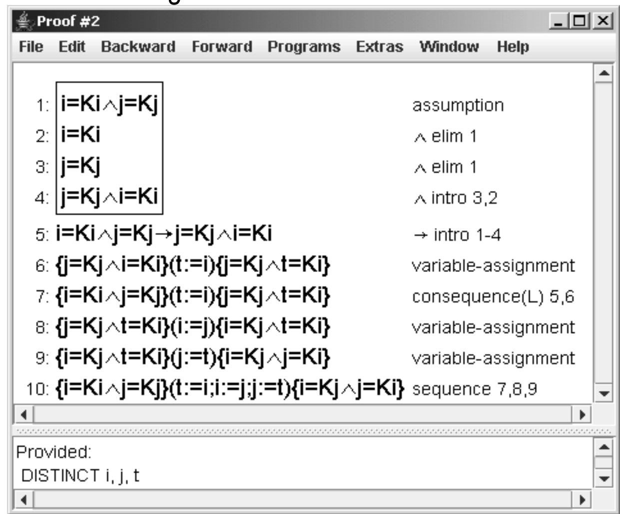
While the automatic checks and proofs of Z/Eves are invaluable, understanding them requires a deeper knowledge of the operation of the Eves prover. An approach to logic through a less powerful 'proof editor' (JAPE) seems to have mitigated this problem by increasing the students' knowledge both of theorem provers and of logic itself. This was partial motivation for adopting an intensive study of logic in the class. Jape helped make this feasible as well as its benefits in making Hoare Logic more accessible.

JAPE and Hoare Logic

Hoare (or Floyd-Hoare) Logic [2] is a software verification method dating back to the sixties . It is a foundational method for formal analysis of programs. An HL theory consists of a set of axioms relating logical facts about program state before and after program operations.

HL proofs have present the student with several difficulties: axiomatic structure, complicated axioms and demand for intuition about the proof. Moreover, the proofs rapidly grow in size. One example, completed by almost all students in the class, reaches 90+ lines, without detailed algebra. The JAPE proof editor's mechanical application of HL axioms selected by the student was a definite boon in organizing axiom application and assuring the students of their individual steps.

Fig. 1: A n HL Proof in JAPE



The simple HL proof in Figure 1 shows both pure logic lines (1-5) and the deduction sequence of Hoare triples (6-10) of the form {predicate} code {predicate}. It was created by selecting axioms from the Forward, Backward, Program and Extras axiom menus. JAPE posed the problem as line 10 and the student applied all other operations. The proof in Figure 1 is the end of this process. All students progressed well beyond this simple example. (Note lines are generally created in reverse order.)

The final FOL to HL sequence of JAPE HL proofs has a salutary effect on student confidence. JAPE HL proofs always lead back to pure logic as premises to the HL deductions. This reaffirmed the importance of the students' prior experience with the Natural Deduction axioms. (See below)

Automation greatly helps with control of complexity and specification of the loop invariant. Invariants, perhaps just because they were a major contribution of Hoare, are quite difficult for students as they are complex, abstract, and require meta-knowledge of the proof's direction. Having a visible overview of the proof's 'bones' was a boon to discussing the Hoare Logic axiom for while statements.

Figure 2: A 'while' proof in progress

```
ile  Edit  Backward  Forward  Programs  Extras  Window  Help
2: {i≥0∧k+i×j=Ki×Kj∧i≠0}(k:=k+j;i:=i-1){i≥0∧k+i×j=Ki×Kj}
   . . .
3: i≥0∧k+i×j=Ki×Kj∧i≠0→_M>0
4: integer Km
   . . .
5: {i≥0∧k+i×j=Ki×Kj∧i≠0∧_M=Km}(k:=k+j;i:=i-1){_M<Km}
6: {i≥0∧k+i×j=Ki×Kj}while i≠0 do k:=k+j;i:=i-1 od
   {i≥0∧k+i×j=Ki×Kj∧¬(i≠0)}
   . . .
7: i≥0∧k+i×j=Ki×Kj∧¬(i≠0)→k=Ki×Kj
8: {i≥0∧k+i×j=Ki×Kj}while i≠0 do k:=k+j;i:=i-1 od{k=Ki×Kj}
```

Figure 2 shows an HL proof containing a while loop. This snapshot was taken immediately after the application of the HL 'while' axiom. Five proof obligations have sprung into being as lines 2,3,5,6,7. One assumption must be made as in line 4. Those familiar with HL will recognize these as the requirements for total correctness of the while loop triple of line 8. The axiom complexity mentioned above is obvious, as we hope is also the value of having it invoked mechanically.

The difficult intuition mentioned before is: what is true *before* the loop, *during* the loop, and *after* the loop, which *also* supports the desired further conclusions. This is the 'loop invariant'. Its discovery typically requires real understanding of the proof and its goals, but has been solved for the student here by the logical statement: k+i×j=Ki+Kj supplied in the JAPE problems 'N-TUPLES'. The inclusion of invariants in N-TUPLES allows the difficulty of invariants to be approached gradually, through experience and examples that may be revisited. Surely this is the correct way to develop intuitions.

JAPE HL has no theory of arithmetic. Instead, the extras menu contains elementary algebra and an 'obviously' operation. This operation allows the user to justify a line as obvious without further proof and is properly used where algebraic manipulation would be required. We insisted student proofs using 'obviously' include the line numbers needed for the 'obvious' algebra. This break in axiomatic completeness did give an opportunity for some discussion as to what proof is.

Despite our ignorance of definitive research on the value for learning of such environments in general, we believe it is a common assumption that automated tools like JAPE are valuable teaching aides. Our opinion may well be based only on experience of ever more intelligent code editing and compilation systems such as Eclipse. However, we still believe that JAPE removes the drudgery but not the essence of reasoning in HL. Rather it allows one to focus more clearly on the difficult parts.

JAPE Natural Deduction

The JAPE [1] proof editor works with many logics. While out goal was HL as above, our initial topic was the 'Natural Deduction' logic theory in JAPE. Much of the benefit of JAPE is this ability to progress through a single tool to multiple goals, thereby modularizing the required material and building student skill and confidence. Figure 3 is a JAPE ND proof.

Fig. 3: A JAPE Natural Deduction Proof

```
Proof #1
File  Edit  Backward  Forward  Window  Help
1: ∀x.R(x)∧∀y.S(y)   premise
2: ∀y.S(y)           ∧ elim 1
3: ∀x.R(x)           ∧ elim 1
4: actual i          assumption
5: S(i)              ∀ elim 2,4
6: R(i)              ∀ elim 3,4
7: R(i)∧S(i)         ∧ intro 6,5
8: ∀z.(R(z)∧S(z))    ∀ intro 4-7
```

If there is one common FOL weakness among programming students, it would be quantifiers. Sentential calculus is familiar as program conditions. Predicates are not too far removed from objects and attributes, but quantification raises the logical bar. Figure 3 shows a simple JAPE natural deduction proof with quantifiers,

Students became comfortable with applying the the axioms of logic and with semi-automated proof before experiencing the more self-contained theorem prover of Z/Eves. Moreover, the JAPE display allows one to focus on problems such as empty domains under quantification, where we need to explain the automatic appearance of statements as "actual i". There are subtle issues where any handhold is welcome. Note that a student may progress on reasonably solid (and mechanically secure) ground without mastering all such subtleties.

Another plus in regard to formal methods was JAPE ND's disproof feature. JAPE ND allows the student to construct worlds that disprove a conjecture. Students readily completed these without formal knowledge of Kripke semantics. The value of learning to relate formulas to models in a formal software methods class we take as obvious.

3. EXPERIENCE

In this section we detail our experience with, and the students' evaluation of, the JAPE tool. We detail how JAPE Natural Deduction, JAPE Hoare Logic and Z-Eves were ordered. We also overview the students opinions on the basis of a brief and informal student survey on the JAPE tool.

Use

The students covered Natural Deduction, Hoare Logic and Z/Eves in about nine weeks. Five of those were devoted to JAPE ND and HL. Most completed the majority of the over 100 proofs and dis-proofs supplied with JAPE. This compared favorably enough with previous classes to invoke the small, informal survey of student experience below.

Overall, a priori ability seemed comparable to previous, 'pencil and paper' classes, but final achievement in HL seemed improved. Most notably, progress in Z seemed similar, if not improved, though much less time was available. The total approach allowed progress to a level the students (and the instructor) regarded as 'almost useful'. All students rated their command of HL at this level.

Initial class time was given to explanation of JAPE ND setup and operation principles. Class time included thorough analysis of example problems with solutions and the application of axioms. Better students completed essentially all ND proofs before going on to the HL portion.

The HL axioms always take some time to explain. In general the students seemed more active and acute in their questions, comments and realizations than previous, pencil and paper, classes. They certainly completed more problems than usual.

The class however showed some consternation when it was demonstrated that one complex problem (shown below) was not provable, i.e. the code was incorrect. This was used an occasion for demonstrating the link between HL and code. To that end, the instructor developed a tool to translate HL into Java. Section 4 describes the Jape2Java tool.

After this preparation, we tackled Z using Z/Eves, with somewhat better results in the remaining time than anticipated. Prior experience with semi-automatic proofs, with axioms and with models seemed to have a positive effect on performance and confidence and to provide insight in Z/Eves proofs.

Student Evaluations

A survey of students in a class of five is little more than anecdotal, especially as there was no chance of a control. Nevertheless, an outline of the results is interesting. We will relate the gist of responses.

First we considered preparation and predisposition. Students were asked if they were best at mathematics, programming or logic. Two thought themselves best at mathematics rather than at programming. None chose logic as their best skill. None had taken what they regarded as a ‘course in formal logic’.

Secondly, effort and achievement was estimated by reported hours spent and problems completed. Hours of effort were generally more for HL than for ND (ND 14.75 hours, HL 19.25 hours) despite the larger number of ND proofs. The 6+ hours per week over five weeks seems to indicate that a mechanical amanuensis did encourage effort. Student estimates of success went 94% in ND to75% in HL. This can be expected given the complexity of HL. Their self-evaluations were very like the grades.

Perceived knowledge and value was our final concern. Nearly all students felt they had gained an understanding of ND and HL adequate to use them. An introductory course only provides the basis for further long and serious application. Attitude is important. Students were positive about JAPE, about ND and about HL (well less so about HL!). Everyone felt they might, or could, find ND and HL useful.

4. JAPE HL to Java Translator

As a further step in strengthening the Logic to programming connection we constructed a translator (Jape2Java) to translate simple JAPE Hoare Logic problems into Java. The precipitating cause was a failed proof.

Failed Poof

Students showed some consternation over a problem (Figure 4) that could not be proven. The 'proof' is long (60+ lines). It must fail, if done 'legally'. This left the question: how can I show it false?

Fig. 4: A JAPE HL problem

```
{i=Ki∧j=Kj∧i≥0∧j>0}
(kq:=0;kr:=i;kc:=0)
{j=Kj×2↑kc∧j>0∧kq×j+kr=Ki∧0≤kr}
while j≤kr do j:=j×2;kc:=kc+1 od
{j=Kj×2↑kc∧j>0∧kq×j+kr=Ki∧0≤kr∧kr<j}
while kc≠0 do  j:=j÷2;kc:=kc-1;kq:=kq×2;
    if j≥kr then kr:=kr-j;kq:=kq+1 else skip fi od
{kq×Kj+kr=Ki∧0≤kr∧kr<Kj}
```

To show a problem false, i.e. unprovable, one may simply find a counter example. This may be done by constructing the code and finding the right input values to violate final predicate. The Jape2Java encoding of Figure 4 is given in Figure 5.

Fig. 5: Java Translation of Figure 4

```
void JapeProgram(int Ki, int Kj ){
int i = Ki, j = Kj;
int kq, kr, kc;

kq = kr = kc = 0;
//{i=Ki && j=Kj && i >= 0 && j>0}
if (i == Ki && j == Kj
        && i >= 0 && j > 0)
   System.out.println("Passed T1!");
kq = 0;
kr = i;
kc = 0;
//{j=Kj * 2 ** kc && j>0 && kq ..
if (j == Kj * Math.pow(kc, 2)
    && j > 0
    && kq * j + kr == Ki
    && 0 <= kr)
   System.out.println("Passed T2!");
. . .
```

The function header supplies integer constants for long division. It is followed by initializing code specific to the program. Predicates are translated to if-then-else tests with results output. Code is translated directly. Note that here remainder and quotient are in ‘kq’ and ‘kr’.

Given the Java program, students could find the error creating inputs. Having done so, they had a disproof of the proposed theorem in a program. Thus we believe it further strengthened the connection between logic and programmers.

Jape2Java [4] was created to do this trivial but tedious encoding. The initial version did only such simple problems as the one shown, but did help connect the logic and code by examples.

5. CONCLUSION

The axioms (of both ND and HL) were better understood using JAPE than in a pencil and paper approach. Effort, success and appreciation improved. The fully automated proofs in Z/Eves became more perspicuous.

JAPE's lack of axioms for algebra means that many proofs must be completed using the 'obviously' rule. This mirrors the non-axiomatic nature of real proofs. This lacuna in the axiomatic system is perhaps also a boon. The discussion of what was **‘obvious’** in a proof seemed valuable in itself.

A mechanical proof amanuensis, at least for programmers, seems to spur more effort and accomplishment. Students were much more aggressive knowing that (most) errors would be caught. They seemed to see it as game, which isn’t a bad understanding of axiomatic systems.

Jape2Java helped make the connection between HL and code. In our ignorance of a definitive exposition of the efficacy of mechanical aids for learning formal, logical or mathematical, concepts, we do believe that mechanization helps. Our survey seems to support this belief.

Future Directions

An improved Jape2Java translator, accepting more complex logicals, is under construction The primary logical problem is quantifiers. A reasonably robust translator could well be paired with a 'Java2Jape' translator for round-trip analyses on at least code snippets. Such would surely tighten the bond, in the student’s mind, between logic and programming.

6. ACKNOWLEDGEMENTS

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A Study of Science Teachers Utilizing Visual Programming Techniques

Cheryl Denise Seals
Computer Science & Software Engineering, Auburn University

and

L. Octavia Tripp
Curriculum & Teaching, Auburn University

1. ABSTRACT

This paper presents a study of learning in Stagecast Creator to discover more about novice programmer teachers, direct manipulation techniques and exploration of methods to create interactive lessons for their classrooms. The authors performed a longitudinal guided exploration of Stagecast Creator with two middle school science teachers. The results of these evaluations help to identify implications for educational simulations for novice programmer teachers and produce a set of initial system requirements.

1. INTRODUCTION

A study of learning in Stagecast Creator was conducted to discover more about novice programmer teachers and their direct manipulation techniques. The teachers that we selected for the study were science teachers that wanted to learn to utilize more technology in their curriculum. To further refine our requirements for future research study, and become more familiar with science teachers domain of discourse about computers and programming, we performed a longitudinal guided exploration of Stagecast Creator with two middle school science teachers. The results of these evaluations help to identify implications for educational simulations for teachers and produce a set of initial system requirements, which will be utilized to refine subsequent studies.

2. COMPARATIVE ANALYSIS OF SIM ENVIRONMENT

During the preliminary stages of this research project, we identified our argument of aiming to provide software with improved usability to increase teacher adoption of new educational software technology in their classrooms. We would begin our journey by studying existing simulation creation software, select software that most closely matched our teachers' classroom needs, and then to modify existing or design and create our own software to support our teachers and their reuse strategies.

Our first initiative was to conduct a language survey and create taxonomy to narrow the field of candidates for further study. The criterion for selecting these languages was that they represent different types of software that will support educational simulation. The plan was to evaluate at least one example from each of the following categories: Visual Programming; Programming by Demonstration; Simulation/Construction Kit and Software Reuse/Visual OOP. In the visual programming environments category we were introduced to completely visual environments, and one example of this domain is LabVIEW. LabVIEW is a scientist's construction kit to build Virtual Instruments by direct manipulation. The system programming is handled by three palettes, which are used for coding, debugging, and creating. All of the programming is handled by icons in these palettes, but with a wealth of icons the programming in this environment would be very complicated for novice users with having to negotiate the cognitive overload of learning to create programs with sequences of icons as in traditional programming with sequences of text. LabVIEW would be the most useful in this category for building working educational simulations, but this selection would be very complex and cost prohibitive (i.e. greater than $1000) for the average middle science school teacher.

In the programming by demonstration category, we were introduced to environments where all the rules are created with the use of a macro recorder device and the demonstration of actions are rendered as rules. This is acceptable for simple rules, but makes the creation of more complex rules more difficult. Of this category we will give details of one example, Stagecast Creator. Stagecast Creator is a simulation micro-world building environment, where programming actions are created with programming by demonstration techniques, and rules can be modified with direct manipulation. This environment had facilities geared to support novice programmer usability and would be useful in the creation of educational simulations, and could be procured for minimal cost (i.e. less than $100). Also, ActivChemistry (i.e. Chemistry construction kit and provides user a fixed number of parts to combine to perform experiments) was a very good candidate for further study, but only supports the Chemistry content area. We are identifying software packages that can be used by all science and mathematics teachers: therefore, environments we study should be able to provide more generalized solutions.

In the simulation/construction kit category, we were introduced to environments that supported the construction kit style of rule creation. The user simply chooses the rules they would like to use and just have to assign an order for rules to fire. This is a very good technique for novice users to create educational simulations and, one example, AgentSheets already had been used by students to create over a hundred simulations and could be procured with minimal cost (i.e. less than $100).

In the software reuse/visual object-oriented programming category we were introduced to environments that are object-oriented in their implementation and support software reuse. These environments would be very good for programmers to build simulations, but have little support for novice programmer simulation creation.

Creating this taxonomy of visual languages helped us to reduce our field of candidate languages based upon which languages we felt would be easily accessible to our teachers and not too cost prohibitive. We also wanted languages, which would support novice learning and reuse in the creation of visual educational simulations. We selected three simulation/construction kits (i.e. AgentSheets, Cocoa, and Hyperstudio) and one programming by demonstration system (i.e. Stagecast Creator)

Early on, it was found that our teachers had very little time to spend learning new technology and not enough time to build technology from scratch. They prefer to adapt content to make it more relevant to their lessons. Therefore, instead of using an exhaustive systems approach to learning to build simulations, minimalist self-study instruction was provided to teachers both to reduce their time in learning to use the environment [Carroll, 1990] and to explore the benefits of reuse programming in a visual simulation programming environment [Perrone, Repenning, 1998]

3. TEACHERS AS SIMULATION BUILDERS

This study pictured teachers as simulation builders who, as content matter experts in their classrooms, were the best candidates for designing educational simulations. Research here worked to reduce teacher frustration with programming. In many instances, teachers knew exactly what they wanted to model, and could create this functionality in the current AgentSheets computational model. Many teachers' domain analysis of the problem was very robust and sophisticated, but most rendered very simplified version of their models. However, since students' knowledge of the domain was limited, they would build structures that simple "look right" [Lewis et al., 1997].

With current tools, teachers might have difficulty transferring their elaborate mental models into working simulations without greater programming skill. In order to mitigate this difficulty for teachers, improved instruction with an example-based tutorial presenting different simulations of the same phenomenon could be provided that included variation in complexity and coverage. This would give teachers better understanding that a range of models can be generated from simplified problem analyses. The types of mechanisms, which are easy or difficult to model, could also be explained; however, this technique would limit exploration, which is in conflict with a minimalist hands-on approach to learning.

Even though these are simplified approaches to programming, many of the problems the teachers experienced appear to be similar to issues discussed for years in the literature on OOD and programming [Rosson, Carroll, 1996; Rosson, Carroll, Bellamy, 1990].

4. STAGECAST CREATOR STUDY

Our aim was to identify ways to motivate these novice programmers to create simulations, and continue to make their own contributions to our planned virtual learning community. In previous experiments, students were generally successful in their work with SC and reported that they enjoyed their experience. Our hope was that if teachers enjoyed building simulations they would utilized the tools and virtual community made available. Also that if their students had fun creating simulations, the students will spend more time in the environment to learn more about the content material, and with continued experience learn more about visual simulation programming.

The environment that we illustrate in the study is Stagecast Creator (SC), which is based on a movie metaphor and users create a cast of characters who interact within a simulation microworld. Users create SC simulations with a macro-recorder device that allows users to program by demonstrating and example, and also by direct manipulation. To demonstrate a rule the user selects the character to be programmed and as in the Figure below a bounding box or "spotlight" highlights the character to be edited. In this example the user wants to cloud to float across the sky. They would simple drag the cloud forward and that would record a new rule for this character. This makes it very easy for novice users to begin rule creation, but there are still some semantic complexities that arise. The spatial context and visual appearance are requirements of the rule's precondition. For example if two characters are next to each other while a rule is being demonstrated, both objects would always have to satisfy the precondition or the would not be executed.

5. LONGITUDIANL STUDY OF STAGECAST

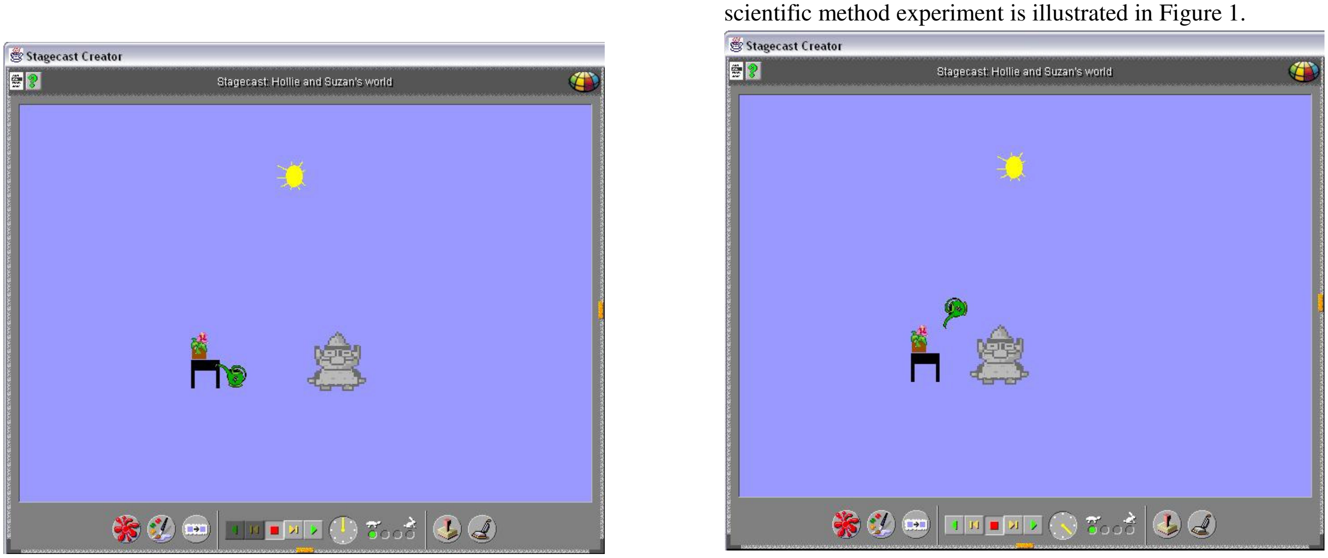
While developing a robust prototype, we discussed content material with at two middle school science teachers. Our development and studies focused on teachers in grades six through nine, and we selected two teachers who participated in the formal evaluation, and thus are already familiar with visual programming systems.

Similar to participatory design methods we wanted to get requirements for simulations from representatives of our potential user group, and get their perceptions on what they expected from a software curricula aid and ideas for simulations. We planned to perform 10 sessions with our two teachers. During our meetings we introduced them to a visual programming environment, gave them instruction to bring help them to bridge the Zone of Proximal development [Vygotsky]. There was considerable distance between what the users knew initially and their potential for knowing and creating in the area of visual programming. Our aim was to increase their level of competence in this area by coordination with the proficient or a more knowledgeable other [McMahon 1996].

In order to get more familiar with our teacher participants and their comfortability with computers and novice visual programming of simulations, we had an opportunity to perform a longitudinal study with two middle school science teachers scheduled for 10 weeks. The tool that they were to investigate was Stagecast Creator. We began their experience as a typical tutorial with guided exploration cards to guide their self-study. Teachers worked individually, during their learning session. It was suggested that their first learning session be structured as a minimalist tutorial in the form of guided exploration cards. The tutorial guides the teachers through starting up the system, opening a micro-world example, interacting with that example and examining the rules and creating new rules. For their second and third sessions the teachers explored some of the system supplied and facilitator supplied examples. Now that the teachers are more familiar with the environment and some simulation examples that can be created, we asked them to bring in a set of requirements. In specific we asked the teachers what topics they would cover during the year and of these topics, which they think, would be good candidates for educational simulations. For their forth session we began by reviewing the following suggested simulation topics for middle school physical science: Scientific Method, Physical Properties, Atomic Theory, and Chemical Properties.

To give the teachers a tangible task for their next four sessions, their task was to create two simulations that they would use in their first month of science classes. Both teachers agreed that their first in class experiment illustrated the scientific inquiry. And to illustrate the scientific inquiry the teachers would illustrate natural phenomena with a small experiment, ask their students to explain their observations, and finally the teacher will explain the scientific phenomena. The first set of simulations created by our teachers dealt with the area of scientific inquiry and their first two classroom experiments were to illustrate "cause and effect" scenarios. Scenario one was "If you add water and sunlight to a plant, then the plant will grow" as an illustration of photosynthesis. And the second simulation scenario was an illustration of scientific inquiry as well.

The first simulation created by our teachers was an illustration of photosynthesis and was described as follows: You begin the experiment with the sun shining and a flower in a pot. With the sun shining, as the gardener waters the flower it grows. This phenomenon is caused by photosynthesis, when the chlorophyll in the plant receives sunlight and water; this is transformed into energy and causes the plant to grow. In the simulation the gardener walks toward the watering pot, waters the flower, and the flower grows in a three-stage animation. The photosynthesis scientific method experiment is illustrated in Figure 1.



A. **B.**

FIGURE 1 TEACHER CREATED PHOTOSYNTHESIS

And the second simulation scenario "Raisins in ginger ale" was an illustration of scientific inquiry as well. The second simulation experiment was set up with ginger ale and raisins in a glass. The scenario is that you pour ginger ale into a glass and next the student adds raisins to the glass. The effect of carbonation in the water will cause the raisins to bounce to the top of glass propelled by carbon dioxide bubbles. Once the bubble reaches the surface it will burst and the raisin will fall back to the bottom of the glass. This cycle will repeat until the level of carbonation is to low and finally all the raisins will finally settle at the bottom of the glass. This scientific method experiment is illustrated in Figure 2.

6. TEACHER INTEREACTION DISCUSSION

When our teachers began this project their first question was "Do we have to draw a glass?" My answer was no we want to investigate you simulation creation techniques not your drawing ability so if we can find usable images we will use those and the ones we can't find we will have to create. Their next question was "Where can we get a big glass to put the raisins in?" the answer was "Let's go to the web and do a Google search."

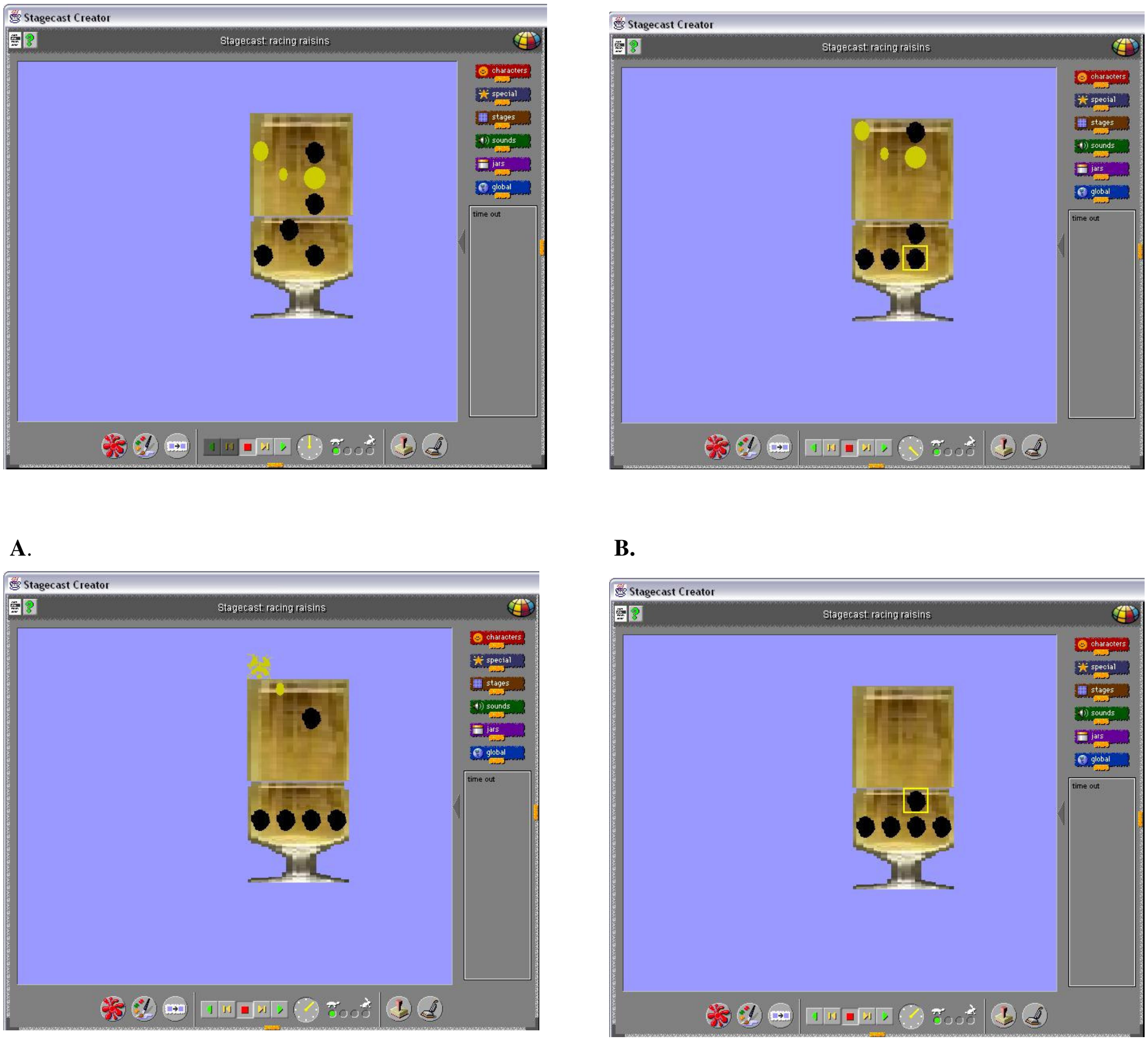


FIGURE 2 TEACHER CREATED CARBON DIOXIDE EFFECTS ON RAISINS IN GINGER ALE

We completed six sessions and gleaned a myriad of information from these sessions. We found that teachers were comfortable with the guided exploration style of our minimalist tutorial and were able to learn to create simulations with self-study of our tutorial materials. From these sessions, we also found that teachers could identify good candidates for simulation topics. This was also helpful in exploring motivational issues for our teachers. They were motivated enough to complete two simulations but were frustrated with having to creating their own objects and preferred to have a handy library of objects to reuse. The facilitators helped the users import some images from the web and import them into their simulation, but created all the rules for their working simulations. The is a great argument that teachers are motivated to perform activities that are useful for their classrooms, and with minimal training our teachers created working educational simulations that would be useful in supporting their science class topics.

Gathering these requirements of topics reaffirms that our teachers would find a software curricula aid very helpful in the classroom. We referenced these topics during our research and to complete our system. We plan to provide technical support of the prototype system, and the aim of this experiment was to ascertain whether the system will be robust enough for teachers to incorporate simulations into their science teaching, what if any impact it has on their students, and what impact they believe simulations and this environment will have on science education.

7. SYSTEM REQUIREMENTS

The end-user population studied in this sample was domain experts in the area of physical science, biological science, and physics. The age groups that teachers designed simulations for were middle and high school students. The goals of the requirements analysis phase were to narrow the scope of work and to begin preparing a structure for the design and development of the system. The system incorporated an environment for drawing, behavior creation and reuse of simulation microworlds and their components. System requirements are highlighted; giving a rational that substantiates requirements for general environment, robust support of reuse and others.

Table 1 Initial Requirements

I. General environment
• Providing a set of rich drawing tools which allow user to draw and modify objects
• Supports simple undo and incremental testing
• Clear recognizable common sense icons
• Easy creation/execution of graphical simulations.
• Satisfactory level of usability for novice programmers.
• Platform independent implementation (i.e. Java or Smalltalk)
II. Robust support of reuse
• A base set of generic template objects that can be reused
• Opening of multiple worlds to facilitate copy/past and reuse learning.
• Support user creation of object behaviors/interactions with rule templates or toolkit
• A library of reusable objects and simulation projects
III. Some secondary requirements
• Importing graphics
• Importing background graphics
• Support for multimedia and interactive simulations
• Ability to have macro recorder to record actions and create rules.

8. SIMULATION BUILDING IMPLICATIONS

Tools for Teachers

The aim was to have teachers able to create real simulations quickly; relying on their domain expertise and the new skills they have learned about simulation creation. The rationale for building simulations as educational material is practical. Kuyper states that simulations are independent of time and place, which makes them more readily available for real experience. He also states that simulations can provide a better conceptual model of a situation, and can be used to create virtual environments [Kuyper, 1998].

With this research, the following general problems with visual languages were identified: environmental, drawing tools, and with rule creation. A problem was also encountered with the level abstraction. Most of the environments studied were based on a grid-based concept and objects, when layered, did not operate as anticipated (e.g., rain on top of a flower in one case would evaluate only the object on top). Minimalist instruction was used by creating tutorial materials for analysis. The tutorials created were very helpful to users, got them started quickly, and aided them in completing the exercises with salient results. Ideas were also explored for the building of reuse libraries by providing categories for types of problems. Since this new environment was created for science teachers and simulations were categorized based on content areas like, for example, Mathematics, English, Biology, Social Science, etc. The first category to be built into the library was Physical Science. Within each category, the plan is for simulations to be organized in alphabetical order. The identification of general problems with visual languages in this study helped to build our knowledge of visual languages.

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On-the-job Difficulties , Online Induction Workshop and Moderators' Teaching Style: What Promotes Reflective Thinking?

Sari Bar-On
Department of Special Education, Levinsky College of Education
Tel-Aviv, Israel

Zvia Lotan
Department of Computers in Education, Levinsky College of Education
Tel-Aviv, Israel

ABSTRACT

Teacher colleges conduct workshops where novice teachers discuss work related difficulties. A central goal for these workshops is to promote reflective thinking which contributes to understanding work related difficulties and to deal with them in a rational fashion. Discussions held in an online environment that consists of a discussion forum are perceived in the literature as promoting reflective thinking.
This current study tested whether differences are found in the perception of the online environment characteristics as promoters and/or inhibitors of such reflective thinking, between two groups of novice teachers moderated in such a forum by different moderators.
Both of the groups perceived the online environment as promoting the thinking process for coping with difficulties. Findings demonstrate that the two moderators presented different styles. Participants whose moderating style was delegative considered their online discussions as more promoting reflective thinking in comparison to participants whose moderating style was combined. On the other hand the advancement in reflective skills of the group with the mixed style moderator was better than the other group.
The significance of this study is in the link made between the moderating style and the perception of the online environment characteristics as promoters of the reflection process**.**

Keywords: Reflective Thinking, Novice Teachers, Moderating Style, Discussions, Forums, Induction Year.

INTRODUCTION

According to professional literature, the first year of teaching is the most important in the socialization of the novice teacher to the teaching profession. The process of "becoming a teacher" has three stages: the pre service studies (the initial training or the pre professional phase), the induction year and the in service- the self directed professional development).

The Importance of the Induction Year

The induction year is considered as the most influential to the socialization of the novice teachers[4]. At the pre service phase the students were responsible to their own learning. The novice teachers, on the other hand, have complete accountability to the class achievements, they struggle with difficulties at the technical and the practical level of teaching skills, and they have to cope in conditions of complex and unpredictable reality [8,17]. During this year the novice teacher undergo several changes:

- A transition from supporting and nourishing environment with clear structure to culture of responsibility to others, in a different organization structure and unexpected and sharply changing environment .
- A sharp transition from idealistic perception of teaching to acknowledgment of tough reality, to face the "shock of the living class" [9]

The induction year is commonly described in metaphors of survival [17], or immigration [12] to describe the difficulties of novice teachers in their socialization to norms, symbols and schools culture. During this year they have to decipher simultaneously inner codes of the new culture as well as becoming agents of socialization to their pupils.

Identified Difficulties During the Induction Year

The novice teacher faces difficulties in three professional dimensions [17]:

1. The personal dimension – relates to the perception of them selves and the role of teachers, while being subject to feelings of loneliness, conflicts between different parts of their role, inadequate expectation of the system and shock of the unpredicted reality
2. The environmental or the ecological dimension: from the 1st day novice teachers have the same responsibility as a veteran. They have to adjust to school culture, to interrelation with colleagues, management, parents, social service & therapy professionals. Main obstacles are misunderstanding of the unwritten rules, the interpretation of expectations of the stuff.
3. The pedagogic dimension- relates to pedagogical content knowledge, to classroom management skills and teaching skills. Typical difficulties arise in lack of particular knowledge in the structure of the disciplines and the subject matter, in misinterpreting the ecology of class and maintaining rules and difficult control situation.

All these might lead the novice teacher to use survival techniques by becoming extremely formal, strict and inflexible in solving problems. Coping in the technical or practical level may strengthen a conservative and authoritative teaching style, while coping through reflective thinking, examines in a rational fashion the solution process and deepens the teaching know-how [7].

Reflective Thinking

Reflective thinking, is a intended and operative thinking about the hypotheses regarding beliefs or knowledge in order to obtain new conclusions. In this context, it is thinking about an experienced difficulty in order to better cope with it in the future. It [3]. It is an important tool for teachers in their work [15] and in particular to novice teachers. However, reflective thinking is difficult to attain and there is no simple answer to the question how to nurture it.

The reflective thinking tends to cluster in five distinctive representation: capability, coherence and closure, related operation, dialectics and context orientation. All the representations can appear in five level of abstract thinking.

A central goal for these workshops is to promote reflective thinking which contributes to understanding work related difficulties and to deal with them in a rational fashion.

Reflective Thinking and forums

Discussions held in an online forum are perceived in the literature as promoting reflective thinking [7,13]. The online environment suggests a new way to nurture reflective thinking in the process of training for teaching. In particular, the literature refers to discussion forums where an issue is defined and every participant is encouraged to discuss and express their inner thoughts in writing in a shared environment, at their own time and convenience. The collaborative model (unlike the mass public model) has specific characteristics that might help the participants to ameliorate their reflective skills:

1. Communicability of the media (e.g. asynchrony, opportunity for democratic discourse, togetherness, informal and paralingual hints, multiloguing and pilled up responses) [16,18]
2. Cognitive aspects of the media (e.g. thinking over and rephrasing responses, learning interactions, reflective transformation and exposure of subliminal knowledge [2, 6,16,18].
3. Emotional support [1].
4. Role of moderator in characterizing the technical, social, cognitive and functional bounds [11,14].

The moderator in this type of a discussion forum becomes less central but his moderating style is very important. Grasha [5] developed a tool for describing the teaching style in high-learning institutions. By his definition, a teaching style is a pattern of needs, beliefs and practices expressed by teachers in class. He has recognized five styles that represent strategies and orientations typical to college teachers: Expert, Formal authoritative, Personal modeling, Mediator and Delegative.

RESEARCH GOALS

The research of the connection between online environment characteristics including moderating and the promotion of reflective thinking is in its infancy. This current study tested whether the online environment characteristics perception as promoting reflective thinking is different between two groups of novice teachers moderated in discussion forums by two different moderators. Two research question have risen:

- Which of the characteristics of the online environment promote the participants' understanding of on-the-job difficulties and developing ways to cope with these difficulties?
- Will there be differences in the novice teachers' assessment of the online environment's characteristics between two groups moderated by different instructors?

These issues were studied by comparing two groups of novice teachers who were instructed by two different moderators.

METHODS

Participants

This study covered 40 novice teachers that participated in two online workshops, in teachers' college. The participants were divided into workshops randomly based on distance. In addition, the participants level of computer usage was similar, as well as the fact that the participants did not take reflective thinking class in a dedicated program.

The workshops were moderated by two college moderators who expressed their will to moderate online induction workshops, and were selected based on their experience in moderating actual induction workshops.

Research Tools

Quantitative and qualitative methods were applied in this research:

Online Characteristics Perception Questionnaire [10]

The characteristics perception questionnaire was passed to novice teachers in two online workshops**.** The questionnaire included a list of 20 characteristics of the online environment defined from the research literature and validated in a 98% agreement by expert judges. The characteristics included statements regarding the communicative and cognitive value of online medium ("the event is written and not spoken", and "one can write at any convenient time"), assignments and role of moderator and participants: The participants rated the characteristics in a 5 step scale from very promoting to delaying and irrelevant**.**

Moderating Style Testing Questionnaire [5]

The moderating questionnaire was passed to the two moderators and their moderating style was determined. The questionnaire, includes a list of 40 statements about moderating styles, in a Leicart scale from 1 thru 7, for example, "students crystallize learning experiences by themselves".

The relativity Index

This index expresses the relation between the number of messages received from the moderator to the number of messages received from the participants in an online forum and is indicative of the level of intervention by the moderator.

Analysis of Reflective Thinking Representations in 5x5 matrix [10]

The logs of the online workshops were copied for both groups and the participants' messages underwent content analysis in order to find changes in reflective thinking components in participants' responses.

RESULTS

Online Environment Characteristics Categories

The online environment was perceived as promoting reflective thinking and resolving dilemmas. About 80% of the participants in both groups evaluated the online environment characteristics as promoting reflection. Over half of the participants evaluated the characteristics as very promoting. Three categories emerged from the questionnaire of online environment according to their promoting potential:

Role Array in the Workshop: This criterion includes characteristics which describe the role of the moderator and the roles of the participants in the discussion group ("The moderator expresses her personal opinion as does each of the participants")..

Media: this criterion includes two subdivisions:

1.Characteristics related to the communicability of the media (e.g. asynchrony),

2. Characteristics related to the cognitive aspects of the media (e.g. thinking over and rephrasing responses).

Assignments this criterion includes characteristics of assignments imposed on the participants by the workshop moderator (for example: "the participants must react on the second week to a specific event").

In both of the groups it was found that the participants perceived the online environment as advancing the understanding of difficulties and promoting the thinking process for coping with difficulties. The Role array in the workshop was perceived by the participants as a most homogenous category that promotes reflective thinking and understanding of the educational situations. The cognitive qualities of the online environment were perceived as better promoting than the communication qualities of the Media, while the Assignments were perceived as the least promoting of all categories.

Moderating Styles

Significant differences were found between the groups regarding the teaching style: The moderating style of one moderator(A) was determined as delegative style which emphasizes students' independent work and interacting upon their request and thus considered less intrusive. The other moderator was determined as combination of Mediator, Personal Modeling and delegative, which emphasizes the nature of student-teacher interactions and thus considered as intrusive style.

The Relativity Index

A ratio of 1:17 was determined between the number of messages of the delegative style moderator (A) to the number of messages of the participants in her workshop, and a ratio of 1:6.6 between the number of messages of the combined style (in group B: Mediator, Personal modeling and Delegative) to the number of messages of the participants in her workshop.

Characteristics Perception

No differences were found between the groups as of their perception of characteristics in the following categories: Media characteristics and Assignment characteristics. As to role array characteristics in the forum, results show that an orientation towards differences between the groups was found ($p<0.82$), so that the group moderated in the delegative style (group A) evaluated the role array characteristics ("The message is pointing to the colleagues" and "group mediating is performed by the colleagues") as the most promoting of reflective thinking than any other category. in comparison, the group moderated in the combined style (group B) viewed these characteristics as less promoting reflective thinking.

Participants who were instructed in a delegator-style, evaluated the discourse with their fellow participants as better promoting than the group that was moderated by a mixed style. Limited involvement of the moderator encourages the participants to trust the instruction skills of their peers.

Level of Reflective Thinking

All the participant relate during the year to all three dimensions of professional development (personal, environmental and pedagogic). However the qualitative paradigm revealed by using content analysis of the discourse, that three participants in group A (delegative style) didn't improve their reflective skills at all and remained in the lowest level of representation. On the other hand, in group B (mixed style) participants improved their level of reflectivity.

The differences between the two groups are summarized in the table:

Category	Group A	Group B
Moderator to participants response ratio	1: 17	1: 6.6
Teaching style of the moderator	delegator	Mixed style: personal model, mediator, delegator
Role array contribution to reflective teaching	Significance of participants	Significance of moderator
Development of reflective thinking	Range of proficiencies in reflective skills.	Prospects for growth: all improved their level of reflectivity

CONCLUSIONS

The findings show that the different moderating styles of the discussion moderators were the key factor in the difference between the two groups. One was moderated in a delegative style, in which the moderator seldom intervened in the discussions and the center of the discussion was the conversations between the participants themselves. On the other hand, group B was moderated in a combined style, in which the moderator often interacted with the participants, suggesting alternatives, asking questions and encouraged to develop considerations in their decision making processes.

Despite the differences in the moderating styles, the online environment characteristics were perceived as promoting the understanding of difficulties and dealing with them, pointing at assessing this environment as promoting reflective thinking.

The near significant differences between the groups were found in the characteristics of the role array category, which is closely associated with the moderating style. Participants, who were moderated in the delegative style, appreciated their own discussions as more promoting of reflective thinking than participants who were moderated in the combined style. The delegative style group evaluated more the a-synchronic characteristics of the media which though it's delayed response nature, allowed for responses from a larger number of participants. This finding may be attributed to a lower involvement of the moderator throughout the year which delegated the moderating role to the participants. They learn to trust the self moderating of the group and appreciate the a-synchronic characteristics of the media as contributing to the deepening of the discussion about the event and coping with it.

This corresponds with Salmon [14] that calls the group moderator to reduce the level of involvement in the discussion as it progresses.
On the other hand, the group with the higher moderator involvement expected more involvement on behalf of their moderator. However their achievements and advancement in reflective thinking corresponds with Schon [15] and the vast literature on teaching styles and its influence on students' achievements.
More attention should be paid to the moderator role in forums. Research should be constructed on other teaching styles in forums in order to find the interrelations and connections of teaching styles on online groups.

The significance of this study is in the link made between the moderating style in the learners' community forum and the perception of the online environment characteristics as promoters/inhibitors of the reflection process.

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Embedded System Education for Computer Major in China

Tianzhou Chen[1], Wei Hu[1], Chen Zhanglong[2], Wang Jolly[3]
[1]College of Computer Science, Zhejiang University, Hangzhou, Zhejiang, 310027, China
[2]Department of Computer Science, Fudan University, Shanghai, 200433, China
[3]PRC Education, Intel China Ltd. Beijing, 100020, China
{tzchen, ehu}@zju.edu.cn, chenzl@fudan.edu.cn, jolly.wang@intel.com

Abstract

In recent years, embedded system has become of the most rapid development directions in computer discipline. Embedded system is at the intersection of control system, command and control, wireless data systems, real-time system and so on. This paper describes the efforts in China to teach computer major students how to master the necessary knowledge and skills from embedded system.

Keywords: Embedded System, Curriculum, Education, Program and Computer Science.

1. INTRODUCTION

Embedded systems have played an important part and will be more important than ever with the progress of semiconductor technology. They are used in our cars, mobile phones, set-top boxes and plenty of other electronic products. With the complexity and prevalence of the embedded devices grow rapidly, the performance, reliability and durability is now the central focus and how to improve the design, implementation and development of the embedded systems becomes more important and urgent. More knowledge and skills are needed in the research and development of embedded system. This is also the aim of education in universities.

The teaching and design of embedded system curriculum is a difficult and challenging task for the universities. Though computer-based embedded systems have been designed for more than 30 years, the subject of education in embedded system of the universities is always new, relatively undefined one [1]. There are still many practices of education in embedded system in universities all over the world.

Though trying to teach embedded computing as a unified topic is a difficult task, the undergraduate embedded system education is still developing at Carnegie Mellon University [2]. P. Koopman et al present the approach of Carnegie Mellon University to organize and teach the diverse areas of embedded systems. The education of embedded systems is divided into embedded application areas and cross-cutting embedded skill areas. Each area is also divided into different sub-areas and different teaching approach is designed for each sub-area by their distinguishing features and key skills and principles.

At University of California Berkeley, the education design of embedded system comes from their strong research on embedded systems [3]. Their curriculum is based on bottom-up aggregation of interests and approaches. The intersection of system theory and computer science is the most important guiding principle for the teaching at this university. The graduate program presented in [3] is divided into three parts: (1) design of embedded systems: models, validation, and synthesis; (2) advanced graduate courses and (3) civil and mechanical engineering. These courses will be arranged according to the grades, abilities and needs of the students to teach their master the knowledge and skills of embedded systems. The detailed curriculum design can be referred to [3] at University of California Berkeley.

There are also many other universities and institutes which attach importance to the education in embedded system such as University of Waterloo [4],Vanderbilt University[5], National Tsing Hua University (Taiwan, China)[6], Royal Institute of Technology [1], The Artist Education Group[7] and so on. They have provide us the experiences and lessons from their embedded system education.

The embedded system education is a challenging undertaking. It is the same to the universities in China. In this paper, we present the efforts in embedded system education in China.

The paper is organized as follows. Section 2 describes the embedded system education in China including the curriculum design, practices and so on. Section 3 presents the experiences from Universities at China. Section 4 offers conclusions.

2. EMBEDDED SYSTEM EDUCATION IN CHINA

Educational Context

Traditionally embedded systems are designed according to their specific application areas. These areas have so few intersections, thus they are almost different entirely ones. But recently embedded systems have become an intersectant discipline covering mechanical engineering, control system, network and so on. This is a discipline which is not mature and how to teach embedded system is not a clear perspective. P. Caspi et al [7] give us what are the obstacles:

1. Diversity of origins: different specific application domains have their own features and intellectual tools.
2. Diversity of cultures: the difference of embedded system engineering embranchment has brought about a large diversity of cultures.
3. Diversity of practices: the possible implementations are different according to the embedded system area.

These obstacles have led quite naturally to a very large choice of embedded system education. The universities should overcome these difficulties when begin the embedded system education.

Another factor considered is the requirements from industry. The vendors of embedded system have to face the fast development in embedded technology, the demanding requirements from the users and the stress from the rivals in the same areas. Their views should be taken into account and some suggestions have been given in [8] such as: the curriculum should be divided into four segments and three months should be given to each team project work and practical experience through industry placement.

Approach to Embedded Education in China

The embedded system education should be designed more carefully and reasonably to teach the students effectively and meet the requirements from research and industry. According to the research and industry environment in China, embedded system is divided into embedded software and embedded hardware. The focus is on embedded software and the latter is commonly used as the prerequisite. Thus our embedded education design emphasizes on embedded software. The landscape of embedded education in China can be shown in Fig.1.

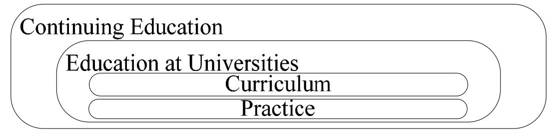

Fig. 1. Landscape of Embedded Education in China

Embedded education in China consists of two parts:

- Education at Universities. Education at Universities is the basic part of embedded education in China. Students including the undergraduates and graduates will be educated at universities. They will learn the basic theories, skills and tools, which they will use in their career.
  - The concepts, theories and skill experiences in embedded education are included in the Curriculum program.
  - Practice program provides the embedded practice such as experiments and projects to students to improve their practical experiences.
  - Engineers from industry will be invited to teach students the experiences from actual production.
  - As a natural result, the teachers at universities can discuss with these engineers to improve the curriculum and reduce the gap between the education at universities and industry.
- Continuing Education. The development of embedded system is rapid and the knowledge of those who do research and teaching on embedded system, as well as those who go to industry should be up-to-date. Thus they should be provided with continuous education on embedded system. This will be achieved by universities together with the industry.

In this paper, we describe the former Education at Universities as the focus.

Curriculum Design

The embedded system discipline includes co-design of hardware and software, embedded architecture, real-time operating system, embedded product design and so on. Some other relative courses, such as some courses from computer science, are also needed as the prerequisite and accessorial ones for embedded system education Besides these necessary knowledge, the practical skills must be taught to the students to help them master the typical development tools for embedded systems and enhance the ability to develop software/hardware for embedded systems. And in some specific application areas, such as handheld electronic products, digital home appliances and automobile electronic, there are special tools and methods for embedded system development, which should be taught to the students after carefully selection.

The curriculum design is considered as a great challenge for its complex. According to the requirements from embedded system, the curriculum areas can be cast as a matrix organization.

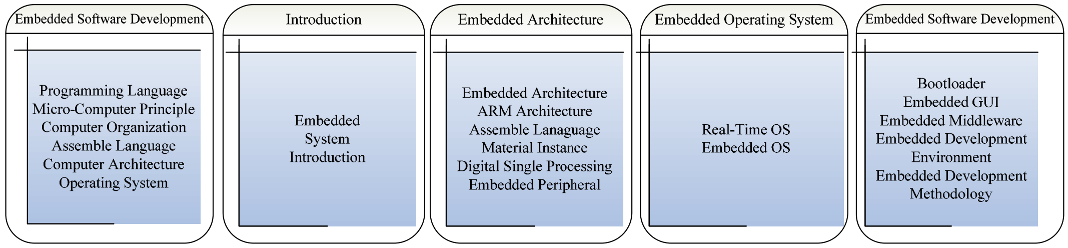

Fig. 2. Courses organization

The Basic Courses are designed as Undergraduate Program for the undergraduate. The main courses are selected from Computer Science (CS) discipline and they are all the foundation of embedded system education. CS is used to describe the abstraction of the real world and the physical implementation will be hidden behind it. Usually embedded systems rely on computer science to construct. The selected courses from computer science emphasize on teaching the undergraduates how to abstract the real world from the perspective of computing system. These courses are the prerequisite ones to learn the embedded system theory and skills, which will be taught to the undergraduates since they enter university as freshman. The juniors will start to learn the introduction of embedded system. From then on the real education of embedded system begins and will continue to the Advance Courses for the graduates.

The Advance Courses are designed as Graduate Program for the graduates or higher qualification. Some excellent undergraduates can take these courses if they master the Undergraduate Program very well. More embedded system courses are introduced in this program.

The curriculum has five main parts, as shown in Fig.2:

1. Prerequisite. This part includes Programming Language, Micro-Computer Principle, Computer Organization, Assemble Language, Computer Architecture, and Operating System. These courses are selected from CS courses. They are the theory basis of embedded system.
2. Introduction. The Embedded System Introduction is the integration of the prerequisite courses and includes the digital circuit course. This part is used to expand the students' horizons.
3. Embedded Architecture. The embedded architecture will be introduced to the students including the common embedded architecture design, assemble language used in embedded system, Marerial Instance including XScale and some other processors, Digital Single Processing (DSP) and embedded peripheral. Because of the broad usage of ARM processors, ARM architecture is also included in this part.
4. Embedded Operating System. Embedded operating system will be introduced in this part including real-time OS and embedded OS. The concept of real-time system will be illustrated. We will teach the students why OS used in embedded system is different and how to improve as well as to implement the embedded OS.
5. Embedded Software Development. This part will teach the students how to develop software for embedded system. The flow of embedded software development will be described and will make the whole curriculum more complete. Bootloader design and embedded Graphics User Interface (GUI) are introduced. And the development environments such as Windows CE integrated development environment, Tornado and other ones will be introduced to the students. These courses will be introduced to the undergraduates in some universities in order to train the embedded software developers.

Practice Design

In order to link the theory and practice, the practice in embedded education should be designed carefully and must be related to the industry/research to reduce the gap between the education and industry/research. The practice is evenly distributed over the whole embedded education at universities. There are three different types of practical assignments. Experiment is the basic practice. It means devices and tools are provided to the students, so that they can use them to verify the concepts by doing some relatively simple experiments and learn how to use these tools in embedded system. They are the basic introductory material to the practice. These experiments are designed carefully and will be open after a unit of the course. The Projects, which are organized as the design and integrative practice of a course, are assigned to the students to improve their knowledge further. These two types of practices are concomitant ones with the courses all along. Research is a special practice which is the advanced topic to the Graduate Program. The selected graduates will join in the research laboratories and complete some research tasks as a member of the research team.

As an additional practice, some speakers will be invited from both industry and research. These speakers bring from reality the thoughts, directions, and tools to the students. This makes the students closer to the

academic hours	hands on lab hours	Course name	Introduction	Organization of Embedded System	ARM Architecture	Introduction of XScale	Embedded Operating System	Real-Time System	Programming of Embedded System	System-on-Chip	Embedded Middleware	Network of Embedded System	Embedded Database	Embedded Linux	Embedded Intel Architecture	Software Design of Embedded System	ARM Assemble language	Experiment
16	32	Embedded Software	*						*					*				*
16	16	Development of Embedded System	*		*										*			*
32	24	Embedded System Design	*		*		*									*		*
20	12	Embedded System and Application	*				*	*								*		*
48		Principle of Embedded System	*	*	*												*	*
24	24	Design and Development of Embedded System	*		*		*									*		*
32		Embedded System	*		*		*									*		*
20	16	Embedded System Design	*		*		*					*						*
32	20	Principle and Design of Embedded System	*	*			*									*		*
22	10	Embedded System	*		*		*		*									*
48	32	Embedded System Design	*		*		*		*									*
16	44	Embedded System	*	*			*		*									*
36	12	Embedded Computing Design	*		*		*		*									*
32	32	Embedded System Design	*				*		*							*		*
24	6	Embedded System	*	*	*								*			*		*
48		Embedded System Foundation	*	*	*	*	*							*				*
24	48	Principle and Application of Embedded System	*	*	*		*	*		*	*							*
38	18	Embedded System and Application	*	*	*	*	*	*	*									*

Fig. 3. Curriculum at universities in China

application and research so that they can know the needs of industry and research. And as a natural result, these speakers will also provide the opportunities for the teachers to discuss with them. In this way, the embedded education at universities will be improved.

3. Education Experiences

According to the above contents, the universities in China organize their embedded education individually. In this section, we will introduce the education experiences at universities in China.

Many universities in China have opened the embedded system courses. The following table shows the curricula in different universities in China including: Wuhan University, Nanjing University, Beijing Institute of Technology, Harbin Institute of Technology, Xiamen University, Peking University, South China University of Technology, Xi'an Jiaotong University, Southeast University, Harbin Engineering University, Northeastern

embedded education, on the other hand, sometime they can unite with the companies to introduce the experiences from industry and to find out what the industry needs. Fig.6 shows these workshops.

As part of the Intel® Innovation in Education initiative, Intel collaborates with universities around the world to accelerate the advancement of research and curriculum to meet rapid technology changes. Intel's support of higher education currently extends to more than 100 universities in over 30 countries. In China, Intel works with around 25 key universities to further enhance the quality of

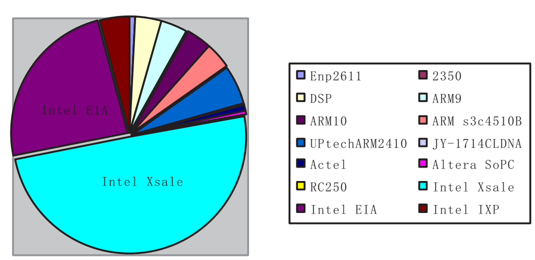

Fig. 4. Experimental devices at universities

curriculum, support classroom instruction and research by providing them with access to the latest technology and technical know-how. PRC Education of Intel China held annual embedded curriculum forum since 2001, which invited the some best embedded teachers.

With Training the trainer strategy, PRC Education of Intel China has built up the Intel-Zhejiang University Embedded Technology Center (ETC). ETC engages and influences more and more new universities with Intel Embedded curriculum program, keeping regular warm activities and connecting more and more faculties. ETC arranges quarterly Workshop, regular tech trainings for universities, faculties' forum, on-line communications, joint effort on textbook draft and syllabus optimizing. ETC has held 8 workshops, involved totally 477 faculties from 129 universities. The lecture topics covered in this course include: embedded processor architecture and programming; I/O and device driver interfaces; OS primitives; real-time resource techniques and application-level embedded system design concepts. The hands-on lab component will provide students with direct experience on both the hardware and software commonly used in embedded system design. This course is designed for the undergraduate or graduate students in Computer Science. There are 47 new embedded courses in universities base on the ETC curriculum workshop. 3797 undergraduate students and 1355 graduated students are learning those embedded courses.

The Ministry of Education of China and the Ministry of Information Industry held the Intel Cup Undergraduate Electronic Design Contest-Embedded System Design Invitational Contest since 2002.

With the help of Ministry of Education of China, Intel China Ltd organizes the six universities into a microcomputer curriculum innovation group, which include Zhejiang University, Fudan University, Peking University, Tsinghua University, Beihang University and Shanghai Jiaotong University. The microcomputer curriculum innovation group works on updating the microcomputer curriculum from the embedded system. The text book named embedded Intel architecture microcomputer laboratory course has published in

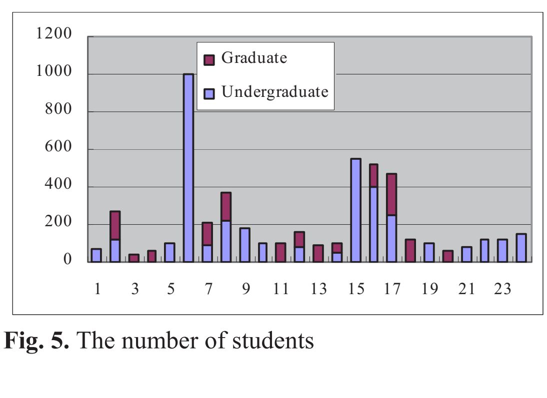

Fig. 5. The number of students

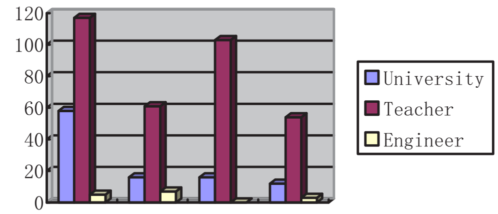

Fig. 6. Workshops for embedded education

August 2006.

4. CONCLUSIONS

Embedded systems cover a large range from semiconductor technology to embedded software development. We introduce the embedded education at universities in China. What we stress are the foundation of basic theory, the practice linked with the theory, and the relationship between industry and research. Embedded education in China now focuses on embedded software. The curriculum is designed as the Undergraduate Program for the undergraduates and Graduate Program for the graduates or higher qualification. Practice is designed to link the theory to reality. As the progress of embedded technology, embedded systems will be more important than ever, and embedded education will be more attention-getting. Embedded education in China will evolve with the advance of embedded system.

5. ACKNOWLEDGMENTS

We wish to acknowledge the help from the teachers at universities in China.

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Project-based Virtual Instrumentation in Engineering Education

Özdemir GÖL
School of Electrical and Information Engineering, University of South Australia
Adelaide SA 5001, Australia

and

Jan MACHOTKA
School of Electrical and Information Engineering, University of South Australia
Adelaide SA 5001, Australia

and

Zorica NEDIĆ
School of Electrical and Information Engineering, University of South Australia
Adelaide SA 5001, Australia

ABSTRACT

Since its inception in the mid 1980s, the notion of virtual instrumentation, propelled by the proprietary G-language[1] computing language has had a major impact on engineering and science activities. The growth and widespread use of virtual instrumentation in industry, academia and research justifies the inclusion of virtual instrumentation programming in university level engineering education programs. It is postulated that this is best done by the adoption of the project-based learning paradigm.

Keywords: Virtual instrumentation, project-based learning, engineering education.

1. INTRODUCTION

Since the mid 1980s, using virtual instrumentation programming in developing and implementing engineering solutions has become a potent approach. The developments were expedited by the advent of LabVIEW, an acronym coined from **Lab**oratory **V**irtual **I**nstrumentation **E**ngineering **W**orkbench [1]. When first released in 1986 on the Macintosh platform, LabVIEW may have been considered nothing more than a cute computing curiosity. But today it is widely used both in industry, research and academia as a powerful and full fledged computing language. Its widespread use justifies its inclusion in university engineering education programs [2] - [6].

2. PROJECT-BASED LEARNING

In contrast with traditional teacher-learner interaction with the teacher virtually conducting a monologue without much interaction with the learners who merely assume the role of passive spectators, problem-based learning has been hailed as a pedagogical approach which promotes initiative to explore toward achieving *deep-learning*. Project-based learning takes the approach to its logical extension by the application of problem solving skills to the actual implementation of practical solutions. The merits of project-based learning, particularly in engineering education are increasingly recognised. Approaches vary from incorporating project-based learning in a mixed learning framework [7] to substituting traditional teaching paradigms altogether with project-based learning.

It is virtually impossible to teach someone anything unless that someone is motivated enough to learn. This is where the project-based learning becomes relevant, especially in the case of engineering education. Because, it promises success, provided the learner is motivated. At the same time it compels the learner to accept responsibility for one's own learning as the price for success. The rewards are acquisition of skills, lasting competencies and – of course – self respect!

3. VIRTUAL INSTRUMENTATION PROGRAMMING

Conceptually, a virtual instrument is an emulation of a physical instrument which has the feel of the actual instrument, performing the same functions, but doing that much more flexibly with extendable functionality [4]. As such it is ideally suited to providing flexible instrumentation solutions for a gamut of engineering problems ranging from data acquisition for test and measurement to concurrent and post processing of data. However, virtual instrumentation programming can also be effectively used in modelling and simulation of engineering devices and systems, as well as in controlling such. This should explain why virtual instrumentation programming should be regarded as a topic of importance and included in engineering curricula.

At the University of South Australia we currently offer virtual instrumentation programming as an elective course at both undergraduate and postgraduate levels in all streams within the School of Electrical and Information Engineering (EIE). The course is offered in intensive mode over three days during the

[1] By National Instruments, Austin, Texas, USA

mid semester break. During those three days, students are progressively introduced to the concepts of virtual instrumentation programming and are given ample opportunity to develop an adequate level of competency in using G-Language - read LabVIEW - in engineering problem solving. In addition to guided hands-on exercises, they are challenged to demonstrate their ability to use the approach successfully. This has to be evidenced by handling such tasks such as:

- Create a VI of your own choice to demonstrate your understanding of the concept of a virtual instrument.
- Build a VI that can be used to convert British imperial units into SI units.
- Design and build a VI which can display waveform graphs. The VI should be capable of varying both the amplitude and frequency of displayed graphs.
- Create a VI of your own choice which can monitor and display measured data (In this exercise, students are encouraged to use software emulation of real-time signals in lieu of real time signals originating from external sources, giving further scope for skill development.)

Although seemingly menial, these tasks are relevant since they represent challenges for students who have not considered the possibility of doing anything like this before in a virtual instrumentation environment. Thus, what they now do lays the foundation for what is to follow next!

It should be emphasised that there is no terminal written examination in the course and assessment is purely based on students' demonstrated achievements during the course calendar.

4. VIRTUAL INSTRUMENTATION PROJECT

Following the completion of the intensive mode of delivery, each course participant must embark on a *project*. The object is to demonstrate at the end that the student has *learned* virtual instrumentation programming and can now apply the newly acquired skills to solving engineering problems. The project topic is selected in consultation with the course coordinator and may involve one or more aspects of modelling, simulation, data acquisition and control. It may involve software, hardware or both. The project must be original in the sense that the students conceive and produce it themselves rather than merely copying or modifying an existing VI solution.

It is of interest to observe that in each case, the process commences with a problem identification based on a declared or observed need. It proceeds systematically through the well recognised morphological stages of problem solving which ultimately culminates in an executable and functional *product* for demonstration.

The following two examples are to exemplify the spread of interest and demonstrate the approach taken together with the level of achievement.

5. EXAMPLE 1: GUITAR TUNER & TUTOR

The project chosen in consultation with the course coordinator was a guitar tuner which would also act as a guitar tutor. Thus the project aims were twofold: (1) Assist the user to tune a guitar correctly to standard tuning frequencies for various strings, and (2) to teach a beginner how to play basic chords. The instrument was to provide visual feedback to the user during the tuning process and aid the user during play.

The project requirements were specified as below:

- Tuning a six string guitar to the standard notes (EBGDAE).
- Provision for common microphone input.
- Accurate to tune with a maximum error of 1 Hz.
- Noise filter.
- Visual display of actual fundamental frequency of the note being played.
- Visual display of a Power Spectral Density Graph of the note being played.
- Visual display of basic chord configurations.
- Visual user guidance on correct finger positions for each chord on the fretboard.
- Sound files for each chord.

The project was successfully implemented and demonstrated. Figure 1 shows a sample sub-VI used in creating the instrument. Figures 2 and 3 depict the front panel – Graphical User Interface – for tuning and learning modes respectively.

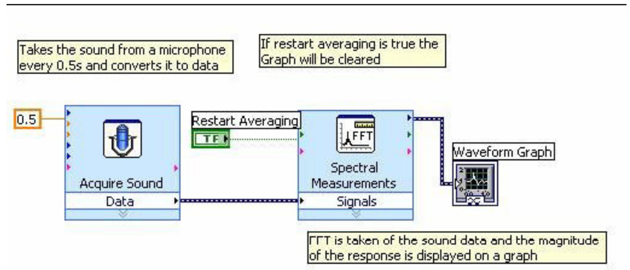

Figure 1. Block Diagram of Chord Indicator VI

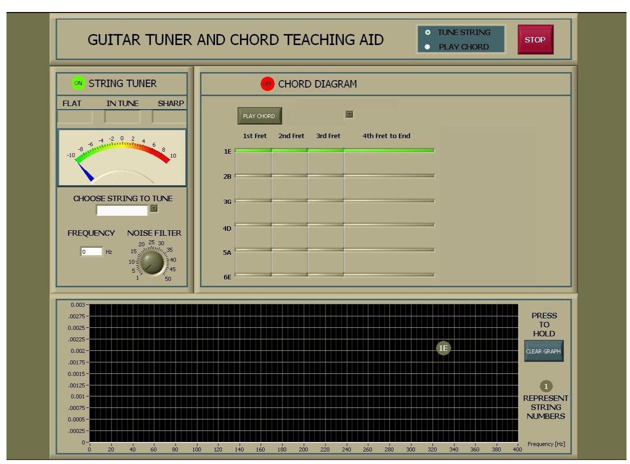

Figure 2. Front Panel of the main VI, String Tune Mode

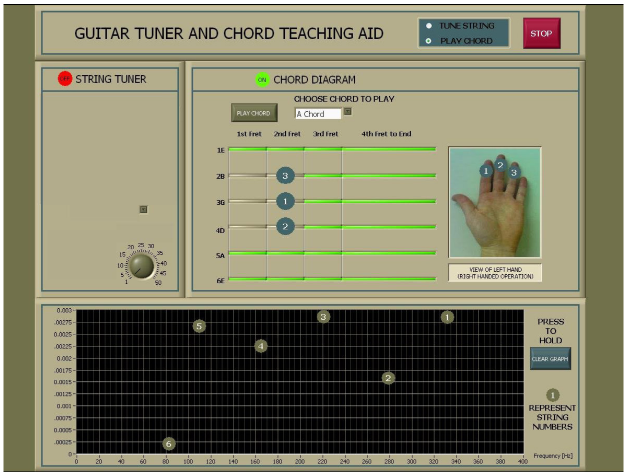

Figure 3. Front Panel of the main VI, Play Chord Mode

6. EXAMPLE 2: AQUARIUM MONITOR & CONTROLLER

The project selected in this case was based on the observed need to monitor and control the aquatic environment in a commercial or domestic aquarium. The project outcome was to be a virtual instrument which would provide visual information about the state of the artificial micro-aqua ecosystem in the aquarium, raise alarms when conditions deteriorated and take corrective action so as to restore the aquatic environment to optimal conditions. This was to be achieved by continuously measuring and adjusting the three key properties of water, namely temperature, pH and salinity. An important design criterion was that correction was to be effected fast, but not so fast as to impose an overshoot and associated shocks onto the system.

The project was conceptualised as illustrated in Figure 4 as a closed loop monitoring and control system.

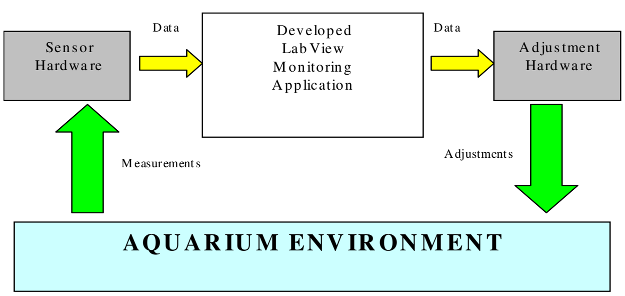

Figure 4. Closed Loop Control for Aquarium

The envisaged implementation would integrate sensors, actuators, dispensers under a supervisory virtual instrument to effect monitoring and control of closed aquatic environment. Sensors would be used to provide information on temperature, pH and salinity (Figure 5).

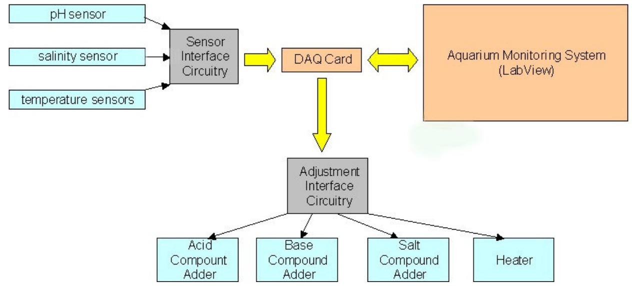

Figure 5. Block Diagram of Aquarium Monitor & Controller

Temperature was to be measured using a thermistor. pH values would be obtained from electrode measurements and calculated using Walther Hermann Nernst formula as

$$V = V_0 + 2.303 \frac{RT}{Z_j F} \qquad (1)$$

where:

V: potential difference measured between indicator and reference electrodes

V_0: standard potential of the electrode assembly, depending on its construction

R: gas constant (8.31441 $JK^{-1}mol^{-1}$)

T: absolute temperature

Z_j: charge of the hydronium ion

F= Faraday's constant

Salinity would be determined on the basis of conductivity measurement as

$$C = G \times k_c \qquad (2)$$

where:

G: conductance

k_c: cell constant.

The resultant values were to be processed by the aquarium monitoring and controlling virtual instrument which would then activate the appropriate control functions to decrease or increase the temperature, pH and salinity of the water according to embedded design rules.

Figure 6 presents the front panel of the ensuing virtual instrument implementation of the aquarium monitor and controller. Visual displays inform the *operator* of the state of health of the water. These include gauges to indicate the current values of the data monitored, charts to show trends and alarms to alert the *operator*. it can be noted that its primary purpose is to offer information to the user in the form of gauge readings, charted information and visual alarms. Control functions are automated, performed automatically as required.

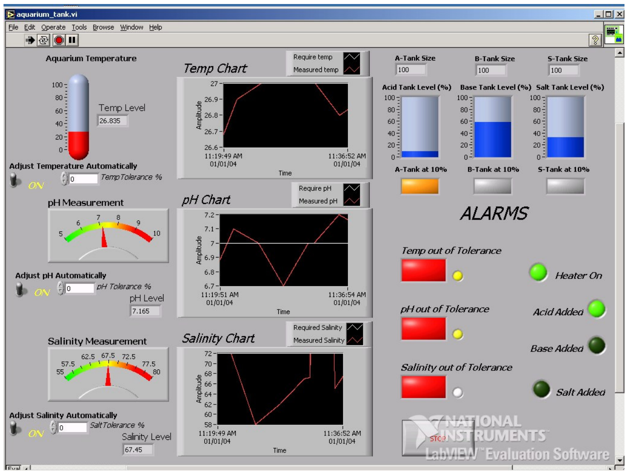

Figure 6. Closed Loop Control for Aquarium

7. SOME OBSERVATIONS

Nearly in all cases students have been observed to recognise the need for a systematic approach when challenged by the demands of project-based learning. This includes enquiry, lateral thinking, setting criteria for measuring the success and acquiring new knowledge as required. The above examples demonstrate that. They constitute projects for which no previous solutions exist in the form of the project outcomes. Of further note is the level of sustained motivation manifested by students.

8. STUDENT FEEDBACK

Student feedback obtained subsequent to courses has been consistently positive, providing the incentive for the further development and refinement of the approach. The results of a survey conducted in 2004, specifically related to the course, are presented below. Figure 7 shows the survey results. These results are most encouraging to say the least. Table 1 tabulates the survey questions. One outstanding aspect is the response to Question 3 where the respondents almost unanimously vouched for the motivational value of having been subjected to project-based learning in virtual instrumentation programming.

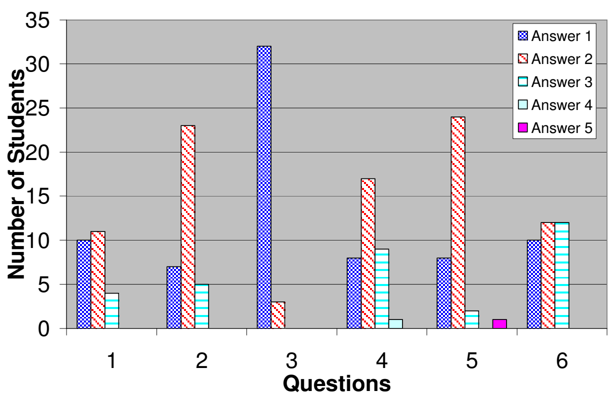

Figure 7. Responses to survey questions

Table 1 Course Survey Questionnaire

Question 1	**How would you rate this course compared with other University courses you have taken on campus and/or online?**
Answer 1	*This course was one of my best learning experiences.*
Answer 2	*This course was better than most courses.*
Answer 3	*This course was about average.*
Answer 4	*This course was below average.*
Answer 5	*This course was one of my worst learning experiences.*
Question 2	**When you compare your achievements in this course with course outcomes, do you believe that you have achieved:**
Answer 1	*All of the outcomes?*
Answer 2	*Most of the outcomes?*
Answer 3	*About half of the outcomes?*
Answer 4	*Only one or two outcomes?*
Answer 5	*None of the outcomes?*
Question 3	**As a result of my experience in this course my interest in this subject area has:**
Answer 1	*Increased.*
Answer 2	*Remained about the same.*
Answer 3	*Decreased.*
Question 4	**How would you compare the effort you put into this course with other University courses you have taken?**
Answer 1	*Much more effort than other courses.*
Answer 2	*A little bit more effort.*
Answer 3	*About the same effort.*
Answer 4	*Less effort*
Question 5	**Was the course assignment challenging enough for you to create a solution creatively from what you have learned?**
Answer 1	*Excellent.*
Answer 2	*Good.*
Answer 3	*Average.*
Answer 4	*Below Average.*
Answer 5	*Poor.*
Question 6	**How do you feel about the freedom to define the course project and come up with a solution that would showcase your problem solving ability?**
Answer 1	*Not a good idea as we do not know what the markers expect.*
Answer 2	*Is a good idea as it gives us the freedom to explore how to apply what we have learned.*
Answer 3	*Is too much of a hassle as we have other courses to worry about*
Answer 4	*Is good as long as we know what the marking scheme is.*
Answer 5	*Is good as it trains us to be competitive to present our skills for rewards.*

9. CONCLUSION

Project-based learning lends a powerful pedagogical edge when compared with other learning paradigms. The approach is especially suited to acquisition of skills and competencies critical in engineering education. The experiences reported in this paper concerning a course in virtual instrumentation programming provide support for the assertions.

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Contextual Teaching and Learning for Practitioners

Clemente Charles HUDSON, Ph.D.
Adult and Career Education, Valdosta State University
Valdosta, GA 31602, USA

and

Vesta R. WHISLER, Ph.D.
Adult and Career Education, Valdosta State University
Valdosta, GA 31602, USA

ABSTRACT

Contextual Teaching and Learning (CTL) is defined as a way to introduce content using a variety of active-learning techniques designed to help students connect what they already know to what they are expected to learn, and to construct new knowledge from the analysis and synthesis of this learning process. A theoretical basis for CTL is outlined, with a focus on Connection, Constructivist, and Active Learning theories. A summary of brain activity during the learning process illustrates the physiological changes and connections that occur during educational activities. Three types of learning scenarios (project-based, goal-based, and inquiry-oriented) are presented to illustrate how CTL can be applied by practitioners.

Keywords

contextual, connections, constructivist, active learning, brain research, scenarios

WHAT IS CONTEXTUAL TEACHING AND LEARNING?

Imagine signing up for a computer-programming course and arriving the first day of class to a room with only desks, chairs, and a chalkboard. During the 1970s, when curiosity about the relatively new phenomenon of microcomputer programming led many students to enroll in computer classes, students accepted being taught about computers in a traditional classroom with a textbook, lectures, and diagrams on a chalkboard. Who could have imagined then, that, one day, a computer with instant world-wide wireless access would fit into a shirt pocket and that courses about computers could be taught through and even *by* that miniscule piece of hardware? The ability to teach content in context—for example, letting students learn to program a computer by actually programming a computer rather than by just reading or listening to someone talk about it—has been drastically enhanced by computer technology. Much has been written about teaching with technology, which is only half of the preceding story. The other half of this story is the idea of teaching content in context.

Defining CTL

Nationally, administrators, teachers and adult learners find themselves drawn to a concept referred to as Contextual Teaching and Learning (CTL) as they seek ways to improve teaching and learning in public schools and universities. A preliminary definition of CTL emerged from projects sponsored by the Office of Vocational and Adult Education, U.S. Department of Education. Ohio State University in partnership with Bowling Green State University utilized this funding to study CTL, and they consequently developed the following working definition: *Contextual teaching and learning is a conception of teaching and learning that helps teachers relate subject matter content to real world situations; and motivates students to make connections between knowledge and its applications to their lives as family members, citizens, and workers; and engage in the hard work that learning requires[1].*

Theoretical Basis of CTL

Wise practitioners are wary of teaching and learning techniques that appear and then just as quickly disappear. Because CTL incorporates several existing educational theories, it can be said that it is based on sound pedagogy.

CTL and Connection Theory. According to Berns and Erickson, “contextual teaching and learning helps students connect the content they are learning to the life contexts in which that content could be used"[1]. Teaching students to program computers by letting them practice on real computers is a step in the right direction, but there is more to contextual teaching than just letting students practice on the same equipment they might encounter in the real world. First, they must be made aware of how the work they are doing relies on skills they already have (reading, writing, logic, etc.). Vygotsky refers to this gap between what is known and what is being learned as the *Zone of Proximal Development*, and he stresses the importance of social interaction between the student and someone (perhaps even another student) who is more skilled at the tasks being learned [2]. As they strive to attain learning goals, students draw upon their previous experiences and build upon existing knowledge. They find meaning in the entire learning process, not just in their computer programming class. "By learning subjects in an integrated, multidisciplinary manner and in appropriate contexts, they are able to use the acquired knowledge and skills in applicable contexts" [1]. The ideal connection process would be three-fold: (1) students review what they already know related to the new concept; (2) they learn about and practice the new concept; and (3) they tie what they have learned to a real-life scenario.

CTL and Constructivist Theory. Incorporating the principals of contextual teaching helps to promote authentic learning and increases students' success by allowing them to make connections as they construct knowledge. In his writings, well-known Swiss biologist, philosopher, and child psychologist, Jean Piaget views the origin of knowledge as genetic epistemology, which he also calls constructivism, due to his belief that "knowledge acquisition is a process of continuous self-construction" [3].

Mayer contends that the concept of constructing knowledge is different from two earlier popular views of learning: (1) learning as response strengthening, based on the study of animal learning in laboratory settings, and (2) learning as knowledge acquisition, where the learner passively absorbs information presented by the expert. He states: *Constructivist learning is active learning in which the learner possesses and uses a variety of cognitive processes during the learning process. The major cognitive processes include paying attention to relevant information, organizing that information into coherent representations, and integrating thee representations with existing knowledge* [4].

CTL and Active Learning Theory. Many educators think of active learning as any strategy that deviates from the traditional lecture format where a teacher imparts knowledge by talking about it. Chickering and Gamson suggest that to be active, students must be doing more than listening [5]. Such strategies as cooperative and collaborative learning, integrated learning, problem-based learning, and work-based learning may be used to encourage inquiry and stimulate higher-order thinking. Research has shown that when students are allowed to manipulate their learning through the use of such strategies, they become problem solvers and they incorporate problem-solving skills throughout their formal education experience [6]. Lankard calls it "learning by doing", and divides active learning into these three categories: *(1) **action learning**, based on the premise that learning requires action and action requires learning; (2) **situation learning**, where knowledge and skills are taught in contexts that reflect how the knowledge will be used in real-life situations; and (3) **incidental learning**, which is defined as a spontaneous action or transaction, the intention of which is task accomplishment, but which serendipitously increases particular knowledge skills, or understanding i.e. learning from mistakes, learning by doing, learning through networking, learning from a series of interpersonal experiments* [7]. In a study of active, interactive, and reflective learning, Berge quotes Lave to stress the importance of constructing meaning through contextual learning among students: *The ideal situation is for independent learners to take what they have learned and apply it, making it meaningful in the context of actions and interactions within their own lives as they seek personal satisfaction, credentials, and advancement on their life path. When students have the opportunity to interact with one another and their instructors, they can analyze, synthesize, and evaluate course content and use their new learning to construct a shared meaning, making sense of what they are learning in the context of their own community of practice* [8].

As the three theories are examined, some recurring themes emerge. The computer-programming example mentioned earlier provides us with a scenario for contextualizing the three theories. After the students have practiced writing programs in the classroom, they might be given portions of code from an actual company and then asked to determine what the output might be. They could be put into groups and asked to think about a scenario, such as a particular customer-service operation in a business, and write a program to solve a problem in that department. They could first be asked to write out the logical progression of steps, and then convert them to the programming language, which they would then type in and troubleshoot.

CTL and Brain Research

Historical philosophers and educators including William James, John Dewey, Jerome Bruner; as well as contemporary author Robert Sternberg, support the idea of making connections in education. In addition, in the past couple of decades, neuroscientists have shown that this need for connections in the teaching and learning process may very well be rooted in the basic physiological function of the brain itself [9].

To understand how we learn, one must understand how the brain transforms learning experiences into actual physiological connections in the brain. The following summarizes the basics from **Brain Facts**, a downloadable file from the Society for Neuroscience:

> *The human brain is made up of three main parts: (1) the brain stem and cerebellum, (2) the limbic*

system, and (3) the cerebrum. The cerebrum is where learning actually takes place.

The ***cerebrum,*** *the most remarkable part of the brain* ***controls our language development, our thoughts, and our voluntary actions, and stores our long term memories****. This is the part that makes us human.*

It contains about ***three-quarters of the 100 billion neurons in our brain.*** *This is the part that holds the* ***key to the brains efficient system of communication and of making connections.***

Neurons communicate *with each other by* ***releasing several kinds of chemicals, called neurotransmitters****. An individual neuron receives messages from other neurons and based on the* ***strength of the electrical signals that excites the neurotransmitters decides to pass the message along.***

The ***neurotransmitter pass*** *to other neurons over* ***tiny gaps*** *called* ***synapses****. The* ***synapse contact points****-which* ***number in the thousands*** *–are* ***tree like fibers called dendrites,*** *which are branching arms of the neurons that transmit and receive messages.*

What is interesting about this complexity is ***that new synapses tend to accumulate*** *as the brain* ***acquires new information and new experiences****. Thus, our brains create neural networks and maps as we gain experiences. When no connection to an experience can be found, or when the neurotransmitter impulse is very weak, a message is not sent to other neurons.*

From experiments made with animals, new experiences that activate certain parts of the cerebrum seem also to make the neurons grow fuller and richer. Their cell bodies become larger and their dendrites develop new branches on which to accept additional connections with other cells [10].

Jensen reiterates that the connections in the human brain are what provide us with the ability to learn. He states, "The key to getting smarter is growing more synaptic connections between brain cells and not losing existing connections" and "good quality education encourages the exploration of alternative thinking, multiple answers, and creative insights" to encourage those synaptic connections to continue to grow [11]. Thus, according to the experts, there seems to be a direct relationship between enriched environments, life experiences, and brain development [12]. The key to coordinating this relationship is the careful selection of teaching methods designed to provide a contextual learning environment.

CTL IN PRACTICE

While the relevancy of contextual teaching and learning has been thoroughly researched, the country's population has become more diverse and educators are faced with the challenge of designing a curriculum that meets the needs of all different types of people. According to Blanchard, CTL strategies that may help to meet each learner's distinct needs include: *(1) emphasize problem-solving; (2) recognize the need for teaching and learning to occur in a variety of contexts such as home, community, and work sites; (3) teach students to monitor and direct their own learning so they become self-regulated learners; (4) anchor teaching in students' diverse life-contexts; (5) encourage students to learn from each other and together; and (6) employ authentic assessment* [13].

Today, education systems risk imposing educational strategies that do not meet the individual needs of the students. The inherent danger of advocating a particular approach to instruction is the possible misconception that readers might assume that this approach is now "the" approach to use. Tennyson refers to the "situation of advocating a relatively simple solution to a complex problem" as the "big wrench approach to problem solving". The three approaches that will be discussed here are not being recommended as the "big wrench"; rather, they will be introduced and suggested for the value they may offer to practitioners who are in the process of evaluating techniques that might work for them and their students.

Helping students construct their own knowledge can be accomplished by guiding them through scenarios where they are required to actively explore the content in order to reach a goal, solve a problem, complete a project, or answer a question. This is a shift away from the traditional, or classical, classroom where the professor imparts knowledge and students receive it; and more toward the direction of student-centered, and even self-directed learning. The following scenario examples (goal-based, project-based, and inquiry-oriented) offer ideas for incorporating CTL in the classroom:

Goal-Based Scenarios

Schank, Berman, & Macpherson's Goal-Based Scenario (GBS) design is based on the foundation that "the best way to teach is to place students in situations in which the goals they wish to achieve require the acquisition of the knowledge and skills you wish to impart" [14]. Components of a GBS include:

(1) ***The learning goals****. These fall into two categories: Process knowledge and content knowledge, focusing on the skill set students*

need to practice and content knowledge they need to find;

(2) ***The mission****. A realistic goal that the student will relate to, and that will require the skills and knowledge stated in the learning goals, is chosen;*

(3) ***The cover story****. A scenario or background story that allows opportunities for the student to practice the skills and seek the knowledge stated in the learning goals is created;*

(4) ***The role.*** *A role that is truly motivating to the student and that helps the student practice the necessary skills is selected;*

(5) ***The scenario operations****. Is comprised of all activities the student does in order to work toward the mission and the learning goals. Examples include: asking experts for opinions relevant to completing the report, compiling information for future reference, making claims about strategies, and backing up claims from the information compiled; and*

(6) ***Resources.*** *Feedback can be given in any of three ways: through consequence of actions, coaching, or domain experts telling stories that pertain to similar experiences* [14].

Project-Based Scenarios

Lenschow points out, "Project-based learning (PBL) is winning ground in industry and at a slower rate in universities and colleges" and is "pedagogically based on constructivist learning in a setting represented by Kolb's learning cycle" [15]. Van Kotze and Cooper believe that PBL "seems to open up possibilities for our students to draw on their prior expertise and knowledge (nurtured in collective struggle), and to build on their experience gathered at their different sites of practice and learning" and that it allows them to "construct new knowledge that is action-oriented and socially relevant, while at the same time gaining academic recognition and accreditation" [16]. Van Kotze and Cooper share their version of PBL:

(1) Students select a topic and form groups;

(2) They plan their project and present plans to each other;

(3) They have weekly meetings where they report on work done, discuss their learning, and plan the next week;

(4) The prepare and conduct an "agogic moment" where the outcome of the project is presented to the commissioning organization;

(5) They prepare a comprehensive report on the project (both content and process) and participate in a collective evaluation process, involving all students in the group and relevant academic staff. [16].

Inquiry-Oriented Scenarios

Bevevino, Dengel, and Adam's inquiry-oriented approach is based on Piaget's cognitive development principles. It puts students into situations "that demand critical thinking and encourage the internalizing of major concepts" and also gives them "the opportunity to express, confront, and analyze preconceptions and misconceptions in an active, non-threatening way" [17]. Bevevino et al. describe their approach:

(1) ***Phase 1 Exploration****. Requires students to use prior knowledge and experience to solve a problem or series of problems presented in a simulation or game that examines the concepts to be developed throughout the learning cycle;*

(2) ***Phase 2 Discussion and Presentation of New Content.*** *In this phase, the students share their proposed solutions, describe conflicts they experienced and strategies they used to gain consensus, and the teacher introduces new content relative to the issue. During the discussion, the whole class scrutinizes each solution according to logic and mutual benefits tests;*

(3) ***Application and Expansion.*** *Requires the students to apply the knowledge, skills, and insights acquired in Phases 1 and 2 to a new situation or to creatively extend their knowledge into new areas of exploration. Each group develops its alternative solutions to a new problem, and the learning cycle ends with the whole class coming to a consensus as to the best solutions offered.*[17].

Scenario learning offers students opportunities to actively engage in constructing their own knowledge. They may have varying degrees of input into developing the scenarios, or selecting content; but as they work through the problem-solving steps, they are learning the content and also developing ownership of their own learning process. Creating scenario learning experiences can be time consuming, and this technique may be viewed by some as adding more work to already over-worked teachers; however, more and more resources are becoming available, particularly on the Internet, with libraries of prepared scenarios to choose from.

SUMMARY

Contextual Teaching and Learning (CTL) has been defined here as a way to introduce content using a variety of active-learning techniques designed to help students connect what they already know to what they are expected to learn, and to construct new knowledge from the analysis and synthesis of this learning process. A theoretical basis for CTL has been outlined, with a focus on Connection, Constructivist, and Active Learning theories. A summary of brain activity during the learning process illustrates the physiological changes and connections that occur during educational activities. Three types of learning scenarios (project-based, goal-based, and inquiry-oriented) are presented to illustrate how CTL can be applied by practitioners.

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VoIP: Teaching New Technology for a Converging Industry

David GORE
School of Technology Studies, Eastern Michigan University
Ypsilanti, Michigan 48197, USA

and

Marie LEE
School of Technology Studies, Eastern Michigan University
Ypsilanti, Michigan 48197, USA

ABSTRACT

Voice over Internet Protocol is an emerging technology being implemented in industry. Traditionally, skills in data and voice have been separate, but the evolving information age requires people with skills in both to implement and administer converged systems. The Communication Technology program at Eastern Michigan University is addressing this educational need through a hands-on laboratory class called Telephone Technology. Curriculum and real world projects were developed in cooperation with industrial partners who serve on an advisory board. The pilot of the course was offered in winter 2006, with a second offering in winter 2007. The Telephone Technology course was designed to incorporate a collaborative classroom and foster a constructivist learning environment. Assessment of the pilot course through course-end evaluations indicates the course was a success. Ongoing adjustments to the course activities and content will need to be made, with industrial support, to reflect the technology changes in the industry.

Keywords: VoIP, Convergence, Telecommunications, Telephony, Communication, Transmission, Constructivist.

Introduction

Industry faces new challenges as voice and data technologies are converging. Voice over Internet Protocol (VoIP) is emerging as the standard for business communications. Consequently, a gap has developed between industry needs and the traditional educational offerings. Professionals in the information technology (IT) field were either trained in data skills or voice skills, and businesses employed specialists in both areas. As voice technology has become digitized, and is able to be sent over transmission lines as data, the role of the IT professional has changed. Typically, data technicians are handed responsibilities for voice, since voice acts as an application on the data network. However, data technicians typically lack the telecommunications background required to understand the full applications of voice, how information needs to be sent over the Public Switched Telephone Network (PSTN) and specific regulations that govern the use of the PSTN. Corporations have been hiring the rare individuals with both a voice and data background and offering them incentives to learn emerging technologies such as VoIP and stay with the company to implement and administer the voice and data network. As VoIP continues to be adopted in both enterprise businesses and small to medium sized business, the demand for experienced voice and data technicians is growing. To meet that demand, vendors are offering proprietary VoIP training. Eastern Michigan University has responded to this need by offering classes in the Communication Technology major.

Communication Technology at EMU

The Communication Technology program at Eastern Michigan University (EMU) is an undergraduate bachelor of science major. The curriculum is an interdisciplinary mix of the technologies of communication (i.e., computers, graphics, media, telephony, etc.) and general business skills. Students supplement their broad understanding of the interrelated technologies of the modern information age with a required cooperative work experience and approximately 16 hours of elective coursework. Graduates of this program typically enter the workforce at the entry level and move up to mid-management positions within 3 to 5 years.

The Communication Technology degree was created utilizing many existing courses from various departments and colleges, combined with a few new technical courses and a capstone experience. This approach was quite unique from a traditional university curricular standpoint where majors are contained within a particular college. The program was designed based on a needs assessment study conducted among communication technology industries in southeast Michigan. The courses and combination of skills that the Communication Technology program was designed to provide were in direct response to the needs of those businesses who would be hiring graduates of the program.

An advisory committee made up of business and industry professionals, at least two faculty members and at least one student, meet to evaluate course content and the overall direction of the program. The advisory committee meets annually. In addition, Communication Technology is accredited by the National Association of Industrial Technology (NAIT). NAIT accreditation review occurs every 6 years, which includes a self-assessment and a site visitation by an accreditation team.

From a local industry perspective, our advisory committee members have repeatedly stated the need for graduates with knowledge of converged voice and data technologies. As more enterprise businesses switch from traditional telecommunications systems to VoIP systems, and as more small and medium-sized business also adopt VoIP as a way to better utilize their resources, there is a growing need for skilled workers with knowledge of voice applications on a data network. Computer application, programming, and engineering coursework have been available at the university level and as part of vendor-specific training for many years. There is very little coursework, however, in telecommunications and in voice technology fundamentals. Specific courses for VoIP technology at the college level are just now emerging, and often are taught from a data network perspective, with voice as an application on the network. The CMT 408, Telephone Technology, approaches VoIP form a telecommunications standpoint.

Telephone Technology Course

As there was a lack of skilled information technology (IT) candidates in the industry in the late 1990's, there is now a lack of skilled individuals in the VoIP industry. There is a call from industry to break down the traditional barriers between voice and data and train students specifically in knowledge about voice carriers (Stokely 2006). While there has been a decline in the salaries of IT professionals after 2000, data networking professionals with VoIP skills have seen increases in pay and bonuses during the same period (Rendon 2004). As a part of our mission to prepare students for careers in this industry the Telephone Technology course was created.

EMU developed the Telephone Technology course to introduce VoIP in the context of the telecommunications industry, based on the fundamental voice technologies that have led to convergence. The prerequisite course, CMT 305, Communication Transmission Systems, introduces telecommunications history, background and terminology, as well as a basic description of how voice technology works. Students also have the opportunity to work as a group as a telecommunications vendor and respond to a Request for Proposal (RFP) from a company in need of a new telephone system. In the Telephone Technology class, students build upon their knowledge and learn the hands-on skills of installation and programming, as well as needs analysis for the business and performing audits of physical equipment, lines, and billing. Although our students may not all pursue a career in converged technologies, the skills are directly applicable to their personal voice and data technology use.

Those industrial partners that serve on the advisory committee are also committed to EMU through the donation and sale of telecommunications and VoIP equipment. Technology Solutions (http://www.ts-llc.com) donated an traditional PBX with a few telephones for students to examine in the classroom. They also provided a Mitel VoIP system at cost, including several telephones, for students to configure. Additional equipment was purchased for students to perform various labs within the context of the course.

Figure 1: Lab Equipment (left to right: punch down blocks, students completing lab, Fujitsu traditional PBX)

The Telephone Technology course was designed as a constructivist learning environment where students work together and are involved in learning through solving problems set in real-world contexts. In the real world, problems are often ill defined and have several possible alternate solutions, or no solution at all. Jonassen (1999) states, "Students learn domain content in order to solve the problem, rather than solving the problem as an application of learning." The activities in the course direct the construction of learning. Each activity is related to the larger project in the course and acts as a learning scaffold to support the learners (Jonassen 1999).

The Communication Transmission Systems class redesign and the Telephone Technology class design emphasized active learning, moving away from a traditional lecture environment. Specifically, "strategies promoting active learning [are] defined as instructional activities involving students doing things and thinking about what they are doing" (Bonwell, Eison 1991). Educational research studies have shown that students prefer "doing" over listening in a traditional lecture classroom (Bonwell, Eison 1991) and that has also been the experience of the authors in the classroom as well. Students indicate they like to learn through "hands-on" activities and by participating in classroom activities that involve small groups. The largest criticism received from former students is that they would have liked more hands-on opportunity to learn different technology. Each class period includes some activity for students to engage in learning and the traditional lectures are kept to short, 10 to 15 minute presentations, which include dialogue with the students through questioning or soliciting opinions and personal experiences which help to anchor new knowledge to pre-existing knowledge.

Because the lectures are short, and require student participation, both the Communication Transmission Systems and the Telephone Technology class include Bonus Quizzes which have also been referred to as a Reading Quiz (Paulson, Faust 2002) in educational literature. Students are encouraged to prepare for class by reading the assignments as they will be quizzed on the material prior to presentation in class. These quizzes are "extra credit" and do not count against the student's grade. This encourages them to attempt to answer all questions without the fear of failure. In these courses, the bonus quiz is given at the start of the class period, which also encourages students to arrive to class on time. At the end of each class period, a Minute Paper (Brum 2001; Paulson, Faust 2002) is given to students to fill out. This is an anonymous form that typically requires a brief response to 4 questions. Students are asked to recall important points from the mini-lectures, write down what they thought worked well or could have been presented in a better way, and what points from the material on which they need additional clarification. Minute paper responses allow instructors to determine the starting point for the next class period, if clarifications were required, and the continuous improvement of the course and classroom activities.

Technology, even when focused on communications technologies and telecommunications, is a very broad topic that is ever-changing. While text books and traditional lectures can cover technology from a historical viewpoint, true collaboration and sharing of knowledge is required for an effective classroom. The teacher's role becomes that of a mediator, showing students how to learn and allowing them to take responsibility for their learning (Tinzman et al 1990). Lifelong learning and the ability to seek new information will be an essential skill for students that will seek careers in a technology field. By being active in the classroom, and collaborating with the instructor and peers, students stay engaged in the learning process and are more likely to transfer their knowledge to other settings beyond the classroom.

The Telephone Technology course was piloted in the winter term 2006 with 10 students from 2 different programs, Communications Technology and Network Information and Technology Administration. Based on minute papers and course end evaluations, the course implementation was successful, however, there were areas that required some improvement which will be addressed in the second offering of the course in winter term 2007. One of the beginning labs was performed off campus at Technology Solutions and taught by the senior technician and customer service advocate, Craig Goins. The lab consisted of students making a category 5 data patch cable, testing and tracing wall jack cables, and creating a backboard and patch panel to connect telephones on a desk to the telephone system. In the 2nd offering, this lab will be completed on campus as additional equipment was purchased to recreate the environment in the classroom. Craig also taught a section on telephony applications, specifically telephone system administration and incoming call flow using voice mail and an automated attendant. Students were then presented with a case study to solve utilizing the information presented. His real-world expertise and first hand experience helps students connect classroom exercises to actual system implementations.

A primary concern of the course design was to create an active classroom where students would be pursuing information via several means – individual and group activities as well as real-world projects. Several activities throughout the semester relate to a final presentation where students synthesize the results of their smaller projects and present a package of information that could serve as the basis for a RFP. The Telephone Technology course was designed to build on the RFP experience in the Communication Transmission System course as a learning scaffold to support their additional experience and deeper understanding of the RFP/proposal processes, which they will likely face in some capacity of their future careers in a technology or service related field.

Telephone Technology Course Syllabus and Schedule

Description of CMT 408 Telephone Technology. Prerequisite: CMT 305. This class will cover an introduction to telecommunications theory and practice. The course will cover both traditional private branch exchanges (PBXs) and voice over Internet protocol

(VoIP) systems including system administration, configuration and testing. Lecture including lab course.

Objectives. Upon satisfactory completion of this course the student will have practical experience and be able to:

1. Describe and explain differences between traditional PBX and VoIP telecommunications systems.
2. Articulate key people and events in the history of telecommunications.
3. Conduct a telecommunications billing analysis to determine accuracy and cost.
4. Perform an analysis of proposals in response to a Request for Proposal (RFP).
5. Program moves, adds, and changes to a telecommunications system.
6. Conduct a needs analysis and design for a telecommunications system.
7. Perform a task analysis in the telecommunications system implementation process.
8. Create a professional document and effectively present an implementation plan.
9. Perform various tasks involved in implementing a telecommunications system.
10. Find and identify career opportunities associated with transmission system technologies.

General Information: There will be one three-hour session each week. There will be times when we will spend all of class for laboratory work or discussion. This class is designed for you to develop and practice your skills relating to the transmission of messages using various available technologies. Hands-on telecommunications systems will be available for you to program and configure. There will also be assignments that will allow you to further your understanding through writing. Also, be prepared to discuss reading assignments in class.

Required Text: **The Essential Guide to Telecommunications, 3rd ed.**; Dodd, Annabel; Prentice Hall PTR, Upper Saddle River, N; 2002.

Assignments:

1. Abstracts for discussion
2. Professional Interview
3. History of Telecommunications and Presentation
4. Group Implementation/System Administration Project(s)
5. Homework from text (possible presentation on speakers)
6. Preparing RFP; evaluating Proposal responses to RFP
7. Presentations and reports on Implementation and RFP projects

Each assignment will be previewed in lecture. Demonstrations will take place in the class session. Video tapes and information sheets will be made available when needed. **All assignments and tests must be completed in order to receive a passing grade for the course.** Course evaluation is competency based, thus you are competing only against yourself.

Class	Topics/Activities	Assignments
1	Introduction Topic: Why Telephone Technology	**Get Book!** And start reading. Article/Chapter handouts
2	Topic: History of Telephone Industry	**Due: Homework – Steps in a Process** Chapter 12-13 Handouts; Ch. 3
3	Topic: Computer Industry, Info Services Industry	Ch. 2; Handouts
4	Topic: Systems, Peripherals, & Cabling; RFP *Group #1 Lab 1; Group #2 – RFP*	Lab Report; RFP Assignments
5	Topic: (see 2/2 above) *Group #2 Lab 1; Group #1 – RFP*	Lab Report; RFP Assignments Ch. 1
6	Topic: Data – The Basics - Midterm Review -	**Due: Lab Report; Abstract #1** Study and work on history presentations!
	- MIDTERM -	
8	WINTER BREAK!	Ch. 4
9	Topic: Network Service Providers *System Programming; Call Flow Plan/Diagrams*	Ch. 5
10	Topic: Public Networks *System Programming; Call Flow Plan/Diagrams*	Ch. 6
11	Topic: Specialized Network Services **History Presentations**	**Due: History Presentation** Ch. 7
12	Topic: Analog, Cable, Digital Modems	**Due: Professional Interview** Ch. 8
13	Topic: Internet	**Due: Abstract #2** Ch. 9-10

14	Topic: Wireless, Globalization NO CLASS – WORK NIGHT	Finish projects/reports; prepare presentation
15	**PBX Implementation/RFP Presentations**	**Due: Implementation/RFP Report and presentations**
	FINAL EXAM	

Table 1: Telephone Technology Schedule

Pilot Evaluation of Telephone Technology

Upon completion of the pilot of the Telephone Technology course, students were asked to assess the course objectives on a scale of 1 to 5; 1 meaning the objective was met completely, 3 meaning that the student was unsure if the objective was met, and 5 meaning the objective was not at all met. Of the 10 objectives, all were scored by students between a 1.2 and 1.9, indicating that all students felt the objectives of the course were successfully met. The objectives scoring the lowest were #10 "find and identify career opportunities associated with transmission system technologies" and #7 "perform a task analysis in the telecommunication system implementation process."

The student evaluations indicated the following concepts gained from the course were:

- Programming of a key system
- Programming of a VoIP/PBX system
- How to analyze a RFP, and begin prep for a new installation
- MAC lab
- How to put together a plan for a new phone system (Consultant Presentation)
- Info from the interview assignment
- Useful info on telephone networks/systems
- History of telecommunications
- Learning about career opportunities and after-college decisions
- How much work goes into an RFP
- Backboard lab
- Importance of future cellular technology
- How to check my phone bill
- Group work challenges
- Always be organized

Again, the largest criticism from students in the course evaluation was that the class should have even more hands-on activities included. Most activities in the pilot course went smoothly, but require minor adjustments to either the time or the scope of the activity. The final project, and sub-projects, require standardization and some additional support through presentation of specific topics and clarification on the project parameters, which will largely address the concern students had with objective #7 in performing a tasks analysis. The project and some activities will continue to be ill defined in the sense that they allow for a constructivist learning environment and a more direct simulation of real-world situations. Additional classroom hands-on labs such as an electromagnetic wave propagation and antenna training module will be incorporated into the class to teach the concepts of wireless communication (i.e., WiFi and cell phone technology).

To address issues raised by students we have:

- Created a VoIP telephone system laboratory for applied assignments within the College of Technology
- Restructured the RFP assignment so that assessment of each group is equitable
- Assigned both the lab and out-of-class work to better utilize classroom facilities and manage student time more efficiently.

Conclusion

Since we are clearly in an era of convergence it is essential for higher education to respond to the needs of the industry. By providing courses that prepare students with the necessary skills to be valuable employees in their companies Eastern Michigan University is filling that need.

Industry professionals and the Communication Technology advisory committee recommend the teaching of a course dealing with the convergence of voice and data. VoIP, is clearly a content area with which the students of the information age must be familiar. The specific course, CMT 408 Telephone Technology, is a means by which this need is being addressed. Obviously, as a first time offering, this course will undergo additional changes to curriculum content, course activities, and laboratory sessions over the next two course offerings. Ongoing, the course activities will need to reflect changes in technology in the telecommunications industry. Due to the rapidly changing nature of the information industry, EMU will need to continue its partnership with practitioners in the field, including those that have graduated from the program, professionals that serve on the advisory committee and other local industry experts who understand the need for students to gain these skills at the college level. There is a need for continued evaluation of the course content to determine if the specific objective of preparing graduates for the new economy in an internet and technological based society is being met.

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Disseminating Health Disparities Education Through Tele-learning

LaSonya KNOWLES, Anissa LEWIS, Denae KING, Lovell JONES
Dept of Health Disparities Research, The University of Texas M. D. Anderson Cancer Center
Houston, Texas 77030, USA

ABSTRACT

Twenty years of research demonstrate that there are wide disparities in health throughout America. Health disparities are differences in the incidence, prevalence, mortality, and burden of diseases and other adverse health conditions that exist when specific population subgroups are compared. Health Disparities in America: *Working Toward Social Justice* is a course instructed every fall by Dr. Lovell Jones, director of The Center for Research on Minority Health (CRMH) at UT M.D. Anderson Cancer Center. The CRMH has created a course that examines the social and societal factors that are fundamental in creating disparities in health. Students from 10 different academic programs and institutions participate in this course. The course is unique in the aspect that various, diverse speakers whom are experts in their field of study instruct each class. This health disparities course is conducted at one of three different academic institutions in the Houston area and broadcast via satellite to various academic institutions by means of tele-education. Tele-education is defined as a mode of instruction utilizing different forms of media such as video, audio technology tools and computers. Video and audio technologies involve the transmission of interface between learners and instructors, either interactive or non-interactive. Tele-education technologies have an important role to play in addressing the dissemination of health disparities education. The purpose of this program is to determine the feasibility of tele-education as a mode of instruction to introduce the multi-disciplinary components of health disparities. Our findings suggest that tele-education is a useful tool in imparting health disparities education.

INTRODUCTION

Over twenty years of research demonstrate that there are wide disparities in health throughout America. Health disparities are differences in the incidence, prevalence, mortality, and burden of diseases and other adverse health conditions that exist when specific population subgroups are compared [1]. The 2002 report by the Institute of Medicine, Unequal Treatment: Confronting Racial and Ethnic Disparities in Healthcare discerned that there is overwhelming evidence that racial and ethnic disparities in healthcare exist regardless of socioeconomic status [2]. A subsequent report and state report cards have also demonstrated the need to ameliorate disparities related to various aspects of health, race/ethnicity, and socioeconomic status [3]. In 2000, Lovell A. Jones, PhD, Professor of Health Disparities Research at The University of M. D. Anderson Cancer Center in Houston, Texas founded the Center for Research on Minority Health (CRMH). One of the primary goals of the CRMH is to seek to address disparities in cancer patient care, research, education and prevention. It is the first congressionally mandated center on minority health disparities outside of the federal government. The CRMH is comprised of a research, clinical, and education core. The goal of the CRMH's Educational Core is to increase the number of individuals in health disparities research by creating unique educational programs and linking them to existing programs [4]. The CRMH's Education Core is solely responsible for creating and administering the CRMH educational programs. The programs are sponsored solely by the CRMH or in conjunction with other academic centers. In addition to the health disparities course, a CRMH sponsored course discussing health disparities and human genomics has also been offered annually.

BACKGROUND

In an effort to increase the awareness of health disparities research as an area of academic interest, the CRMH created an annual academic course entitled Health Disparities in America: *Working Toward Social Justice.* Dr. Lovell Jones, director of the CRMH, instructs this course each fall semester. This course examines the social and societal factors that are fundamental in creating disparities in health. The course is officially offered at the University of Houston, Rice University, and a historically minority serving institution, Texas Southern University. While the course is officially held at each fall semester at one of these 3 institutions, undergraduate and graduate students from 10 different academic programs and institutions actually participate in the health disparities course. These institutions include Rice University, University of Houston, Texas Southern University, The University of Texas Health Science Center, Graduate School of Biomedical Sciences, The University of Texas School of Nursing, The University of Texas Health Science Center-Tyler, Florida A&M University (FAMU), The University of Texas Health Science Center-San Antonio, and Texas A&M University-Corpus Christi.

The development of this course has also lead to the creation of the Health Disparities Education, Awareness, Research and Training (HDEART) Consortium. This consortium is an entity of more than 28 major institutions and hospitals located in and near the Texas Medical Center.
The course is unique in the aspect that various, diverse speakers whom are authorities in their field of study instruct each class. As the consortium and the number of participating institutions grew there was a need to find a way to disseminate this course on a broader scale. The course is conducted at one of the three collaborating academic institutions in the Houston area and broadcast via satellite to various academic institutions by means of tele-education. The purpose of this project is to determine the feasibility of tele-education as a mode of instruction to present the multi-disciplinary components of health disparities.

INTERGRATION OF TECHNOLOGY

Tele-education has been defined as a mode of instruction through different forms of media such as video, audio technology tools and computers [5]. Video and audio technologies involve the transmission of interface between learners and instructors, either interactive or non-interactive. Tele-education technologies have an important role to play in addressing the dissemination of health disparities education. Through the integration of this technology we are able to broadcast this class to other universities real-time. The most recent course was broadcasted from University of Houston-Main Campus. During this telecast four other universities are displayed on the screen simultaneously and the schools can interact with each other through audio and visual technology. Rice University also has 11 screens simultaneously displaying classrooms at other universities to other schools with interaction abilities. Students in person and via telecast attend the course. The course is also available via a live internet broadcast on Rice University's web site.

A multidisciplinary team is required to get all facets in place. This team should consist of technical personnel, facilities management, equipment personnel and a coordinator for the course at each site. The institutions must have an experienced and dedicated technical person that is available to ensure that each site has the capabilities to participate in the course. Technical problems are always present; therefore it is imperative that each site coordinator is available during the entire duration of the broadcast.

Each participating institution has to be technologically up-to-date in regard to their media's audio and visual capabilities. The media should be previously tested to guarantee the best outcome for the site. Each classroom must also have accommodations for students at each satellite locations. Each satellite location should be equipped with audiovisual means that allow participants to not only see and hear the guest speaker/lecture but also ask questions and orally participate during class.

RESULTS (OUTCOMES) AND CHALLENGES

The purpose of this project is to determine the feasibility of tele-education as a mode of instruction to introduce the multi-disciplinary components of health disparities. Through the use of tele-education we found that it is feasible for academic institutions to participate in this course via telecast. In order for academic institutions to participate in the course consideration has to be given to personnel, technology, equipment and an accommodating location. Extensive planning and preparation prior to taking on this educational endeavor will allow the planning team to arrange and execute a successful outcome.

Since inception of the course there has been a steady increase in the number of consortium members. Figure 1 illustrates a decrease in the number of participating schools from 2005 to 2006. The number of participating schools increased from 19 in 2004 to 26 in 2005. From 2005 to 2006 there was a decrease in the number of participating schools by 50%. There was a steady increase in the interest in participation of the course due to the subject matter of health disparities. The number of participating schools decreased due to technical difficulties. Therefore, the need for a dedicated technical person to manage the modes of media of each participating institution in the course via tele-education was not foreseen.

Figure 1: Comparison of number of increase in consortium members to number of schools in consortium participating in the course from 2005 to 2006.

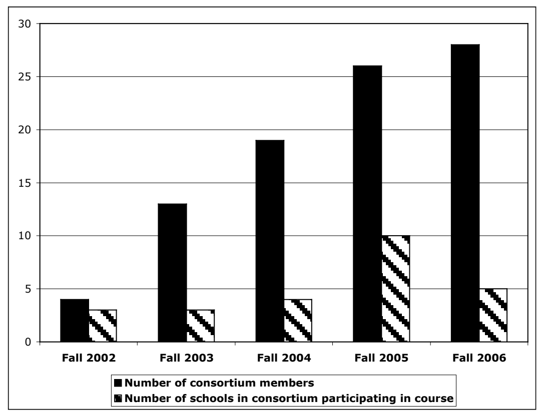
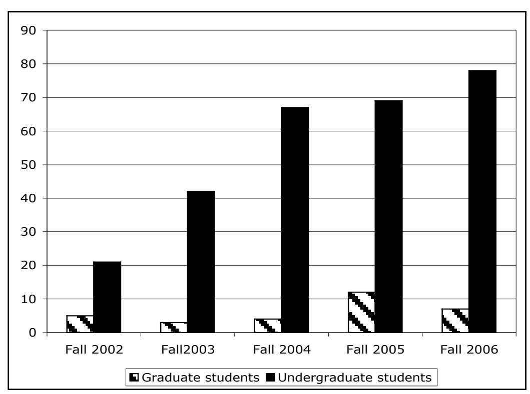
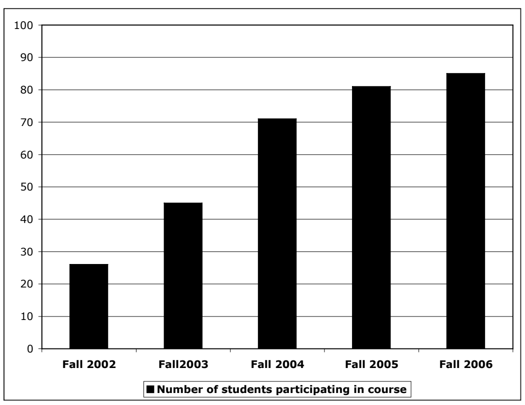


Figure 2: Comparison in the number of graduate to undergraduate students participating in the course from 2002 to 2006.



The initial year of the course was 2002. At that time, the number of consortium members was four. The number of schools that were members of the consortium and were participating in the course was three. There is a gradual increase from 2002 to 2005 in the number of consortium members and participating schools. From the 2005 to 2006 there is a drop in participating schools from 10 to 5, although the consortium continued to increase. In comparing Figure 1 to Figure 2 there is a drop in graduate student participation from 12 to 7. A possible explanation for the drop in graduate students may be a decrease in the number of schools participating in the course. Two of the schools participating lacked a dedicated technical person to administrate the course. The course is offered in the evening, and is three hours long, which requires technical personnel to be available for the entire course.

Figure 3: Increase in overall number of students participating in the course from 2002 to 2006.



A steady increase in the number of students participating in the course from 2002 to 2006 is shown in Figure 3. The popularity of the course is growing because of its uniqueness and continues to be appealing to other institutions.

CONCLUSIONS AND FUTURE WORK

Our findings suggest that tele-education is a useful tool in imparting health disparities education. If accessibility issues are resolved early in the initial stages of preparing to participate in the course via telecast or web cast the course can be successfully broadcast. Preparation for the Fall 2007 course has already begun. Thus far we have two additional schools that will participate in the course, three potential schools have expressed interest in the course and one more possible consortium member. For the Fall 2008, a fourth academic institution will be added to the rotation as a host school for the health disparities course. Our goal is to continue to increase the number of participating institutions and use tele-education on a much broader scale as a tool to disseminate health disparities.

ACKNOWLEDGEMENTS

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Educators Influence/Perspective on Cyber Defense Competitions

Haïder W. Qleibõ, Nate Evans
Department of Electrical and Computer Engineering
Iowa State University
haiderq@iastate.edu, natevans@iastate.edu

Abstract

In this age of rapid information technology development, the task of preparing future network security professionals is not a straight forward one. While an educator could find numerous books and methods detailing how he/she can bring out a skillful scientist or engineer, yet there is no best way known to achieve the desired goals in the information assurance field. We believe that early education will result a clever professional with skills tuned and toned to the real world needs. This paper discusses how cyber defense competitions offer to bridge the gap between in-class taught techniques and real world needs. It gives participants the opportunity to design their own network and then protect and defend it from outside attacks in a simulated environment. Furthermore, the paper sheds light on the importance of early education and awareness and its impact on future performance in the uncertainties of the information assurance age. We also would like to use this paper as framework to identify and meet educational goals in information assurance.

1. Introduction

There is not a single day that passes without recognizing how technology made our lives easier. You don't have to think hard to realize to what impact technology changed your life in the past decade or so. Our dependency on information technology and the internet is not growing any less; on the contrary, we are relying on it progressively. Although our systems might be protected with state-of-the-art security technologies like firewalls, intrusion detection systems, yet it takes a moment of carelessness of a system administrator to bring the entire network down. Having the tools to defend your network is only part of the equation to a better secure environment, knowing how to use and configure them is just the beginning of the "secure journey".

In a world full of developing threats, during a cyber attack event, soldiers, tanks, stealth planes and man power are the last things you should be thinking of. Your highest and most valuable resource is well trained and skilled information technology professionals. The common arising question is how could we prepare these candidates to face the constant demand for security, confidentiality and integrity? The best way to defeat your enemy is to think like one, using this prudence to stay one step ahead of them. Keeping in mind, the greatest battles are yet to be won.

Information assurance is a topic gaining popularity in colleges; some even implemented a focused curriculum serving this need. This popularity is driven by the need of skilled and professionals in this field. This paper focuses and an event-based way to accelerate network security hands-on understanding by the students. These skills are tested in a simulated real-world internet environment. Throughout the past four years, Iowa State University has been hosting cyber defense competitions for colleges, but last year was a major turn in the realm of audience invited to such event. We had the experience of involving high school students from the state of Iowa to be participate in one of the biggest cyber defense events held for students of this age.

2. Educating by Experiment

While it is not easy to escape the traditional ways of teaching; which proved its success over centuries; but its time to teach an old dog new tricks. New ways of educational techniques are needed to match the on going development in the technical field. Teaching is no longer bound to the classroom and books. Educating students about information security has to have a specific agenda covering both depth and breadth in a specific way. To come up with a concise roadmap covering the most important subject in information assurance is faced with numerous challenges. As a field, information assurance has a wide breadth, and many branches varying from network design, to secure coding, to ethical behavior, to management in network security. [1] The challenges to come up with a concise curriculum for information assurance are not easy to face.

The objective shared with all cyber defense competitions that have been surfacing the past several years is the same; providing a venue for practical education in the implementation of all strategies, tools, techniques and best practices employed to protect the confidentiality, integrity, authenticity and availability of designated information and information services [2]. In the report published several months ago by The Department of Home Land Security (DHS) about Cyber Storm [3], the largest scale cyber security exercise led by the government to test how prepared the government is to face a cyber attack and what are the incident response policies. While the target audience for this exercise was different from competitions led by schools, but the objective is the same.

In our experience, we have been integrating Kolb's Experimental Learning Theory (ELT) developed in mid 1980s [4] in our competitions at Iowa State University. This helped us achieve better results based on solid ground. ELT has four stage cycles and the competitions managed to incorporate all of them: (1) concrete experience, (2) reflection observation, (3) abstract conceptualization and (4) active experimentation; these stages are illustrated in the figure 1.

For instance if we take the High School Cyber Defense Competition that took place last spring at Iowa State University, each group of students had to form a team representing their school, later referred as blue teams. They were required to design, implement and maintain an operational network emulating a real company or organizations' network, consisting of a variety of platforms and running services. From scratch, each of these blue teams had to build the entire network come up with a defending strategy of their own demonstrating what they were taught theoretically in class. We supplied each school with instructional DVDs, developed by graduate students from the Information Assurance program at the Electrical and Computer Engineering Department, to specifically bridge the gap between what the teacher knows and what are the current real life challenges facing a systems administrator. There was a continuous relation between the graduate students and the schools after the DVDs were delivered to them to further explain concepts and sometimes visits were made to these schools. Not only this was an experience to high schools, but also it was a lesson for us to face a challenge of conducting an event of this magnitude.

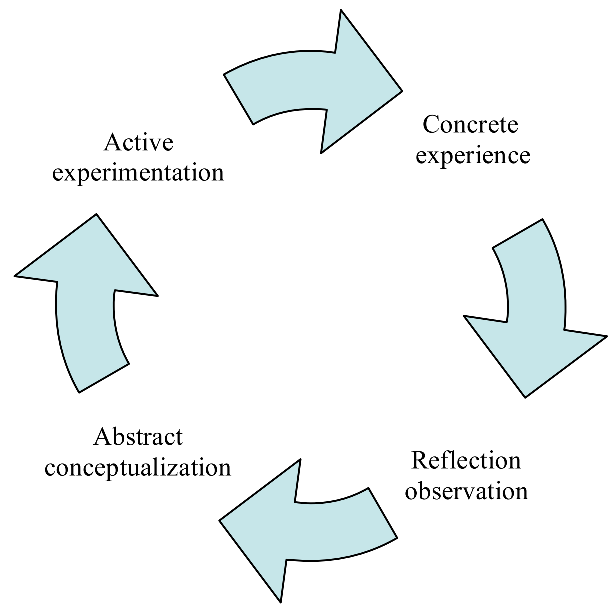

Figure 1: Kolb's Experimental Learning Theory

"Tell me, and I will forget. Show me, and I might remember. Involve me, and I will understand"; it comes to no surprise that we still use the same wisdom of Confucius from 450 BC. As the results will show in the rest of the paper, all four stages of Kolb's theory of learning styles were a major part of educational event. Students sensed the need for security and took it seriously, they observed what teachers and graduate students taught them, then they were left to reflect on the what they have studied and think about it and finally they were part of the big event where the cycle start one more time.

3. Test-bed: ISEAGE

Pronounced (ice age), is the Internet-Scale Event and Attack Generation Environment (ISEAGE) at Iowa State University is the first of its kind facility in a public university dedicated to creating a virtual Internet for the purpose of researching, designing, and testing cyber defense mechanisms as well as analysis of cyber attacks. Unlike computer-based simulations, real attacks will be played out against real equipment.

3.1. The Competition: Objectives

The purpose of the Cyber-Defense Competition is to provide students with a simulation of real-life experiences with information assurance. Students play the role of the Blue Team, or information assurance professionals, under fire from the Red Team, simulating the hackers on a network. The White Team oversees the competition, judging (and scoring) each Blue Team based upon Red and Green Team reports received. The Green Team effectively demonstrates the role of the general network users. The Blue Team with the fewest demerits at the end of the competition will be named the winner. Each member of the winning team is given a one hundred dollar gift certificate to the bookstore and their names on a plaque.

One of the primary goals of the competition is to give students an opportunity to design a security system to protect an organization based on a scenario. They must then install, configure, and manage a wide range of security devices in order to carry out the security plan. This includes configuring systems straight "out of the box" and also reconfiguring legacy systems that may already exist in an organization. The students are given very few constraints on what they can do in designing their system. They must provide the services described in the scenario and keep their systems running during the competition. During the first competition we had 6 teams of 6 students each. During that first competition we noticed the teams were too large and that a larger number of smaller teams would work better. In the fall 2006 competition we had 12 teams of 4 students each. The students choose their own teams through a web based sign up sheet, the web site also provides the rules and scenario.

There are two different ways in which educators can incorporate this competition into an education model: a curriculum-based method and an interest-based method. A curriculum-based method of implementation mirrors a class and the competition. Students are taught skills and methods in class, which will be directly useful in setting up a scenario for the competition. The competition would then act as a final project, allowing students to demonstrate the knowledge learned in a real life atmosphere. The educator acts a guide, showing students what needs to be learned. The students would act as a listener absorbing the information presented to them. The advantage to this implementation is the ability of the educator to make sure selected topics are covered and to provide a method of rewarding students for participating in this event.

In an interest-based implementation, educators play a hands-off role and the student acts in the guide role. Educators are used as an encyclopedia of knowledge in which students can ask questions. The students choose the operating system, the services and the plan to implement their defense. The advantage of this method is it encourages creativity and diversity among students. Students try out new operating systems and different technologies.

One of the biggest problems in security is the inherit disadvantage of the defender. A defender of a network must think of every way in which an attacker can break into a network while an attacker only has to think of one. As such it is hard to educate people in how to think like an attacker. Students need to understand how attacks work in order to better defend against them. A CyberDefense Competition gets students to think like an attacker. There is no way to reproduce this experience in the classroom.

3.2. Guidelines

Blue team guidelines:

- Each team will be required to run a major service on all three Operating Systems: Macintosh, Windows, and Linux/Unix. They are also required to run a re-built legacy image and a "unsecure" OS of the teams choice. The version does not matter but it must fit within guidelines for allowed software.
- Each Blue Team will be required to submit a report before the competition detailing their network setup. This document will explain while certain choices were made from a security standpoint and will include supportive diagrams.
- After each attack the Blue Team has the opportunity to submit a report detailing the attack that will be used to determine scoring.
- After the activity each team will also be required to submit a report entailing how vulnerabilities where caught and anomalies handled
- The Blue Team cannot perform any offensive actions towards any other team.
- All software used must be on the list provided to each team or personally created by a member of the team. Software which was created by a member of the team must be documented and sent to the competition's committee before the competition.
- The Blue team is not allowed to receive or request assistance from anyone not registered on the Blue Team.

Red team guidelines:

- Team members must fill out the Attack Evaluation form for each successful attack.
- No personal contact with the Green Team or Blue Team is allowed within the context of the

competition. Internet-related communication is appropriate (such as e-mail, etc).

- No DDOS attacks can be used against any team.
- Offensive security breaches are limited to the ISEAGE environment.
- A final evaluation of each Blue Team must to be filled out by the Red Team at the end of the competition.

Green team guidelines:

- The Green Team is expected to complete daily activities (such as checking e-mail, general internet browsing, etc), but are not limited in activities. This team can even attempt to attack systems on their own.
- Fill out a Usability Form hourly must be completed within a 15- minute time period.
- The Green Team must be responsible for the initiation and testing of the predefined anomalies.
- Green Team users may only log in under their assigned User ID.

White team guidelines:

- The duties of the White Team do not permit aiding or assisting any team in accomplishing tasks.
- One member of the White Team must be monitoring the competition at any given time.
- The White Team is responsible for scoring updates throughout the event.

3.3. Scoring

Scoring is kept updated and monitored by the white team with the aid of the green team. Blue teams will be scored based on their ability to secure their perimeters and respond to threats while maintaining the availability of their networks and services.

Each team starts the competition with no demerits. The winning team is determined by whoever has the fewest demerits. Demerits will be added to the team's score through 1 of 5 criteria:

1. Before the competition, each team must submit a report detailing their respective system setup. This submission will detail each team's specific design choices regarding information security and should include complementary diagrams (network diagrams etc) explaining their setup. If the report is not completed and submitted by the start of the competition, a penalty will be applied to the teams score.
2. Blue Teams will be penalized rule infraction at White Team discretion. This could include using unapproved software or bringing in hardware without prior approval.
3. A Blue Team can be penalized for not providing the services listed on the scenario. These services include (but are not necessarily limited to): web serving, file serving, e-mail, remotely accessible programming environment and routable Internet to the clients. For each service that is unavailable, demerits will be added to that team's score.
4. Teams will be subject to demerits based on Green Team usability reports.
5. The team can be penalized with demerits as vulnerabilities are found and exploited.

A team may also improve their score in one of 2 ways. This means demerits will be subtracted from the teams score. The following actions will result in scoring:

1. Effective dealing of anomalies. Anomalies are normal headaches that occur to a system. This may include something as simple as the power going out, to something more complicated like a flood of random traffic.
2. The blue team may submit reports to the white team determining what types of attacks are happening to their system and any feasible solution that may have to solve a breach.

4. Survey Results

A survey of educators from the last few competitions including three local competitions, one national competition, and one high school competition showed that both methods above were implemented successfully.

About half of the educators surveyed (4 of 10) used the CyberDefense Competition as part of a class exercise or as a class. Two others stated that they would have but the timing was bad. The one's who did not implement it in classroom environment did it on an interest level. Students were encouraged to obtain information and do everything outside of any classroom. However guidance was still necessary from an educator's point of view to keep students on task and focused.

The students get a real hands on approach to security and get to install and configure security mechanisms that they would not have time to do in class. Hands-on immersion is one of the best teaching tools.

5. Conclusion

This event not only managed to help students engage in cyb

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Communicating Cyber-Cultures through Children's Television: A case study of *Cyberchase*

Shu-Ling Chen Berggreen, Ph.D.
School of Journalism and Mass Communication, University of Colorado, Boulder
Boulder, Colorado 80309-0478, USA

ABSTRACT

Through textual analysis of Cyberchase, a PBS children's programming in the United States, this study explores the role of television representations in creating the images and shaping young viewers' understanding of cyber-cultures.

Keywords: Children's television, PBS, Cyberchase, Cyber-cultures, media and socialization.

1. INTRODUCTION

Children's early learning experiences are more successful through play than by direct teaching. Transformation play is a particularly important part of that playing and learning process. For better or for worse, mass media have become a significant (and in many cases, useful) resource in generating an imaginative tendency in children's play. Therefore, it is crucial in the information age to have characters and TV cultures that properly encompass cyber elements for young children to mine for their imaginative play. In other words, in the age of electronic childhood, media-induced play is now a part of children's socialization process, preparing them for the inevitable cyber-cultures they are to live in [1].

Currently, the Internet is the engine of cyber development and of cyber-culture evolution. Although the Internet has many positive values, such as providing people with a wealth of learning resources, negative implications also abound [2]. For example, observers are concerned that heavy Internet users, especially children and teens, seem to lack traditional person-to-person, face-to-face social interaction skills and they venerate solidarity much more than teamwork. In addition, studies have shown that teens are posting material on social networking sites, such as MySpace and Friendster, that could elicit many negative consequences [3].

Research indicates that in the United States children as young as three years old are using the computer on their own. By the time these users reach their teens, they use Internet as crucial resources for their identity formation and opinion configuration [4]. Therefore it is important, even for young children, to be cyber media literate in order for them to successfully and safely maneuver in the cyber society to come. In this age of electronic childhood, fortunately or unfortunately, television becomes an unobtrusive tool for them to acquire this cyber-cultural capital. As in many other instances, the Public Broadcasting System (PBS) is leading the trend in creating a cyber-cultural show for young children. Thus, the chase for cyber literacy is on and not a minute too soon.

2. *CYBERCHASE*

Produced by Thirteen/WNET, *Cyberchase,* an animated program, premiered on January 21, 2002. Broadcast by 350 PBS stations and channels in the United States, *Cyberchase* now reaches five million viewers weekly. It is ranked among the top 10 PBS programs for children across the United States [5].

Cyberchase is currently at its 5^{th} season and has a total of 72 episodes to date.

The Story

The show features three children, Matt, Jackie and Inez, from the planet Earth and Digit, a cyber-bird from Cyberspace. They team up to stop the evil deeds of "the Hacker" and his two sidekicks, Buzz and Delete, who constantly attempt to take over the Cyberspace, which is guarded by Motherboard.

The first season began with the episode "Lost My Marbles." Hacker first infected Motherboard with a computer virus and then captured Dr. Marbles, Motherboard's repairman. Meanwhile, at a library on Earth, Matt, Jackie and Inez was using a computer mapping device to locate their desired sections of the library. In the process, they were sucked through a dimensional portal into Cyberspace where Motherboard enlisted their help. Teaming up with a cyber-bird named Digit, they rescued Dr. Marbles. Motherboard was restored and Cyberspace returned to normal.

From that point on, in each episode, Hacker attempts another scheme to either bring chaos to or conquer the Cyberspace. A variety of new characters and new cybersites are introduced through each new season. For example, season two saw the appearance of Wicked, a female witch from the cybersite "Happily-Ever-After." In the third season, the cybersquad (the earth children and Digit) met Slider, a cyber-being lives in the cybersite "Radopolis," where everyone skateboards everywhere.

Through various cybersites and a variety of characters, each episode takes the viewers on a gripping adventure driven by a different mathematical concept. In their quest, the heroes have to use minds, not muscles, to overcome obstacles and danger to outwit Hacker and save Cyberspace [6]. While a typical "good triumphs over evil" story, the show encourages teamwork and logical thinking, teaches mathematics and projects possible virtues and inflictions of cyber-cultures.

3. TEXTUAL ANALYSIS

Viewing and Sampling

Viewing of the program for this study began in 2004 and continued through June, 2007. Initially, the viewing was to familiarize the researcher with a relatively new children's programming, a routine task for any student of children's television. However, as the TV series gained popularity, the move to continue viewing becomes an obvious move.

This viewing experience is used here as a framework and background for the study, while the detailed examples in this paper are derived from a sample. A probability sample of two composite weeks in spring 2007 (up to June 6) was constructed. Six episodes of the show are available weekly, Monday through Friday and Sunday. As a result, 12 episodes were selected for textual analysis. It should be noted that only nine episodes has been produced for season five. This means that in spring 2007, almost all episodes aired were reruns from all five seasons. Therefore, the sample of two constructed weeks from spring 2007 offers the advantage of providing examples from across all seasons for detailed analysis.

Episode synopsis

A contextual framework is necessary in order to understand cyber-cultures projected in *Cyberchase*. This section, therefore, provides brief summaries of some episodes which typify the story plot of the show.

"A broom of one's own": Wicked is a female witch who has a crush on Hacker at one point. However, just as Hacker, she is eager to conquer Cyberspace. In many instances, Wicked battles against Hacker for the helm of Cyberspace, despite the love interest they seem to have for each other from time to time. In this episode, Wicked came up with "Wickedy Brooms" and promoted them on Cyber-TV informercial with false advertising. She even used the pictures of Cybersquad to endorse the product without their permission. The brooms were actually computerized vacuums which could drain power from the Motherboard. Consumers who purchased the products became Wicked's Cyber-army and almost took control of Motherboard.

Even though the Cybersquad was first unhappy about their names being falsely used, they were excited about the possible fame as a result of being on Cyber TV. As soon as they realized the wicked plot, they calculated and tested the speed per second needed to out fly Wicked and her Cyber-army to rescue Motherboard. They succeeded because of their teamwork, logical deduction and precise calculation.

"The grapes of Plath": In the underwater Crab Kingdom of Cyberspace, the crab prince yielded to peer pressure and jumped into abyss the night before his "shell change ceremony," a rite of passage before his ascent to the throne. However, the abyss made the prince into a liar. Now the chaos was to come to his kingdom. Motherboard informed the cybersquad to obtain the grapes of Plath from the Fountain of Truth to cure the prince, so as to maintain the balance of Cyberspace. But Hacker, of course, was in the way. Once again, using their brain powers, every one in the squad contributed various ideas and computed and tested a way to reach the fountain and devised a ladder with accurate measurement to reach the abyss to retrieve the prince. Cyberspace returned to normalcy.

"A crinkle in time": As the cybersquad unraveled another of Hacker's plots to destroy Cyberspace, Hacker decided to trap the squad in "Tick-Tockier." It is a cybersite of a different dimension. Unless one knows how to rework the clocks on both dimensions and use the time difference to warp back to other cybersite, one will forever stay in Tick-Tockier. Once again, using reason, instead of force, the squad figured out how gears work. By combining different sizes of gears to rework the clock, they were able to outfox Hacker and free themselves from Tick-Tockier.

This episode also incorporates humors even in the midst of tension and pressure, which is a regular and consistent feature of the show. For example when they entered Father Clock's house in Tick-Tockier, one clock asked, "When does a clock gets sick?" Another answered, "When it is run down." Matt laughed and then asked, "Why does the boy throw the clock out his window?" The answer was "because he wants to see time fly." They all had a good laugh, which seemed to make their difficult task of racing against time more manageable.

"The Borg of the ring" and "Totally Rad": These two episodes feature the cybersite, Radapolis, where the cybersquad first met Slider, a cyberkid who looks just like an earthling. In "the Borg," Hacker took the ring, the crown of Radapolis, and used its power to attempt another Cyberspace conquest. The cybersquad and Slider devised a plan to defeat Hacker. First, they had to find out the historical background on the ring. They encountered "information overload" and had to use induction and deduction to reorganize their research strategy. Afterwards, they were divided into two teams. Matt, Slider and Digit went to recover the ring while Inez and Jackie searched for the "Circle of Supreme Safety," where the ring must be placed once reclaimed. Inez and Jackie also needed to locate the exact center point of the circle without any measurement tools. Clear thinking, aided with materials from the surroundings, helped them accomplish the mission. The ring was returned and Cyberspace was safe once again.

In "Totally Rad," Hacker actually captured Radapolis temporarily but the Cybersquad restored it by winning a skate-off contest against Hacker's team. During the contest, Hacker went through various cheating schemes to change the shape and the size of the skating rink. But through calculation and measuring, the cybersquad was able to detect the deceit and win the contest. The episode ended with Matt at his earth home. Using lessons learned from the Radapolis skate-off, Matt designed a rink with a perfection dimension and shape for his pig.

4. LESSONS FROM THE CHASE

Four major themes emerged which characterize the virtues and inflictions of cyber-cultures depicted through *Cyberchase*.

The obvious speed and convenience
Throughout the show, computer-related technology (along side logical thinking and sometimes primitive tools) are used at ease to accomplish various tasks. The cybersquad flew to rescue Motherboard on brooms with special computer chip inside. They warped from cybersite to cybersite with the aide of Cyber Positioning System. Even on earth, while at the library, a Global Positioning System was used to track down location of information. They also received C Mail (Cyber Mail) and whenever possible downloaded information from cyber computer sites to help solve problems.

While it is fictional, the show draw attention to viewers the speed and ease of cyber travel, be it for information or transportation. It also stresses the omnipresent of computer in the information age and in the cyber-cultures to come. However, with all the convenience, *Cyberchase* also highlights hidden danger that may not be so evident.

The insidious danger
The show implies vividly the futility of using computer blindly, which could lead to information overload. Therefore, the only way to accomplish a task under the circumstances is through clear thinking and "logical" use of the technology. In addition to information overload, it also discusses reliable versus unreliable information sources, as Hacker often releases intentionally unreliable information to confuse cyber computer users. Therefore, intelligently, not blindly, reliance of computer is once again reinforced.

Further, it cautions posting materials carelessly on computer sites and forewarns the ease of identity theft, such as Wicked did of the cybersquad in the "Wickedy Brooms" episode.

Ultimately, there is, of course, "the Hacker" of Cyberspace. Whatever brilliancy one enjoys from a cyber-oriented world, one needs to be aware of the Hacker. Nevertheless, the program also presents ways of outmaneuvering the persistent Hacker.

Brain power is the key
Episode after episode, no matter how powerful Hacker's computer chip or cyber transporter or Wicked's Cyber army was, the cybersquad consistently using their logical, clever and clear thinking to defeat evil forces in Cyberspace. *Cyberchase* is not the only futuristic children's show highlighting the defeat of a dark force. However, it is the only show in which the good triumphs over evil with the brain power not the muscle power. There is never a weapon, an explosion, a hit or a kick.

Teamwork is the way
Teamwork is another way to victory over the Hacker. Again, *Cyberchase* is not the only children's programming featuring heroic rescue episode after episode. However, in *Cyberchase*, it is never about one superhero (with a few sidekicks or assistants) coming to the rescue. It is always the whole squad working together and everyone contributes equally to accomplish the mission.

Teamwork and interaction and socializing with other children and cyber-beings are a norm rather than an exception in this show. This feature is in direct opposition to "solidarity" - to some observers, a worrisome characteristic of cyber society.

5. CONCLUSION

Children today are inevitably to develop and grow in an electronic media saturated environment. Information delivered to them and experienced by them through electronic sources, such as television, for better or for worse, has become very influential and powerful. As the society enjoys and celebrate the advantages of Internet, experts and observers also dread about the possible danger, especially for young users. While teaching mathematics, *Cyberchase* interweaves many realistic as well as possible features of cyber-cultures into the show's action-adventure climate. It has stood out as an intelligent and effective way of communicating with young viewers about the pros and cons of cyber-cultures. Once again, PBS is on the right track in helping the growth and development of children in the United States. While television should only be one of the many sources of information in children's lives, the commercial TV industry should pay a closer attention to this PBS example and search for a better way to serve the young audiences, the future of our society.

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Balancing Evidence-based Practice with Practice-based Evidence: A Cybernetic Framework

Dale FITCH
School of Social Work, University of Michigan
Ann Arbor, MI 48109, United States

ABSTRACT

This paper applies the systems science of cybernetics to the implementation of evidence-based practice (EBP) in the provision of professional social work services in an agency setting. It does so by systemically balancing EBP with practice-based evidence (PBE) with a focus on the organizational and information system infrastructures necessary to insure successful implementation. This paper builds upon the author's prior research in this area and extends EBP research to the organizational level.

Keywords: Cybernetics, Evidence based practice, Management information systems

BACKGROUND

Evidence-based practice is the use of research, ideally drawn from rigorously designed controlled studies, when working with clients [1]. This research is then translated to guidelines or "best practice" procedures. The issue of the role of EBP has itself undergone numerous reviews because the resulting EBP guidelines are oftentimes viewed as being developed by researchers who have limited or no understanding of the exigencies faced by practitioners in serving clients in real world settings as opposed to the experimental settings from which the EBP research originated. Some authors have identified epistemological and methodological issues in their critiques [2, 3], while others have argued that "practice" should be co-created not only by those you develop EBP guidelines, but also by those you have to use the guides and by those affected by the guidelines, i.e., the service recipients [4]. Specifically in the field of social work, the concept of EBP has been addressed by numerous authors (e.g. [5, 6]); however, arguments to its relevancy or appropriateness for practice continue to be addressed [7].

One such argument involves the relative neglect of practice-based evidence (PBE). Barkham et al outline the need for such in the development of an outcomes measurement tool that can provide feedback on treatment effectiveness [8]. While they note the use of this data can have systemic effects at the organizational level, the mechanisms by which those effects can occur were not addressed. Even as these discussions have been going on, a recent *American Journal of Public Health* issue was devoted to the role of systems sciences in addressing the EBP – PBE divide [9]. Specifically, the plea was made for the systems sciences to augment EBP with simulation and modeling capabilities applied to PBE to more closely capture what happens in applied settings as opposed to experimental settings.

While Gambrill and others have described the need to address the applied setting, or the organizational context, the social work research community has largely ignored the PBE context in which these guidelines will be used [10]. One noteworthy exception is the work conducted by Barratt and others in the United Kingdom in the *Research in Practice* project [11].

Specifically, they noted that information should flow both up and not just down through an organization. Her research subjects also cited the need for audit mechanisms, but the audits were not linked to PBE and there was a tendency not to identify organizational structures that might facilitate PBE. Their research and the author's prior research form the basis for applying cybernetics to this subject.

THEORETICAL FRAMEWORK

Cybernetics provides a framework to assess organizational processes in such a way to determine whether or not the requisite variety activities are negentropic or not. Of prime concern would be whether or not the organizational structures are in place to facilitate the gathering and transmission of PBE back through the organization. Otherwise known as empirical based practice, PBE arguably has a longer history in social work practice the EBP, including the early work by Nurius and Hudson in their design of clinical information systems [12]. For reasons beyond the scope of this paper, the case for PBE has not been as persuasive at the case for EBP hence the use of those clinical information systems for PBE purposes has been largely underserved.

Within the broad range of cybernetics, this paper will apply Stafford Beer's [13] Viable System Model (VSM) to aid in understanding and evaluating an agency's organizational structures and systems of information with the aim of improving EBP integration. The author has used this theoretical framework to evaluate the functioning of human service agencies' systems of information to determine how effectively they have been designed. Beer's VSM has been used in numerous organizational studies [14-17], although cybernetics has not been widely used in the human services sector with Raymond [18] being a notable exception.

OPERATIONALIZING THE FRAMEWORK

Overview

Key to understanding EBP integration is recognizing implementation factors at the executive, supervisory and operational levels of the organization. These three distinct levels correspond to Beer's System 4-5 (executive), System 3 (management or supervisory), and System 1 (the operational level or line staff) with System 1 being the source of PBE.
System 2 would be the translation of EBP guidelines into procedures and protocols implemented by System 1.

System 4-5

While Beer would strenuously argue that a description of organizational processes should begin with System 1, the convention is oftentimes to begin at the "top" of the organization and work down. This paper will do so, as well, fully cognizant that this decision largely mirrors the problems inherent in doing so. Accordingly, the decision to use EBP guidelines is made by System 4-5 for the whole organization. The impetus for this decision has largely been driven by environmental inputs originating from managed care entities, other funders, or licensing entities. Noticeable by its absence is the impetus to implement EBP from either System 1 staff or as a result of PBE outputs. To their credit, System 4-5 executives are well aware of the pitfalls of this top down approach, but feel largely powerless to do so otherwise. All of these outside entities, due to the funding strings attached to their directives, carry considerable weight in this decision making process.

On the other hand, System 4-5 staffs want to do what is best for the clients they serve. As such, if a study has found a certain treatment or intervention to be effective, then they naturally would want to make this intervention available to their clients. However, what is oftentimes missing in this deliberation is the knowledge of how well their own interventions may be working, a point to which we will later return.

The decision to use a particular EBP guideline may also have implications for program design, training, and hiring decisions, thus it has considerable import. It may require a different type of staffing level and skill package for staff providing the intervention. There may be associated mandatory training and the costs associated with that training. It may also require other ancillary resources from the agency.

An important parameter in this decision making process is the frequency with which it occurs. Cybernetics is sensitive to time parameters and this type of decision may be made only annually or even less frequently. It is oftentimes viewed as a strategic decision by System 4-5 and is framed as a 'treatment philosophy' or 'treatment approach' and may be part of advertising or other promotional material.

System 3

If the decision is made to implement a new guideline, it is natural to understand that System 4-5 would want to make sure the guideline or practice is implemented as designed and that job falls to the responsibility of System 3. Typically occupied by Program Directors or Managers, these staffs set about first by adapting the EBP guidelines to the practice setting and then implementing them via treatment or service protocols (System 2), a variety amplification process. At the end of this string of decisions are the System 1 staffs who implement these protocols.

The monitoring of these protocols is accomplished via System 3 audit measures, e.g., a Quality Assurance or Quality Improvement function in an organization. These audits include monitoring System 1 documentation of service delivery and then subsequently via monthly or quarterly protocol implementation monitoring reports. If no further use is made of this System 1 clinical documentation, then that process by design is attenuating considerable variety, otherwise, why is the information being noted. Most onerous would be those agency information systems in which the documentation of service delivery occurs on paper only to be noted and aggregated again at some point in the future via another paper form. This type of process would be characterized as entropic. Knowing whether or not the use of EBP guidelines is making a difference in the lives of the clients served by the agency should be a requirement for the agency having the necessary requisite variety to provide those services. Ideally, this requisite variety is not being jeopardized by variety attenuation processes or being achieved otherwise via entropic processes.

Unfortunately, these processes are usually not evaluated in terms of their cybernetic qualities. In other words, the processes and tasks required to accomplish those processes become conflated, i.e., they become one and the same. For example, a typical System 3 quality audit practice is to make sure that client documentation is completed within a certain time period. To assess this quality parameter, a committee draws a random sample of cases and analyzes the documentation to ensure it is complete and performed within the established timelines. Oftentimes the content of the documentation is assessed separately or not at all. In evaluating this audit process one would note the staff effort required to perform this task, that the resulting data is tabulated on a tally sheet then transferred to a spreadsheet (before ultimately ending up as a report in a Word document) as well as the fact that this audit routinely takes place some time after the actual client was served, sometimes weeks or months later. In sum, there are considerable staff resources and time expended in a task that only serves an audit function. In that it does not produce any actual work it might be viewed as a net entropic process. An alternative approach to accomplishing this task, while serving the overall function of the process, is described below.

System 2

As previously stated, the EBP guidelines are operationalized via this System 2 function. Oftentimes originating in large controlled studies, EBP guidelines may share little resemblance to the clients faced by the human services professional. While the presenting problem may be the same, e.g., alcoholism, the way in which it is manifested in the community setting is oftentimes accompanied by other issues, e.g., unemployment, cognitive issues, family problems, etc. These contextual factors then require the agency to adapt the guidelines to the practice setting.

One routine adaptation is the coordination function performed by System 2 in that a client who has multiple issues will need to have their interventions coordinated to avoid gaps or duplication in efforts. Not addressing these gaps or duplication may introduce oscillatory behavior to the organizational functioning. This coordination function may require an adaptation of the EBP guideline that may compromise its overall effectiveness, a System 3 concern, and it is not uncommon for this process to take quite some time to transpire. Unfortunately, System 1 staff may not be involved in these deliberations.

Another adaptation is the modification of an EBP guideline in light of the organization's overall philosophy of practice. While a consideration of System 4-5 in adopting a guideline, it is left up to the System 2 function to operationalize what it will look like. Tradeoffs in this process are oftentimes cited as a lack of treatment fidelity, in other words, the intervention was not implemented as it was envisioned or tested. This possible outcome is then addressed by System 3 as outlined above, and with all of the same encumbrances. Rather, as an alternative to the notion of lack of treatment fidelity, it may be informative to gather systematic feedback, i.e., PBE, from System 1 regarding these implementation failures. In its place, weekly or monthly staff meetings should provide a forum for System 1 staff to provide this feedback; however, this feedback is usually ignored or disregarded as too anecdotal, a variety attenuation process, and not recognized for what it truly is – PBE.

System 1

This roundabout way of getting to System 1, which Beer asserts is actually what the organization is all about and is the only system that actually does the work of the organization, aptly conveys what it feels like by those who work in System 1 when confronted with the message that they must use a guideline that is deemed to be "evidenced-based" or a "best practice" as opposed to what they may already be doing. Indeed, this raises the very question as to what it is that is happening at System 1. To assert *a priori* that it is not evidence-based in strongly argued against by Fox [3] and Ferguson [4] among others. Indeed, it may be a perfect example of the "absence of evidence is not the evidence of absence" assertion. Moreover, this purported absence may be the cybernetic crux of the matter, i.e., this absence of information is actually a manifestation of the breakdown in the feedback process.

Before addressing this issue, it would be helpful to return to Beer's Viable System model. In addition to Systems 1-5 are three channels that serve to connect these systems on the command axis: the resources channel, the channel that communicates the corporate ethos, and the feedback channel. The resources channel sets the constraints by which the organization must accomplish its goals, i.e., the numbers of programs, staff employed, etc. The corporate ethos channel sets the broad parameters in which the organization must function, e.g., this is a mental health agency and this is what we do. As previously discussed, much of this corporate ethos is operationalized by System 2. The last channel is the one most often overlooked – the feedback channel. It should serve as the primary mechanism to let the other systems know whether the overall organization is achieving its mission, which is distinct from the System 3 function of monitoring whether or not programs are being implemented as designed. While the other two channels flow down, it is the only channel that flows up directly from System 1 to System 4-5. [Granted each communication point in Beer's model assumes reciprocal communication; however, this brief paper is focusing on primary system functions.]

The data that would comprise this channel is routinely recorded by the System 1 staff because it is what they need to know if they are making a difference in what they hope to be achieving with a client. That is, System 1 staffs are most sensitive to their own requisite variety when working with a client. This diligence may be reinforced by a supervisor, but it is the staff person for whom it is real. As such, they will record what they know they need to know regardless of any management directive to do so. Where and how it is recorded, though, may be problematic for it is oftentimes recorded in paper documents, i.e., a client file or form. As such, while the data is recorded, to the extent that it is on paper and made relatively inaccessible to other systems in the organization at an aggregate level, it is essentially lost to the organization, i.e., it represents a massive variety attenuation process. This is not news to System 4-5. Indeed, it is almost expected as a feature of bureaucratic paperwork; thus, to counter this process, System 3 implements almost equally massive audit functions to amplify their variety such that the organization maintains some type of homeostatic balance with the environment.

In essence the process looks like this: a System 1 staff person works with a client and records progress toward goals and other notes on a piece of paper. This is almost always done concurrently when seeing a client. This paper is placed in a folder and filed away in a cabinet. It is most likely never viewed again unless the client returns for services to the agency. Then, on typically a monthly basis, the System 1 staff person goes about filling out a tally sheet about the clients they served. The tallies can cover a broad range of issues, all identified by System 3, as important for the organization to know. As such, it purportedly serves a variety amplification process, but attenuates a massive amount of variety in the process. The most problematic feature of this process is that it duplicates information already recorded in the client file thus a net entropic process. Cybernetically, the process can become very ugly at this point because the tally sheet is oftentimes done on paper which means a System 3 staff person then enters the data into a spreadsheet so it can be aggregated and reported out. Often overlooked in this process are the amount of time and resources that are used up in essentially reproducing data repeatedly.

Apart from this potential waste of time and resources, though, is the most essential overlooked aspect of this process, that is, what is it that is occurring at System 1. If System 1 is acting in response to EBP directives filtered down from System 4-5, then the cybernetic balance of the equation must be that System 4-5 should act in response to the PBE sent back from System 1. To do so fundamentally requires that System 1 have the ability to communicate that information in the most expeditious fashion. Instead of recording client outcome data on paper, that data must be entered once digitally and then transmitted to the various other systems in the organization as cybernetically necessary. In essence, the capturing of this client outcome data then becomes practice-based evidence! However, it has several distinguishing factors from EBP:

1. PBE has immediate relevancy to the client served. While an EBP guidelines purports to outline what should help a client, the PBE will capture the data that indicates what actually helped a client.
2. For organizations that have several System 1s or if it provides services in several locations, then aggregated PBE data will allow the organization to learn about itself. Historically this knowledge management process is attempted through staff meetings and other venues, but the resulting data neither is systematic nor is there any attempt made to share aggregate data. Indeed, while System 5 will oftentimes produce an Annual Report to distribute amongst various constituencies, rarely do System 1 staffs read these reports!
3. PBE will have immeasurably more requisite variety than any EBP guideline since PBE data is generated by the collective host of all System 1 staffs. Put otherwise, while there may be one EBP guideline derived from a controlled study of several hundred or several thousand research subjects, PBE data can reflect the sum total experience of tens of thousands of clients in a very short timeframe.
4. Time – whereas the decision to use an EBP guideline may be made on an annual or less frequent basis, PBE decisions are made on a daily basis for clients served. System 1 staffs

do not have the luxury of waiting for quarterly or annual reports; they have to make decisions with clients as a routine aspect of daily work. To the degree they do not have access to PBE is the degree to which the organization does not know if they are taking the right course of action with any given client.

5. Finally, to the extent that System 1 staffs do not have access to a management information system that facilitates the recording and access to PBE is the extent to which the organization will be engaging in entropic behaviors. Granted, MISs cost money, so does entering data two or three times, operating blindly, and excessive dependence upon audit reports.

Returning to the earlier paperwork example, if an agency had an MIS, then a System 1 staff person would type in their notes as they normally would. Also included, though, would be data fields capturing all the relevant client outcome data needed by both the System 1 and System 3 staffs, i.e., what is already being captured on the tally sheets. However, most of those tallies would become irrelevant in a MIS. For example, the System 3 quality audit report about the timeliness of clinical documentation would be performed by simply running a query against those data fields in the clinical record. This would obviate the need for System 1 staff to record this information and it would preclude the need for System 3 staff to manually retrieve the data and enter it into a spreadsheet. This query could be performed hourly, daily or however often as needed. Secondly, another query could be run against the actual content of the note to be reviewed by supervisory staff. Instead of the time and resources spent in manually searching through client files or records, this data could be delivered to the appropriate staff on an as-needed basis for decision making purposes. No longer would valuable data be lost to the organization in folders or file cabinets. The net effect is that the organization would be engaging in more negentropic and variety amplification behaviors and less time in entropic and variety attenuation behaviors resulting in overall increased requisite variety for the organization.

Summary

While the debate about the relative merits of EBP vs PBE has principally been philosophical in nature, I argue it is fundamentally cybernetic in nature in that if the feedback process from PBE to EBP is not optimized, then the EBP guidelines may become disconnected from the needs of clients resulting in homeostatic imbalance for the organization and perhaps the whole treatment community. Indeed, many authors critical of the EBP approach will oftentimes mention the need to "balance" the guidelines by learning from their actual implementation [4], or that there should be a "bottom-up" flow of information [3]; however, none of these critiques have used an explicit cybernetic framework to explain how that balancing act might occur. Vital in this equation is the acknowledgement that PBE decisions are made much more frequently and in a shorter timeframe than EBP decisions. As such, the data derived as a result of EBP implementation, i.e., PBE, must be on the command axis of the organization if all organizational decision making relative to EBP guidelines is to have the necessary requisite variety to assure the validity of subsequent implementation research. Stated otherwise, while the path of implementing EBP guidelines from System 4-5 to System 1 is well trodden, the path back from System 1 to System 4-5 is oftentimes hard to find.

OUTCOMES

Cybernetics will allow agency administrators to be able to operationalize and measure the following variables: requisite variety, variety amplification, variety attenuation and entropy. The whole discourse about EBP and PBE could be reframed as a variety amplification process to address the requisite variety needs of our System 1 staffs as they deal with increasingly complex clients. Process variables to record and access PBE should include frequency and time factors. Assessing these variables will be fundamental to balancing EBP with PBE and the successful integration of EBP into social work practice. Other authors would like to extend the debate beyond the integration the EBP and PBE to develop a new model of PBR, Practice Based Research [3]; however, that model, too, would be wise to explore the cybernetic implications of this model to make sure all salient processes are addressed.

Beer's Viable System Model would also dictate the next iteration of this modeling process, i.e., once the PBE is fed back through the organization as input to System 4-5, then System 4-5 must turn it into output for their environments. Stated otherwise, how are EBP guidelines to be evaluated and modified? Most onerous would be to replicate what is already being done, that is, to engage in another top down process led by an organizing or accreditation body conducted by a System 3 audit function with all of their respective organizations. Instead, the PBE outputs from each organization should be aggregated across agencies and delivered as an input to this meta-organizational body. Cybernetically, it will have more requisite variety than any System 3 audit function that might be envisioned. One can only imagine all the additional contextual factors that could be identified at the organizational level. Using alcoholism, for example, these contextual factors would range from work setting, populations served, age of clientele, co-morbid conditions, socioeconomic factors, treatment setting, etc. Granted the EBP requirement for a control group would not be achieved, but such a need would be obviated since the only function of a control group is to know whether or not a difference that was observed was statistically significant. Since the PBE data will contain data of what worked and what did not work, then a new form of EBP-PBE data will evolve. To augment the *EBP → practice* model, we would now have the *PBE → EBP → practice→ PBE → EBP…* model.

Finally, by allowing the System 1 staff to play a vital role in the formation of input into EBP, then the EBP guidelines themselves become less of a philosophical, epistemological, or methodological issue. Instead, they simply become a pragmatic issue to be gauged against PBE.

IMPLICATIONS

While social work debates the merits of EBP, medicine, psychiatry and nursing continue research in implementing EBP guidelines. If this implementation is divorced from a research-based understanding of the organizational context in which they will be used, then social work practitioners may be obligated to use guidelines possibly poorly suited for the human services workplace. As the primary providers of mental health services in the United States, this might be problematic. Cybernetics may remedy this outcome.

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Computer-based tools and social organizations' role in the instrumented mediation processes: framework and methodology need to be built.

Serge AGOSTINELLI
UMR CNRS 6168 LSIS, Université Paul Cézanne
3, Avenue Robert Schuman, 13628 Aix-en-Provence, France

and

Sylvain TOURNÉ
CRAIC, Institut d'Etudes Politiques,
25, Rue Gaston de Saporta, 13625 Aix-en-Provence Cedex 1, France

ABSTRACT

The purpose of this paper is to submit questions and to propose a methodology in order to analyse the computer-based tools and the social organizations' role in the instrumented mediation processes. We initially propose an inventory of fixtures which reactualizes already known questions. In the second time, we suggest elements for an adapted method in order to resolve the type of problem involved. There, we will approach seldom used theoretical fields as well as methodology. Eventually, we will look at our approach limits and at the opening prospects.

Keywords: Artefact, Culture, ICT, Mediation, Methodology.

1. POSITION OF THE PROBLEM

This research considers Information and Communication Technologies (ICT) as a plurality of devices, on the side of human activity products. They are also means of drawing up human relations in a collection of contrasted situations. This research based on instrumented and socially built situations requests the construction of a centred methodology on human beings relationships through the role played by ICT. This methodology must clarify the role played by the stable configurations (hard- and software) and their moving practices, especially on the "effective mediation[1]" that occurs in the social construction of the interindividual relations. Regarding mediation, the perpetual construction of ICT practices[2] allows to do what the technique effects restrain because of the stability of the "supposed practices"[3].

The stake which distinguishes the "supposed practices" from the "effective practices" goes further than the techno-centred speech which generally preaches an *a priori* founded on the message transmission. This stake positions the technical object as one of the "sociotechnic system" actors [1]. The community members allot intentions of communication to this technical object as well as means for supporting or amplifying information transactions. This original vision places us in an anthropological approach of the computer-based tools of communication. Indeed, in any culture or community, the objects are the product of a human activity. We allotted them a cultural intentionnality and we suppose they are selectively organized or used for honouring their communicative value [2].

The originality of our ICT anthropological approach is to observe the tools practice as a cultural performance. This anthropological approach gives the possibility of bringing a new glance on various fields which usually lead research in a dispersed way regarding the relations that human-beings (users) and ICT maintain.

- For example, cognitive psychology studies the cognitive strategy of the individuals related to the use of the TIC from the object's properties point of view. It organizes its research throughout an experimental way by reducing each individual to a subject status.
- The ergonomic side highlighted the systematic shifts which exist between the rules followed by the users in their practice and those worked out by the designer. One of the conclusions could be that the operating user's logic has to be distinguished from the constructing tool's logic.
- Regarding communication, ICT are too often interested in messages transmission forgetting the

[1] Mediation = media + interaction, (media = tool) mediation is understood as an interaction amplified by a cognitive or material tool.

[2] What the individuals do with the technique.

[3] What the technique affords.

individual way of thinking and the way ICT are used. The traditional approach seeks excellence in each unit (transmitter/receiver). The upheld assumption is that the communication quality depends on the material functionalities output. Accordingly, communication is often limited to information broadcasting, following canonical modelled circuits.

None of these approaches takes sufficiently into account the personal interactivities as a communication basis. Moreover, the role played by the tools on situated knowledge which authorizes the information "contextualisation" is forgotten. This lack of contextualisation homogenizes every particular interactive situation. However, situated knowledge division (in the computer work's environment) leads to a collective information and communication management. The direct consequence for ICT design results in proposals for a "navigation" assistance. It forgets thus that an informational research needs to locally take into account the activity purposes.

To conclude this first part, the ICT seldom generate the awaited changes in individual and collective operations. The individuals tend "to embezzle" technical devices according to their intentions. Consequently, the interactive methods are raising the question of knowing how to combine an artificial communication space which offers a "resistant" structure (as an operation framework) to each actor's project and a "malleable" context which could be adjusted following practices and evolutions senses that each user needs to give to situations [3].

- As a corollary, it is appropriate to know which situated knowledge play a role in ICT contextualisation.
- Do conditions likely to support the implementation of this knowledge exist?
- How individual or collective practices and situated knowledge, collectively built, in order to take into account the negotiated construction of an essential communication space with the organized action, can be articulated?
- How individual nature and collective pressure, in which practices could be "locally" understood, can be concealed?

The communication tools are considered as interactions places which connect an individual, ready to seize the regularities of the situations that it crosses, and the sociotechnic reality which allows him surfing the Web and making him "heard". Communication is built up from everyone's information practice that rises in situation. Each individual communicates while building a "community of practices, uses and exchanges". He is a mix of initiator, carrier or tester[4]. The community formed by his presence and the one of others allows him: to improve its situated knowledge, to discover new ones and to indistinctly manage information, constraints and instrumented situation. By this way, he contributes to create an interactive sociotechnical situation, closely associated the contexts, in which he gives sense thanks to his practice.

2. PROPOSED RESEARCH POSITION

Methodological position basis refer to anthropological communication approach. It enables us to take into account the way in which the ICT and social organizations play their roles in the instrumented mediation processes.
This interactionnist and praxeologic approach considers practices as indexed[5] in the situations in which they are implemented. This indexicality places ICT practices in a particular social group[6]: which it is called "the communication[7] building itself". Consequently, the sense given to information is no more a "wooden object" resulting from a logico-spatio-temporal system (i.e. asynchronous email) but it becomes the central element of context's and the practice's comprehension in a dynamic situation of collective communication.

In other words, this deals with the collective work using ICT components. This takes into account the matter of social (human) dimension in the creation of new practices, without neglecting the normative nature of the technique.

The practices are unending constructions which are not outer from the actors. They are not objective because each individual is not an actor without history or passion; he is a prisoner of the values which settle his behaviour [4]. The practices are constantly moving because they are always in a construction combining the *"common sense"* [5] and the practical knowledge that the individuals constantly solicit to act on everyday "things". Theses everyday "things" become a way of thinking, questioning, structuring the world and appears then like the social organization of community members.

[4] Communication is *"embodied"*[4].

[5] Subjected to obvious information supplementation

[6] A given working group, i.e. a virtual community

[7] Production and diffusion of information and the relation

We have also to consider the communication human-machine-human (HMH) as a complex phenomenon broader than the disciplinary fields which is questioning it. This anthropological vision of HMH interaction considers ICT as a common culture construction built up with rules lay down by a situated contract (group implicit operation rules). These are implicit rules which organize a socially elaborated communication and collectively approved. Thus, our position rejects the disciplinary approaches which reduce the ICT to resources for action. In fact, we consider ICT as a system which connects a user, a tool, knowledge, a situation and a context. It is what we call *"artefactual system"* [6].
An artefactual system is a relational system. The artefact term does not indicate any more an object or a tool, but a representative system. It regards the system of thoughts which is built up in relation with others (cf. [7]). Regarding the HMH, a communication artefact is a system of thoughts which authorizes a communication situation understanding within a context. In that case, the context defines a communicative intentionnality to the tools. Consequently, the production and the diffusion of information concern a "Communication Artefactual Process". This process allows building individual and collective practices depending on human resources and their related communication situations.

Our position is then significant regarding an intermediate phase for the construction of an interdisciplinary field of research. It is necessarily opened to a questioning right at the borders of some various requested disciplines. The transitory character of the proposed methodological position is essential here. It is therefore advisable to discuss today on the relevance of certain number of ICT observation point of views. Indeed, observation proposals supported by comprehensive sociology, ethnomethods, contextualized research, etc., are questioning the cogency methodology which proposes to connect all disciplines. This approach requires not taking position in meta-discipline absorbed by the artefactual anthropological system. The opposition "what enables" *vs.* "what is done with" gives ground to overstep these concerns. In fact, it is no more question of looking at ICT with multiple enlightening which can only reveal object parts which are at the intersection of the glances. It would be advisable to observe what this object shows at the borders of the referring disciplinary fields. Such an approach requires of course the greatest forethought in the use of the theories and the "borrowed" models. We must stick to a necessary accessibility (*"accountability"* [4]) on the rebuilt theoretical discourse. Moreover this discourse would have to be confronted with the situated practices ("what is done or said") of individuals who are forging them within contextualized situations.
Under such constraints pressure related to the field research dynamic, the analysis which we could lead then takes the risk of an impossible remote setting of scientific discourse faced to the field realities.

3. SUGGESTED METHODOLOGY

This part is presenting the limits of experimental methodologies in comparison with the above suggested questions. In a second time, the presented ethnomethods would allow a transversal investigation on the questioned phenomena.

Any experimental approach basis is to control and vary the conditions of appearance. It emphasises a phenomenon in order to determine their individual and collective influence on this phenomenon. It requires a variation of experimenting conditions by the researcher according to his will. In an "objective" way, the researcher will build up or control situations which enable him to observe these variables. These situations are always built up and artificial. In this context, the purpose of any observed situation is to maintain an empirically control by one or more assumptions on behaviours which were considered to observe. For example, human interactivity observation, within a group who is carrying out a specific activity, makes sense in terms of experimental device only if the researcher evacuates the information which is not directly concerned by the observed activity. The individual[8] is not observed, but the cognitive dimension is observed in relation to the subject connected to the activity strategy. The experimental approach consists in confronting effective results with formulated predictions that are studied regarding the level of the assumptions. Generalizing the results becomes then a difficulty.

In experimental approaches, two points of view are evacuated. The first one evacuates the dynamical aspect of being related to others, which cannot be only reduced to a cognitive dimension. The second aspect is the existence of indexical variables that, in order to be contextualised, request a situated and local comprehension. In that case, there cannot be starting assumption (regarding the experimental direction). On the other hand, observations are not

[8] Socially built person

confronted and not compared with others. For these reasons, they will not have any intrinsic value.

Two essential points are necessary to mention for understanding our methodological approach:

- Any situation is considered as culturally built up. Consequently, the main objective is to seize the "native's", the *"member's"* [4] point of view and his relationship to the everyday life[9] in order to account for his world vision (the mundain). The variables are not any more controlled or evoked, but given to see. In that case, the purpose is much more focused on describing what are the relationships as the group is living specific situations, taking into account the every day life behaviours and way of thinking, than generalizing.
- The second point considers the concept of member, the membership of a community of practice. The ethnomethodological meaning of a member is *"[...] the social membership of a group, [as] a normally preliminary condition to any analysis and description activity of the social activities of this group."* (Lecerf, 1985, p. 5). In other words, the concept of member is here perceived as an individual's mastery of the rules laid down in a situated contract. This contract represents a common knowledge and some practices which are related to the membership status of a group, called a community. *"Once affiliated, the members do not need to wonder about what they do. They know what's implicit within their behaviours and accept the routines inherent to the social practices."* [9].

These two points enables us to consider the communication as a locally situated interaction merely belonging to the observed group. The members of this group recreate communication at every moment of their practice. If the goal is to provide a reusable description (generalization) of what it is observed, the researcher cannot be external to the group any more. He must become a member of the studied community, because if he remains external observant, he will no more be likely to understand properly what he sees. He does not share the action and can neither understand, nor describe it. Becoming a member is required as essential to be able to observe a community of practice.

Consequently, the observer position is basically interactionnist. The only way the researcher is authorized to understand inner actions of the studied individuals is to interact with them. Several types of observations are available for the researcher: non-participating and participating observations. Those can be intrusive when the people are conscious of being observed, that is to say non-intrusive, when they are not:

- "Visible" participating observation: proclaiming the researcher condition and creating significant relationships to the context;
- "Invisible" participating observation: hiding the researcher condition and creating significant relationships to the context;
- "Visible" non-participating observation: proclaiming the researcher condition and observing without creating relationships to the context;
- "Invisible" non-participating observation: hiding the researcher condition and observing forethoughtly, without creating relationships to the context.

In conclusion, our approach leads to the fact that the only way individuals can give sense to their activities depends on their interactions. These interactions are developing a proper dynamic in which the concept of group corresponds to a action process rather than a structure.

4. CRITICAL, PERSPECTIVE AND DISCUSSION

The ethnomethods do not bring answers on what appears to us to be a true methodology to be deepened. The difficulty of such a methodology emerges from the nature of the observed processes: former feelings, perceptions, values, knowledge... However even this dimension is not sufficient for characterizing an observing and analysing project of the dynamics between artefacts and human organizations. When there is a situation of working towards an end, the impact of temporality requires to be centred on an anthropological approach that follows several points.

The first point relates to the situation design that forces to take into account the situated nature of the action. It seems to us that this dynamics should be set into problems. Indeed, saying that a situated action is an action which is adjusted with local circumstances, or which takes support on indexical information available in the environment, is not satisfying. This particularly appears when ICT, regarded as communication artefacts, have an essential role in the contextualisation of the situation. It seems indeed necessary to improve a methodology for the instrumented communication situations. This methodology could be supplemented

[9] The observed situation

for a pragmatic communication approach that would take into account the information division. This information division has been structured in a knowledge that has been built up from the past. This knowledge constitutes a sort of legacy which questions temporary description, inspired of the American culturalist current which phased anthropology into the approach of the social phenomena.

In these phenomena, the forms and the modes of communication would be the bases of any culture. The human organizations (institutions) could be defined as the lump sum of the attitudes, the ideas and the behaviours shared by the members of a group.

Developing such a methodology of instrumented communication situations of communication would thus need, in a second time, to clear up ICT communicational nature. Indeed, the tools and the processes, which we tend to account, are still too oftenly amalgamated. For example, talking about a relation between A and B underlie that A and B are entities that can also be separately analyzed. This very Cartesian vision was already rethought by the complexity approaches. Are the relations between A and B limited by the exchange which will modify their approaches of the situation in which they are? The mediation can implicitly (or not) be exclusively considered as a bijective process between two systems of thought, if the answer is "yes". But then, we can hardly explain why this mediation becomes more effective while using a cognitive or material tool?

The artefactual process is a relational process, which builds in the individual's mind an interpretative system of knowledge and practices which helps him to understand the world. This world is built in a recursive way. Any artefact gives a rising subjectivity. In fact, the practice would not be any more the essence of the human-machine relation as a single solution but an immediate solution, *hic et nunc* and nonprojective. The methodological risk by studying a temporary and dynamic "time-space" could be an impossible generalization of a moment "T" to "T+1". This is only an appearance originally from a too experimental vision which limits the understanding of the observed object to linear and sequential aspects: "there is an initial state and a final state".

The mediation cannot thus fall under a human-machine relation identical to itself. It does not appear in varied terms, in a universe which recognizes it and which it recognizes. The mediation is a transitory contextual agreement of a bond between the individuals.

The complexity with which should be considered the role of ICT shows that no natural separation is locatable, that no supposed border resists between the individual's vision of the world and the construction of its practices, during the mediation. Consequently, the practices *de facto* reveal their empirical existence as a system of thought. This one is significant of the objects (ICT) comprehension and the practices which modify in real time the conditions of the HMH relation. The intelligibility of the phenomenon thus calls the implementation of formal construction and ways of thinking which closely pair this mobility within which the artefacts signify the world to us.

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Development of Information Society in the Republic of Croatia Aimed at Increased Competitiveness

Darko Dukić
ABACUS Tuition, Research and Business Consultancy
Mosorska 8, 31000 Osijek, Croatia

Gordana Dukić
ABACUS Tuition, Research and Business Consultancy
Mosorska 8, 31000 Osijek, Croatia

Mate Sesar
University of Josip Juraj Strossmayer in Osijek,
Faculty of Agriculture in Osijek, Department of Agroeconomics
Trg Sv. Trojstva 3, 31000 Osijek, Croatia

ABSTRACT

Croatia is one of the countries which emerged after the disintegration of Yugoslavia. Since early 1990s it has been going through a process of complex social and economic transformation. The establishment of market economy had been significantly slowed down by the war, but also by the loss of former markets, decrease of competitiveness, in many respects poorly conducted privatization, as well as by wrong macroeconomic policies. Although certain advances in social and economic development have been achieved, overall results are far from satisfactory. In such circumstances it is expected that information society, proclaimed as one of the most important strategic goals, will contribute to acceleration of reforms and create prerequisites for Croatia's joining the European Union and NATO. This paper intends to describe the main characteristics of the information society development process and how it bears on the efforts to increase the Croatian economy's competitiveness. Once the set goals are achieved, citizens and entrepreneurs would be able to continuously receive information and participate actively in different social and business activities. General use of an information system network would encourage the development of stronger ties within business sector, the exchange of information and experience, as well as the creation of a transparent, fast and efficient state administration. In the analysis of the stated issues some indicators used to measure the information society development will be presented, then the problems characteristic of the informatization process will be highlighted, as well as the obstacles hindering the expansion of electronic business. The paper will also present the most important projects initiated in the framework of the Program *e*-Croatia, as their implementation is a precondition for increasing the country's competitiveness.

Keywords: information society, increased competitiveness, economic growth, information society development indicators, Program *e*-Croatia

INTRODUCTION

Since gaining its independence the Republic of Croatia has been going through a process of complex social and economic transformation. Abandoning the 45-year old tradition of socialist management system and the beginnings of a market economy coincided with the war of 1990s, the consequences of which are still strongly felt. The reforms had also been slowed down by the loss of former markets and decreased competitiveness of the domestic economy, which failed to make timely adjustments to the world globalization processes. Another important problem is in many respects poorly conducted privatization. The socially-owned capital, built up for years, went into the hands of a relatively small number of people, who were for the most part tightly connected to the centers of political power. As a consequence of their incompetence and desire to get rich quickly, a number of companies went under, and their employees were made redundant. These negative trends were greatly aided by vague and incomplete legislation, as well as by the inefficiency of government institutions, which hardly ever sanctioned criminal activities occurring in the privatization process. It is therefore not surprising that Croatian citizens view the legal system and political parties as the most corrupt segment of the society.

The activities in the Croatian economy decreased sharply in the first half of 1990s, marked also by war destruction. Although the war had the strongest effect on overall economy, it should be pointed out that faster recovery and growth of living standards were thwarted by some failed judgments of macroeconomic policy makers. In such circumstances, it was only in 2004 that real gross domestic product exceeded that achieved in 1990, the year which marked the beginning of the transition process.

Although there has been some progress in recent years, the Croatian economy is still burdened with numerous problems, in particular high unemployment rates, low productivity, excessive internal and foreign debt, unfavorable export-import ratio, and a rampant grey economy. On the positive side, there has been a long-term stability of prices and exchange rate. This, however, has not produced impressive increases in economic activities that would enable Croatia to come closer to the standards of developed countries.

A possible way out of this situation lies in developing an information society. This trend is expected to contribute to faster reforms and create prerequisites for Croatia's joining the European Union (EU) and NATO. This paper intends to describe the main characteristics of this process and how it bears on overall social developments, in particular on an increase in competitiveness. In the research of this topic, we first state the most important indicators of macroeconomic performance, which are crucial for its understanding. This is followed by the data showing the development level of information and communication technologies (ICT) and usage of electronic services. After that we briefly present activities undertaken within the Program *e*-Croatia aimed at developing an information society, as well as the problems associated with this process. Finally, we propose possible guidelines for future activities that should contribute to a more intensive development and increased competitiveness of the Croatian economy.

BASIC INDICATORS OF MACROECONOMIC PERFORMANCE AND INFORMATION SOCIETY DEVELOPMENT

In the year 2006, Croatia attained the gross domestic product (GDP) of 42.915 billion US$. Taking into account the estimate that in 2006 the population of Croatia was 4.441 million, GDP per capita was 9663 US$. In 2006, the real GDP increased by 4.8%. The physical volume of industrial production grew by 4.5%, of building and construction by 9.3%, and trade turnover by 2.1%. All this indicates the trend of economic recovery which has been faster than the growth recorded in the EU in the past few years. Nonetheless, these achievements were not sufficient for a more significant breakthrough in the development of the national economy, which would make up for previous lagging behind and reduce the gap between Croatia and highly developed countries.

The biggest increase in the past period was recorded for investments, whose comparatively high growth rate did not result in the expected GDP increase, which in turn indicates their lack of efficiency. Investments are followed by the growth of exports, which went hand in hand with the growth of imports. These trends led to further increases of trade deficit, amounting to 11.112 billion US$ at the end of 2006, with the export/import ratio of 48.29%. There has been a significant increase in private consumption in recent years, however, this is increasingly financed through loans, thus contributing to growing private indebtedness. Foreign debt is also continually growing. In late 2006 it amounted to 38.151 billion US$, which is 84.7% of the generated GDP. It is worrying to note that in 2006 the foreign debt increased by 13.45% compared with the previous year. Although recent years have witnessed a tendency to reduce unemployment, the results are far from satisfactory. The average rate of registered unemployment in 2006 was 16.6%.

In such conditions Croatia is managing to maintain the stability of prices and exchange rate, which has been successfully maintained since 1994, when hyperinflation was curbed. Measured by a consumer price index, the average annual inflation rate in 2006 was 3.2%.

Lack of competitiveness of Croatian economy is the result of a number of factors, the most prominent being high capital and labor costs, low labor mobility and poor skill composition of the labor force, low level of accumulation, insufficient information dissemination, and inadequate technical facilities. The change in current situation and increase of competitiveness can be encouraged considerably by the development of an information society. Such a society is based on creating, dissemination and usage of information. The basic tool in an information society is ICT, whereby business operators can directly increase their competitiveness. It follows that government institutions need to support the development of an information society in order to increase the competitiveness of the national economy. In addition to the informatization of public administration, the second important precondition for its development would be to establish an open market for electronic communications.

To better understand the circumstances in which Croatia is developing an information society, we should note at least some indicators of its current state of progress. There are several indicator groups used for this purpose, which have been defined by the United Nations, the EU, and independent analysts. We will list the data on information society state of progress in Croatia and compare them with the averages recorded for the EU 25 member states. It should be noted that the EU indicators used here show the state of affairs at the end of 2004, whereas for Croatia it is the end of 2005. This naturally implies comparatively higher values for Croatia. Furthermore, France and Malta have been left from our considerations due to the lack of data, and Romania and Bulgaria were not EU members at the time of this analysis.

Table 1 shows seven indicators which refer to the Internet access and usage in the population segment.

INDICATOR	EU25=100 (%)	CROATIA (%)
Internet access	48	44
Regular usage of the Internet	43	35
Using the Internet for sending/receiving e-mail	42	69
Using the Internet to seek information on products/services	39	63
Using the Internet to read online newspapers/magazines	17	54
Using the Internet to handle financial affairs	19	14
Households with broadband Internet access	23	6

Source: "Studija razvoja informacijskog društva u Hrvatskoj u 2005. godini", Središnji državni ured za *e*-Hrvatsku, IDC Adriatics, 10/2006.

Table 1. Chosen indicators of information society development in population segment in the EU and Croatia

The data presented here indicate that Croatian citizens' lagging behind is most prominent in the area of broadband Internet access. These discrepancies have resulted primarily from late introduction of broadband technology, its relative costliness and lack of adequate local content. The differences in the Internet access and its regular usage are much smaller. In this area, Croatia has lower results than the EU average however, the percentages are higher than in some older member states.

Croatian citizens use the Internet more than the average established for the EU for sending and receiving e-mail, seeking information on products and services, and reading online newspapers and magazines. According to the conducted research, Croatia is ranked at the top of the analyzed countries in terms of using the Internet for reading online newspapers and magazines. On the other hand, a smaller proportion of population in Croatia uses the Internet for handling their finances.

Taking the indicator values EU25=100 as the basis of comparison, we get the following graph.

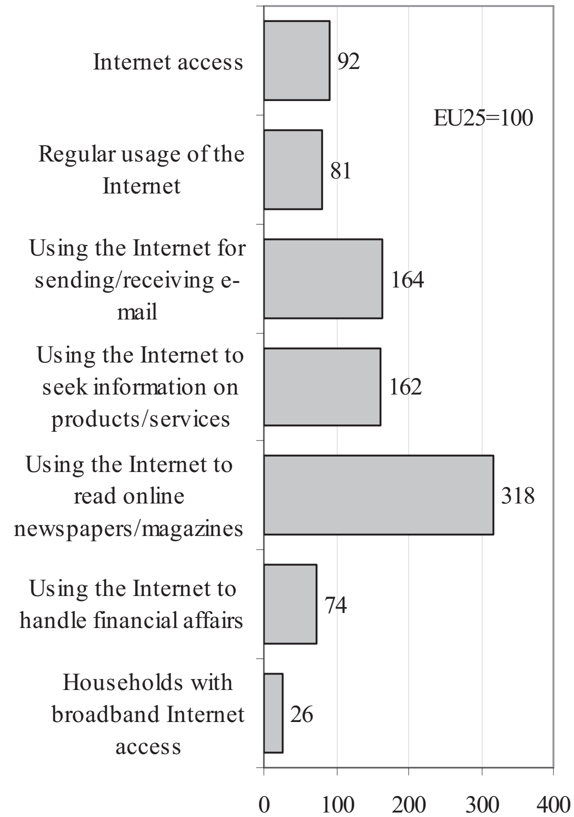

Figure 1. Indices for information society development indicators in Croatia in the population segment (EU25=100)

Table 2 contains the chosen indicators which refer to ICT access and usage in business environment.

INDICATOR	EU25=100 (%)	CROATIA (%)
Employees who used a computer at least once a week	35	39
Internet access	91	95
Companies with own web-sites	61	58
Companies using the Intranet	34	29
Companies using the Extranet	15	6
Companies that have had security issues	29	28
Companies with broadband Internet access	63	57

Source: "Studija razvoja informacijskog društva u Hrvatskoj u 2005. godini", Središnji državni ured za *e*-Hrvatsku, IDC Adriatics, 10/2006.

Table 2. Chosen indicators of information society development in the business segment in the EU and Croatia

The research results show that employees in Croatian companies use computers connected to the Internet more than the EU average. A higher percentage of companies in Croatia has Internet access, however, they have lower rates for having their own web-sites, using the Intranet and Extranet systems, and broadband Internet access. The banking and finance sector is a trailblazer in ICT usage in Croatia. All banks have implemented broadband connections, and Internet banking is one of the most used online services in the country. Another highly popular service is paying parking charges by SMS.

If we take the indicator values EU25=100 as the basis of comparison in this case as well, the result is Figure 2.

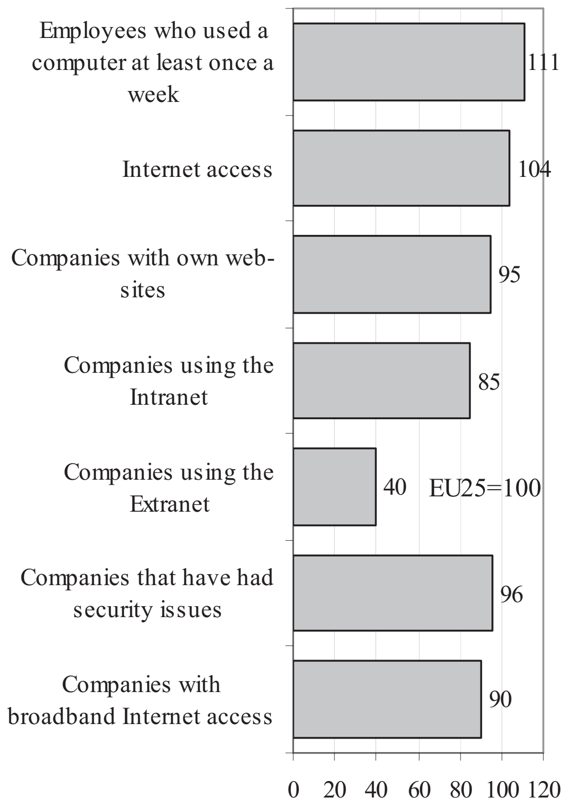

Figure 2. Indices for information society development indicator in Croatia in the business segment (EU25=100)

The progress achieved by Croatia in developing an information society was confirmed also in the World Economic Forum Report, published in late 2006. According to the Lisbon criteria, which were defined as a measure of progress in reforms, Croatia was rated as the country leading the way in information society development among the candidate countries for EU membership. With a rating of 3.69 Croatia lags behind the EU25, whose average rating is 4.58, however, Croatia's reform results are better than in some EU members, particularly in comparison to Romania and Bulgaria, which became members on 1 January 2007. Still, all these results and ratings have to be interpreted with caution. Even with the advances attained to date, the potentials of electronic business operations in Croatia are still largely untapped. In the ICT sector, the prevailing investments are still made into hardware, while investments into applications and services are still lagging behind. This is more pronounced with small and medium companies, which do not participate enough in developing the market for advanced electronic services, digital content and electronic trade. Furthermore, the added value achieved by the ICT sector in Croatia is significantly lower. The average in EU member states is 413 US$ per 1000 inhabitants, whereas in Croatia it is only 23 US$ per 1000 inhabitants. Such indicators clearly show that Croatia needs to further intensify its efforts in developing an information society.

PROGRAM *e*-CROATIA

Following the EU recommendations and the Lisbon agenda, by the end of 2003 the Croatian government adopted a special document entitled “Program *e*-Croatia 2007” envisaged as a well-elaborated, comprehensive and dynamic action that would put Croatia on a fast track to becoming an information society. Its basic aim is to enable all citizens and businesspeople to receive timely information and to participate actively in the life of the society through a networked information system. The design and implementation of such a system would contribute to the strengthening and better interconnectedness in the Croatian economy. It would allow comprehensive exchange of information and the creation of a transparent, fast and efficient government service, leading eventually to the increased competitiveness. There are five main areas within the “Program *e*-Croatia 2007”: *e*-Government, *e*-Justice, *e*-Education, *e*-Health and *e*-Business.

Within the area ***e*-Government** several projects have been started with the aim of providing a better service through increased speed, efficiency, flexibility and transparency of public administration. One of the most important services in this areas is easier and faster foundation of a company or a small business. Instead of previous practice where a person had to spend days in gathering all kinds of documents required to register a company, it is now possible to do all the necessary work in one place. Informatization of public administration has also been initiated in the area which refers to citizens' personal records (register of births, marriages and deaths). Furthermore, the citizens can access voting lists through a web service or SMS. In accordance with Croatian regulations, a central register of personal records has been established, consisting of the main data collection, and auxiliary collections and records. In order to standardize the public administration terminology in Croatian and English for the bodies and procedures in the Republic of Croatia the *Eurovoc* thesaurus was adopted, with the Croatian appendix *Crovoc*. It covers standardized terms in these two languages for the areas of politics, history, geography and other fields characteristic for Croatia. There is also a catalogue of official documents of the Republic of Croatia, comprising bibliographic descriptions with links to the integral texts of regulations, public documents, international treaties, and government agencies publications. In this electronic catalogue, the list of Croatian regulations partially or fully harmonized with the EU legislation is regularly updated.

The area ***e*-Justice** is comprised of the projects intended to introduce modern work methods and to create a network of all judicial institutions. The project of updating and systematizing cadastral records and land registry books is particularly interesting for citizens and entrepreneurs. Its main goal is to facilitate and speed up the registration of real estate and ownership in cadastral offices and land registries. This reform will gradually bring order into real estate ownership issues, which is believed to be one of the prerequisites for foreign investments. Digitalization of cadastral and land registry data will allow everyone to check the validity of the entered data, time of the last change of records, and the documents on the basis of which that change was carried out. The electronically managed cadastre has thus become the most complete land and area database in the Republic of Croatia, which makes it crucial for resolving cadastral problems, correcting obsolete information, increasing security in real estate transactions, and developing zoning plans. In addition to cadastre and land registry reform, another important project is the establishment of a single Intranet network for all judicial bodies. This would create the prerequisites for easy exchange of information and documents within the judicial system, which is one of the control mechanisms in the anti-corruption policy. One of the activities intended to create a more favorable entrepreneurial climate is the establishment of the electronic Court Register where all the newly established businesses will be registered. The investments into its information system, automatization of administrative and accounting procedures within the judicial system, and establishment of criminal and misdemeanor records have all simplified the procedure of company incorporation. A greater transparency in the work of courts has been achieved by publishing the anonymized rulings of the Supreme Court. In addition, a choice of different lower courts' decisions was published, as well as those by the High Commercial Court of the Republic of Croatia.

A very important segment of an information society is knowledge and education, to whose improvement the projects in the area ***e*-Education** are dedicated. In this context we can observe the activities of line ministries in training of state officials, as well as primary and secondary teachers. The improvement of their knowledge and skills in the domain of informatics and new technologies is promoted through special programs. Since the youth especially needs to prepare for the changes that an information society is bringing, the school subject Informatics has been included in the Croatian National Educational Standard, and all the primary and secondary schools now have Internet access free of charge, as well as at least one computer room. In the meantime the Ministry has completed the first phase of the pilot project which connects island schools with those on mainland through fast connections and video link. During 2004 gigabyte city networks in eight Croatian cities were developed in order to create stronger and better ties between tertiary education and research institutions. Between three largest cities Intercity gigabyte connections have been put into operation as well. Considerable funds are invested into informatization of the higher education system. Examples are the completed informatization of student canteens and restaurants, as well as registration for exams and enrollment in the next academic year over the Internet, which is possible at many Croatian university departments. At some departments there are successful experiments with SMS registration for exams.

The aim of projects within the area ***e*-Health** is to make improvements to the health care system, which has been facing numerous problems for years. Informatization of primary health care and hospital administrative procedures is part of these efforts. One of the concrete results in implementing such projects is scheduling the patients for specialist examinations or procedures through waiting lists directly from the office of primary physician. Further developments of this system would make it possible for patients to automatically receive notice on treatment and preventive checkups through SMS. Another group of projects refers to the quality and speed of service for legal and physical persons who have to take out health insurance. Thus, health insurance registration will be possible over the Internet at all hours. In this way there will be fewer people besieging the counters in the health insurance offices, costs will be reduced and employers' paperwork simplified.

The area ***e*-Business** comprises projects aimed at creating a more favorable entrepreneurial environment. The starting point was the assumption that electronic business operations will be influenced most significantly by the development and expansion of such services provided by different government institutions. Keeping this in mind, the *e*-Croatia program has put special emphasis on the introduction of electronic signature that would, where possible, eliminate the need for confirming transactions through paper documents. In order to stimulate the development of electronic business operations there is continued expansion of services available over the Internet. Some services that are, or will shortly be available over the Internet to Croatian entrepreneurs include value added tax registration, insight into taxpayers' accounts, tax returns for private citizens and corporations, submitting forms on payments into pension schemes, registration of crew and passengers by companies or private persons that deal in yacht and boat charter, submitting and control of customs declarations, and registration of the special coffee tax. To build up the usage of electronic services special attention will be given to developing the cooperation with the private sector.

A basic precondition for developing the above mentioned services is the establishment of the legal framework. In the past few years the Parliament has passed a number of ordinances, regulations and laws that refer to this area. A more intensive development of an information society requires also adequate infrastructure. In this context it is particularly important to promote broadband Internet access. The first results of market liberalization in telecommunication services are reflected in price decreases and a wider range of services, which has contributed to overall development efforts. In the past few months this has resulted in the increased number of broadband users. Another very important infrastructural condition for the informatization of public administration is further development of ICT network between different public administration bodies called HITRONet. The aim is to connect 80% of public administration services of central government bodies into this network by the end of the year 2007.

CONCLUSION

After adoption of the *e*-Croatia Program, the country has intensified its efforts on developing an information society. In this way the government and other stakeholders wish to create prerequisites for improving Croatia's competitiveness, and its active participation in knowledge society development. Due to limited space, we have listed here only the basic features of that process. For better understanding, we have pointed out some of the available indicators of ICT development level. Although they mostly suggest that the requested predispositions for information society development are in place, it is beyond doubt that the potentials of electronic business in Croatia are underused. Main obstacles for its expansion in the business sector include the fact that advanced information technologies are still not sufficiently accepted, employees being inadequately trained, and generally low level of information regarding the options for using different electronic services. For this reason, continued investments into ICT will have to be accompanied by a comprehensive reform of business and management system. Another area requiring increased investment and efforts is education. It is only with concerted efforts in all these areas that we can expect the growth of efficiency and productivity in the Croatian economy, and thus its improved competitiveness. The result of these processes would be improved macroeconomic performance, which is currently unsatisfactory, despite the progress achieved so far.

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THE CONTENT ANALYSIS of ONLINE NEWSPAPERS in TURKEY and CONSUMER PERCEPTIONS

Sema DUNDAR KURTULUS, Ph.D.
Marketing Department, Istanbul University
Istanbul, 34320, Turkey

Kemal KURTULUS, Ph.D.
Marketing Department, Istanbul University
Istanbul, 34320, Turkey

Diren BULUT
Marketing Department, Istanbul University
Istanbul, 34320, Turkey

ABSTRACT

The newspapers are one of the main information systems within the community for transaction, sharing news and informing people. The printed word, especially newspapers, used to be a dominant medium for mass communications for a long time. The media and its ability to present news constantly changes, keeping up with technology. Technological developments create new mediums that make information transaction easier. Through the use of hyperlinks, text, still and moving images, audio and other multimedia presentation, news can be utilized to provide more in-depth coverage than in traditional print editions. The online media is one of the emerging sectors which is rapidly growing in numbers of audience and usage opportunities. In this regard, this new media is also attracted many research attention from many aspects such as content, interactivity, comparison of printed media, evaluation of consumers.

The purpose of this study is to examine present situation in online newspapers; distinguish the main features of the news websites, portals and the online issues of the newspapers in Turkey based on content analysis. Besides that, it is also measured the level of integration of ink-on-paper with online newspapers and the differences between ink-on-paper issues from online issues. In addition to that, the research is also tried to determine consumer's evaluation about online newspapers.

Key words: Online newspaper, electronic publishing, online media, content analysis, Turkey.

1. LITERATURE REVIEW

The newspaper, as a product of the printing press was the most common, maybe the only, medium for mass communication until the arrival of radio and TV to the century. Although newspaper publishers discovered the internet as an electronic publishing platform very lately (around 1993's), developments in new electronic communication technologies helped to create new mediums that make information transactions easier. While the internet allowed online publishers to emerge, the WWW helped them to bloom and become the major platform for online newspapers or newspapers published on the internet [1]. One of the most common uses of the Word Wide Web is the circulation of news and information on current events.

The newspaper business is facing substantial changes like declining readers of the print product [2], the challenges of the web and competition [3]. The spread of the use of the internet has had a significant effect on the newspaper sector. In this respect, one may claim that the growing development of communications via the Internet and its subsequent use as a medium for publishing the digital versions of most of the printed newspapers, has led to substantial changes in the newspaper business [4]. Printed papers create their own competitors in time. For instance, according to Kimber, traditional printed papers are the form of information gathered by the previous day by nature. Because of this formation, even the most updated information may become as an old news. In addition to intense competition of radio and TV, due to rapid changes in information technologies, newspapers got one more major competitor; online news mediums [5]. On the other hand Dennis Skulsky, president of CanWest MediaWorks Publications, says that "if the beginning of this century will be remembered as the era of media convergence, the approaching years will emerge as the age of integration and localization of newspapers. The traditional print newspaper's role such as a staple of daily life, bringing not only news and information, but also the depth and breadth of solid analysis and quality journalism, will continue. But technology will advance the evolution of its delivery options, giving readers access wherever they go.This integration of print and digital is the future" [6].

The print newspapers have an online presence with the growing number. The print newspapers have been searching new ways and strategies to promote the internet version of their newspapers to increase readership rate [7]. Online newspapers are at an important stage of media convergence. The new digital media represent incredible improvement in the development of modern journalism because of the important advantages they have, from both the supply and demand sides. The use of new technologies is characterized by the speed of news to reach the readers, the low cost of information distribution, the chance to establish more direct contact with the readers and interact with them [8]. Although many form features of printed newspapers apply to the online medium, features such as archives/search engines, interactivity features, audio, video, animation, multimedia, vertical form with unlimited newshole, increased user control make online newspaper significantly different than their printed counterparts [9]. The internet is expected to have a significant content and process. And so, gathering and distributing news as well as public consumption will be quite different through internet [10]. The online newspapers usually do not have limitations on space, so might be able to provide more local coverage, background for today's story and an extra information about social, political or related issues by serving supportive links. There are constant forms of information that don't appear in the printed newspaper but that are well suited to an online newspaper [11].

The online newspapers are expected to have a significantly different content than the printed version. Content, more than just the diverse materials presented on different media, changes from day to day. Content mostly related to what is communicating and how messages are presenting [12]. By using multimedia, the combination of text, still and moving images, audio and computer animation in the production of content might be possible for online news [13]. Within this framework, the content coverage and links should be sufficient to the purpose and also accurate, the information is dated and current, the evidence cited and source data must be appropriate [14]. A major characteristic of online news that differentiates it from traditional newspaper news, is the nonlinear nature of writing and reporting. Analysis of online news sites has shown that nonlinear storytelling is increasing and they are using more links today [15]. By using more links and other writing devices, online sites might provide additional depth, background information, graphics and references to previous coverage for their readers [16]. The online newspaper can take more people's attention by developing attractive contents according to their needs and wants [17].

Traditionally, printed journalism has provided few direct opportunities for interactive communication like letters to the editor or public. Obviously, the internet could extend interactive option in journalism [18]. Interactivity refers to use of public to public and one to one communication spaces such as forums, chat rooms, user-authored sites [19]. According to Massey and Levy, two broad dimension of interactive online journalism appear to take shape. One is content interactivity, defined generally as a degree how journalists technologically empower consumers over content. The second is interpersonal interactivity, or the extent to which news audiences can have computer-mediated conversations through journalists' technological largess [20]. Technological improvements describe potential of interactivity for internet rather than the reality. Not every communication mediated by the internet is interactive [21]. It's very important that how or what degree are these online newspapers using the interactive power of internet in their presentation [22]?

The reliability and credibility of the information and online news is also very important for both customers and publishers [23]. The printed newspapers have time and opportunity to do the follow ups, and check the source and the actuality of the information gathered. But for online publishing, since the immediacy and update ability gets more importance, the news people have limited time to check the reliability, credibility and accuracy of information. So, reliance on printed media attended to be an important predictor of credibility of its online counterpart [24]. Nevertheless, personalized news pages, polls, availability of writing comments on the news and up date alerts could be very attractive for online news papers' readers. Venues for interpersonal communication, multimedia, and content that is hyperlinked, archived, updated frequently and available for personalized delivery are cited variously as hallmarks of the ideal interactive World Wide Web news site [25]

Within this content, one of the objectives of this research is to examine present situation in online news mediums, distinguish the main features of the news websites in Turkey. Based on content analysis, it is aimed to determine the level of integration and differences of printed paper with online newspapers. In addition to content analysis, a web based survey is conducted to understand the factors that affect the consumers' choice. The reasons they choose to view that World Wide Web version of the newspaper and their expectations are also been tried to be determined.

2. RESEARCH METHODOLOGY

Online information sharing also gets a new structure through development in technology in our country. Based on these developments, it is important to clarify, understand and study the actual situation in Turkey. From this point of view, two different researches are conducted. First one is content analysis of online newspapers to understand current situation of online media, second is a web- based survey to determine readers' evaluation online papers.

The Content Analysis

Online news mediums could be categories in three major categories in Turkey. The first one is news portals, which could be established by world wide news agencies or some news cooperation. The second type could be the extension of television channel/networks or radio stations. The third type is the online newspapers which usually operates parallel to the printed counter parts. This study is based on the content analysis of the online newspapers' web sites; their similarities and differences from printed papers. Only national-wide published and full content (politics, economy, world news, sports, entertainment, culture, health and magazine) newspapers are included in this research. Since some printed papers do not have the online newspapers, they are excluded from our sampling frame.

In the content analysis, 8 national full content newspaper's web sites were examined. These newspapers were chosen due to their coverage, reputation and their printed paper's circulation rate [26]. These eight newspapers differ in their reader profiles. The content analysis is conducted based on both journalism patterns and web site evaluation criteria. These online newspapers were examined by their technological features, design, and similarity with the printed paper issues, content, design patterns, logos, photo galleries, interactivity, flexibility and personalization level [27]. The advertisement locations and types, online polls, up date times, special stories, archive features are also been considered. All the online newspapers were searched for two weeks time in order to determine their status.

Findings of The Content Analysis

Zaman (www.zaman.com.tr): It started online newspaper in 1995, claims to be the first national online newspaper in Turkey. After several up dates in design temple and technological background in years, now it is one of the interactive and up-dated news source. . Online interactive applications are; forums, e-mail services, reader polls, up-date alerts and author links. The design is simple and easy to access. Only interactive applications require membership, which doesn't require subscribers' fee. The full coverage of printed paper issues is available; on the other hand last minute flash news could also be viewed during the day. Links to related TV channels web sites and additional news publications are also available.

Radikal (www.radikal.com.tr): This newspaper started online news publishing in 1998 and gives access to their archive from that date for their viewers. Membership doesn't require subscription fee but is necessary if someone wants to write comment. Other interactive features like e-mail services or polls don't require membership. Content of the printed paper could be viewed online, but some news series are published limited and printed paper is addressed for further content. The site doesn't give flash news. The design temple is very similar to ink-on-paper version without the paper margins. This newspaper doesn't belong to any news convergence or network, also doesn't give links to other sites that are not related to news context.

Sabah (www.sabah.com.tr): It is a part of a media network that owns one of the well-known and reputable TV channel, several magazines, some different newspapers and radios. This convergence affects the online newspaper from design temple to news up-date frequency. Site design covers link to other network partners, even their program schedules and aired shows. Full access to the daily paper is free of charge or does not require membership. Membership is just to collect information from viewers in order to understand their profile. Design temple eases to search within and out of the site. Visual components like videos, up-date alert and photo galleries are available in the site.

Milliyet (www.milliyet.com.tr) and **Hurriyet (www.hurriyet.com.tr):** They show very similar attributes with each other. They are also a part of a media convergence. Which means the source of their news are shared with other newspapers and magazines. The sites of these two newspapers are very alike and show similarities with Sabah. "Milliyet" online access and membership doesn't require subscription fee. Membership is just to collect information from viewers in order to understand their profile. Design temple eases to search within and out of the site. Visual components like videos, news videos from other televisions channel's web sites, up-date alert and photo galleries are available in the site. E-mails and comment board are also available. "Hurriyet" news web site doesn't require membership for interactive features and requires subscription fee. Design temple eases to search within and out of the site. Visual components like videos and photo galleries are available in the site. E-mails, up-date alert and comment board are also available.

Aksam (www.aksam.com.tr): This news web site doesn't require membership or subscription fee. Site has many links to other related newspapers, TV channels and radio station. E-mails and comment board are also available. Archive access is also available. The web site is representing front face of the media convergence.

Vatan (www.gazetevatan.com): Interactivity of the site includes up-date alert and e-mails. Photo gallery is available for every viewer. Design temple is easy to understand, and search tool could be used both within and out of the web site.

Cumhuriyet (www.cumhuriyet.com.tr): It differs from other web sites with its subscription system. This online newspaper requires a subscription fee, which is lower than the ink-on-paper issues and annually charged. Subscriber could access whole daily paper, in the original ink-on-paper design. There is no up-date during the day but gives full archive search. There are limited links to other sites, mostly sites that are related with the publication company. Interactivity possibilities are limited, only e-mail communication and comment writing availabilities are in use.

Generally, the similarity of the content is preferred by the printed newspaper admission, this means minimum cost for new coverage [28]. When we examine Turkish news papers we also see some of them tend to stick with the same coverage. It is even the same page design for www.cumhuriyet.com.tr. This issue is closely related with the formulation of the media convergence. The network design of newspapers usually connected with national television networks, radios and some related newspapers if all those medias belong to same owners. The connection between television and online newspaper gives the greatest opportunity to update and distinguish their content [29]. The online newspapers that are closely related with their news network have the power to update the news through the day.

The Consumer Survey

While the internet accessibility and usage rate is increasing, the online newspaper viewing has great potential to grow. While demand is growing, a significantly increased amount of online news is also available now. So, it is important to understand the customers' evaluation, their perspectives and priorities related to online publishing [30]. What does a viewer expect to see on the online version of the well-known printed paper that he or she prefers to read? Do they expect to see any differences on the online version of the printed paper? Why do they prefer to read online? How many of the web sites they are visiting in every day and the frequency of the visits to web sites and the total time they spent on the WWW and news. Internet survey is used to get answers to these questions Another objective of this survey is to determine the major characteristics and key attributes of online newspaper readers such as; perceptions about news, the web sites' designs, context and contents, need of customization and interactivity, reliability, accessibility, updateability [31]. Researchers want to clearly understand what viewers want to see as desired attributes. These attributes are explored and detailed according to the content analyses results.

Findings of The Consumer Survey

In order to understand the consumer preferences and most important features that affect online newspaper choices, four day online survey was conducted in May 2007. Two days were weekdays and two days were weekends.

304 respondents participated in the survey online. When the characteristics were examined it is seen that, 55,3% of the respondents were men, again 55,3% were single. 48,7% of the respondents were between the ages of 26-35, 51,6% of them had masters degree or PhD, 18,8% of the respondents were working in the public sector and 32,6% of 304 respondents were earning 100-1500 YTL/month.

The 61,5% of the respondents declare that they spend 0-1 hours a day, for online for news web sites and online news papers view. The 60,9%of the respondents access internet from their work places. In addition, %50,0 percent of them also reads ink-on-paper newspapers. The most important reason for online reading seems to be reaching up-date news (45,1%), followed by reaching news without buying newspapers (27,3%) and reaching news through day in addition to newspapers (17,1%).

Most viewed online newspapers are milliyet.com.tr (17,8%) and hurriyet.com.tr (14,6%). Most viewed news web sites turn up to be ntvmsnbc.com.tr (17,5%) and haberturk.com (2,9%).This results are parallel to the recent studies and general circulation rates [32].

Consumer preference scale Cronbach Alpha value is 0,788 for 27 items. For the scale reliability, Cronbach Alphas were calculated and 0,70 was regarded as the minimum level. In some exploratory research Alpha level can go down to 0,60 [33]. 0,788 Cronbach Alpha value for the weighted attitude scale is greater than 0,70, thus the scale is reliable.

Respondents' attributes towards online newspapers' features we presented in Table 1. To determine the sample tendencies from the scale average (3,00) (1-strongly agree/5 strongly disagree) t-test was run. Except "Design match of online and print newspapers" attribute, all attributes do differ from scale average of 3,00.

The most important attribute is up to dateness, which was also the most important reason for online news view for the respondents [34]. Followed by, "Fast site upload" with 1,22 mean, "Ads shouldn't cause an obstacle to read" with 1,23 mean and "Reliable source" with 1,26 mean. "Shopping availability" and "Extra features like games" were found to be not desired attributes.

Table 1. Attributes Towards Online Newspapers Features

	Mean	Std. Dev.	Sig. (2-tailed)
Up to dateness	1,17	0,439	0,000
Objectiveness	1,37	0,733	0,000
Reliable source	1,26	0,539	0,000
Clear Language	1,37	0,528	0,000
Actuality	1,35	0,622	0,000
An expert newsman interpretation	1,77	0,839	0,000
Forum for readers	2,36	1,015	0,000
Free of charge	1,33	0,627	0,000
Dissident interpretations	2,27	1,055	0,000
Design match of online and print newspapers	3,02	1,109	0,786
Links to TV etc.	2,28	0,946	0,000
Links to other news sources	1,81	0,838	0,000
Expanded online content	2,09	0,929	0,000
Reader polls	1,94	0,875	0,000
Attractive design	1,51	0,619	0,000
Different writers for online paper	2,32	1,005	0,000
Fast site upload	1,22	0,495	0,000
Site personalization	2,13	0,967	0,000
Update alert	2,05	0,943	0,000
Reader comments availability	2,20	0,983	0,000
Different administration for online paper	2,70	1,056	0,000
Visual and audial news content	1,96	0,824	0,000
Smooth context	1,48	0,597	0,000
Clear and simple design	1,64	0,685	0,000
Extra features like games	3,34	1,272	0,000
Shopping availability	3,52	1,146	0,000
Ads shouldn't cause an obstacle to read	1,23	0,651	0,000

n=304 respondents

3. CONCLUSION

As a conclusion, eight online newspapers examined in this research were not found to be significantly different from each other in terms of content. Minor differences such as subscription fee and flash updateability exist in two of them.

Although, half of the research sample buy and read at least one printed newspaper, they still like to be informed about on going developments during the day. Therefore, users of online newspapers in Turkey significantly prefer to read news through internet because of updateability and being free of charge.

Internet research having 304 respondents indicated that consumers do not like to see features such as games, entertainment, advertisements and shopping links on their online newspapers. Thus, one can conclude that Turkish online news readers expect to have traditional printed newspaper features for online version.

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On the nexus among complex adaptive systems, academic entrepreneurship and international research collaboration (Part 1: complex systems foundations)

Dr Patrick O. Ezepue
Business Intelligence and Quantitative Modelling Research Group
Computing and Communications Research Centre, Faculty of Arts, Computing, Engineering and Sciences, Sheffield Hallam University, City Campus, Howard Street, Sheffield S1 1WB, UK

p.ezepue@shu.ac.uk
Tel: + (44) (0) 114 225 3163

Abstract

This paper reviews the literature bases on complex adaptive systems and their links with academic entrepreneurship and collaborative partnerships in higher educational institutions (HEIs). The focus of the paper is on developing model-based *computational schemas* for understanding the dynamics of career advancement among academics in HEIs. The rationale for the paper is the need to ensure that academics can explore the nuances of their career progress (as determined by the complex system of institutional and personal factors and circumstances in which their careers are enmeshed) and possibly better attain their career expectations on the basis of a model that generates alternative pathways for career progress. The paper examines the implications of complex adaptive systems for model development and optimisation. It explores the practical implications of the model for training, coaching, mentoring and forming collaborative *networks* among beginning and experienced academics fighting for survival in HEI ecosystems. The nature of *micro-informatics* ensuing from the model and networks is considered in light of how individual academics operate to optimise their career progress. These implications are also related to how the model could facilitate knowledge exchange programmes, joint projects and research development among academics in developed and developing nations. The paper has two principal parts. Part 1 looks at the complex systems foundations of the CA model. Part 2 looks at its applications in academic entrepreneurships, career progress and research collaborations amongst groups of academics.

Key words:
Complex adaptive systems, micro-informatics, academic entrepreneurship, research collaboration, international educational development, model-based career progress

Conference Themes:
Relations between society, organisations and informatics, particularly [1] Education for the Information/Knowledge Society and [2] Organisational (micro) informatics for high performance at individual, team, organisational and external levels of workforce engagement

1. Introduction and rationale for the paper

This paper is motivated by the need to provide structures and guide points that could help beginning and older academics and knowledge workers develop their careers in an organic way. This motivation came about in a discussion three years ago with academic colleagues at Sheffield Hallam University UK, about how difficult it is to manage the different roles academics undertake, including research, teaching, third-stream income generation and core university business (e.g. administration, student mentoring and counselling and training of research students); see Ezepue (2005a, b & c).

It was considered that these different sides of academic work when brought together constitute a *complex system*. From the standpoint of complex systems and general systems thinking, and based on the fairly meaningful presupposition that each academic could regard such a complex system as also a unit *business* to which all forms of management thinking could apply (e.g. excellence models, strategic planning, integrated performance management based on score-carding similar to the Balanced Scorecard), a corporate academic model of academic career planning and management was constructed (Ezepue 2006a & b and related references Checkland 1999, Kaplan & Norton 1996 & 2000, Stacey 2003).

Compared to Ezepue (2005, 2006), this paper more *technically* links together complex adaptive systems and related fields, academic entrepreneurship and international research collaborations amongst corporate academics (CAs) – a term we use to refer to academics who behave in conformity with the stipulations of the Corporate Academic (CA) model of (Ezepue 2005 and 2006).

The potential stakeholders to the CA model include: academic research communities devoted to research on complex systems theory, via the promotion and further exploitation of the current state of knowledge; beginning and older faculty members who could use the model as a *transactional tool* for managing their careers (more) optimally; faculty members and research students who can be trained, mentored and coached on pathways to academic entrepreneurship using the model; software engineering academics and professionals who collaborate in research towards producing a corporate academic career optimisation software (CACOS) based on the CA model; and human resource management (HRM) professionals who could use the CACOS to support their staff development drives not only in higher educational institutions (HEIs), but also related *knowledge management* industry sectors e.g. financial services and construction industry.

The CA model facilitates model-based career progress of individual CAs, including *micro-informatics* and *knowledge management* practices. Teams of researchers in research groups and institutes could use the model as a *common language* in fostering ant-like unity of thought and action in their undertakings (see *social cybernetics* and *networks*), *processes* and *mechanics* (ways and means) for achieving *whole-system* i.e. individual, team and wider organisational excellence (Ezepue 2006, 2007).

2. Review of pertinent literature on complex adaptive systems, (social) cybernetics, with links to academic entrepreneurship and collaborations

'Many natural, artificial and abstract objects or networks can be considered to be complex systems, and their study (complexity science) is highly interdisciplinary' (http://en.wikipedia.org/wiki/complex_system). Examples of complex systems are ant-hills, humans and systems they evolve in their different life-worlds, cells and living things, energy and communication infrastructures including social networks (see related works in Axelrod 1997, Lewin 2001, Gladwell 2005, Smith 1998, Gribbin 2005, Surowiecki 2005, Capra 1996, Fonseca 2002, Gigerenzer 2002, Cilliers 1998, Bak 1996, Bohm and Peat 2002 and McMillan 2004).

Drawing from these texts, this paper asserts that the CA model is about enabling innovating entities (primarily individual knowledge workers) to blend different knowledge bases, thereby benefiting from *emergence* of new ideas, *thinking*, *adaptation* and *transformation* of their careers and life-worlds. The following facts are of interest to this paper:

(a) complex systems exhibit structural features which permit a 'certain kind of mathematics' (the pseudo-mathematics explored in the CA model is a species of this sort of mathematics);
(b) interest in complex systems is on collective behaviours, interactions and relationships amongst components of the system (the three areas of academic work devised in the CA model – the primary research domain (PRD), the primary application domain (PAD) and the general cultural literacy (GCL) components of the model are built to exhibit such interconnections);
(c) there is a vital link among complex systems, psychology, biology and cybernetics (Caldwell 2002, Hayek 1952). Ezepue (2007 a & b) argue that using the CA model to discover novel ideas at the crevasses of cognate disciplines in the PRD and PAD parts of the model is akin to a new *geography of the mind*, a cybernetics that produces a 'new synthesis of *mind* (as of a CA's idea origination processes) and *matter* (as of the creative artefacts from the processes, Capra 1996);
(d) Hayek asserts that economics and the sciences of complex phenomena, including biology and psychology (e.g. the psychology of work and human performance) facilitate *pattern prediction* of complex phenomena, as opposed to *precise predictions* of non-complex phenomena, as with physics. This view explains the potential use of the CA model to be more about predicting *career trajectories* of typical CAs, given a few assumptions about the collective behaviours of classes of such CAs, than about precise numbers of publications likely to be achieved from year to year (Ezepue 2005, 2006). That said, the advantage of a model-based approach adopted in this line of work is that at whilst the 'state equations' defining the CA model will be used to decipher the shape of a CA's output curve, hence the gradient, velocities and rates of progress, the equations also enable a stochastic estimation of the stock numbers for the different output categories. This way, the model recovers the overall pattern of

progress as well as estimates of future output. This holistic picture facilitates CA play, counselling, planning, self-audit of performance and strategies to do even better in future on the part of a CA. For an illustration of the state equation and output curve see Equation 1 and Figure 1 in Part 2 of the paper.

The above notes illustrate the deep connections between foundational constructs in complex systems and the *control*, *adaptation*, *transformation*, and *scoring* of career performance which the CA model facilitates. This connection enables knowledge workers to coagulate a rich *ecology* of thinking and acting within aggressively competitive university (HEI) ecosystems, an ecology that propels them up the HEI career ladder (Axelrod 1997); harnesses 'dispersed knowledge' around a CA's key academic and industry related work (Surowiecki 2005), and promotes model-based *micro-informatics* and *computational schemas* for career progress over time (this paper and related papers such as Ezepue 2005, 2006 and 2007).

Most applications of complex systems theory have been with regard to the character and evolution of economies and hierarchies of relations outside a single human person, as in social cybernetics and network theory. However, little work has been done on what happens in the *innards* of a single human person and how that connects with the usual external-organizational *systemics*. This paper and related works attempt to close this gap in the literature, by making the CA model as much an *internal*, *inside-out* mind-body system of relations among the PRD, PAD and GCL components (as conceived in the mind of a CA player) as an *exteriorized*, *outside-in* system of performance in the CA's life-worlds.

Complexity theory, as opposed to deterministic chaos, deals with the properties of a small number of non-linear interactions, (Cilliers 1998, Bak 1996) and is about the *emergence* of simple behavioural patterns from a huge number of interactions (Colander 2000). In this paper it is argued that a number of *idea cells* (nuclei or grains) taken from the PRD and PAD domains of academic activity (managed by a single CA or groups of collaborating CAs) could be cross-pollinated in such a way as to generate a huge range of new possibilities (some vacuous and others non-vacuous in *meaning* and *relevance*). This application of the intuitive meaning of complexity is addressed later on in this paper.

The CA model enables issues in performance management, person-centred development and organizational roles and responsibilities to be addressed, measured and (self) audited by individuals, teams and the wider organisations in a systemic way. These remarks link this paper to *socio-cognitive systems,* since individual CAs and HEIs are typical examples of such systems, for which the *systemics* of whole-system performance and the underpinning 'hierarchy of abstract systems' are germane. Amongst the characteristics of complex systems in nature, the following are relevant to the ideas explored in this paper:

(a) relationships are *non-linear* (small perturbations in the CA model parameters, rhos in a [0, 1] interval, may cause large career performance effects);
(b) relationships contain *feedback loops* (as between production elements in PRD and PAD domains of the CA model);
(c) complex systems are *open*, exist in a thermodynamic gradient and dissipate energy (in the CA model energy is

transferred in form of learning and conversions between conference output, journal papers and taught modules from year to year and amongst collaborating networks of academics; the model quantizes the energy/learning/innovation capacities in the system);

(d) complex systems have a *memory*, change over time so that prior systems may have an influence on present states – the CA model is constructed as a Markov dynamical system of inputs and outputs in which a CA's output in year t depends on the outputs in year t-1 and can be scored and depicted in a performance dashboard, with clear trajectories *signalling* progress or stasis;

(e) complex systems are likely to produce emergent phenomena; the CA model facilitates such emergence by way of meaningful combinations of distinct idea cells into ideas at higher levels of meaning (within the model itself). The model also engenders *collaborative behaviours* amongst groups of academics which are different in character from the different individual CA behaviours.

3. Brief review of the CA model and associated stakeholder gains

As outlined in Ezepue 2005, 2006 and 2007a, the CA model starts with a range of intrinsic model parameters known as model rhos $\rho \in [0,1]$ where each lives in a 0 - 1 interval as shown. 'As values of the parameters tend to 1, the CA player adopts a pure strategy for the particular model characteristic depicted by the rho. Contrariwise, rho values nearer to zero indicate near absence of the characteristic in question. For instance, a player with a teaching rho close to 1 is basically a teaching staff, while one with a research rho close to 1 is mainly a pure research player. For majority of staff these values are not exactly 0 or 1 as some admixture of roles is normal. The beauty of the model-based approach to career optimisation which these parameter choices permit is that a CA player has an abstract representation of their mental and physical work (spaces), mental with regards to the performance trade-offs that different choices of rho values denote and physical in terms of the academic outputs which flow from the model.

Interestingly, the model enables a CA player to interrogate the facts of their career performance, construct dashboards that record the *velocity* and *momentum* of their career trajectory, creatively generate novel value-adding ideas, using combinations of simple ideas from the PRD, PAD and GCL work segments (lattices), and visualise the performance trade-offs and synergies among research, teaching and consulting aspects of their work (Ezepue 2005a, b & c, Devlin 1997, Kowalski 1979, Ortony 1979, Liu et al 1994 and Searle 1995).

The research discusses *integral excellence* and *applied organisational semiotics* in almost all relevant facets of academic engagement, and the tenor of strategic planning and execution required to achieve superior performance in the different facets (Ezepue 2005, 2006, 2007). Further benefits from using the CA model complement the stakeholder gains noted earlier in Section 1 of this paper and are summarised in Ezepue (2005, 2006).

The technical presuppositions of the CA model are fully exposed in Ezepue (2005, and 2006) and will not be repeated in this paper. A symbolic score function for CA optimisation and performance management given by

$$MaxF(WP_{i+1}) = (\rho_{mR} = 0.80)\sum_k n_k = \rho_{mR}\sum_k ((n_{jp}, \rho_{i,i+1} n_{cp_i}, \rho_P n_{rm}, \rho_P \rho_{i,i+1} n_{cr}, \rho_P n_{mn})_{k(i)}. \quad (1)$$

subject to all $\rho \in (0,1]$. The above model facilitates meaningful discussions of performance management of a typical CA's career (Ezepue 2006 a & b and Part 2 of this paper).

4. Conclusion

This part of the paper twines the CA model with the ideas in complex (adaptive) systems, much as space could allow. Part 2 of the paper further develops these links by considering the connections among the CA model and systems theories akin to complex systems e.g. social cybernetics and artificial intelligence. This concluding part also foreshadows the application of the ideas in this paper in such areas as international academic developments, ideas which are more fully developed in related papers (Ezepue 2007).

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See remaining references to the paper at the end of Part of Part 2 of the paper.

On the nexus among complex adaptive systems, academic entrepreneurship and international research collaboration contd. (Part 2: model applications)

Dr Patrick O. Ezepue
Business Intelligence and Quantitative Modelling Research Group
Computing and Communications Research Centre, Faculty of Arts, Computing, Engineering and Sciences, Sheffield Hallam University, City Campus, Howard Street, Sheffield S1 1WB, UK
p.ezepue@shu.ac.uk
Tel: + (44) (0) 114 225 3163

Abstract

The abstract to this paper is as presented in part 1 of the paper.

1. The CA model and other fields related to complex adaptive systems

Cybernetics and socio-cybernetics

Cybernetics (Greek kybernetes for governor, pilot or rudder) is related to complexity theory, adaptive systems, artificial intelligence, control systems, decision support systems, dynamical systems, learning organisations and systems engineering. Following Louis Couffignal (1956) it is simply 'the art of ensuring efficacy of action'. These links apply directly to the role of the CA model in this paper. The model uses the associated performance measurement system, the artificial intelligence inherent in the Corporate Academic Career Optimization Software (CACOS) as a decision support system (called a Career Simulator in Ezepue 2006) and the supporting diary and knowledge management elements of the model to facilitate career *control* and *learning* on the part of CAs and their employer HEIs. Cybernetics has a long history in the study of *teleological systems* (i.e. systems designed to achieve ends, goals and purposes) and the CA system has in mind the goals of excellence, proactive career management, integrated performance measurement and monitoring, learning and knowledge management (Ezepue 2005, 2006 and 2007; Rosenbleuth et al 1943, McCulloch & Pitts 1943, Weiner 1950, Patten & Odium 1981).

Socio-cybernetics explains the wider organisational (HEI) applications of the CA model and is founded upon the General Systems Theory and Cybernetics. It underpins Organizational Development (OD) consultancy practice, theories of communication and computer sciences and connects the CA model with the CACOS knowledge-ware (Ezepue 2007c). This is especially in relation to *counselling, coaching* and *mentoring* beginning academics and research students, towards enabling them to become *academic entrepreneurs*. Indeed, the term 'socio' implies other than single and is illustrated in this paper by componentizing the CA model into PRD, PAD and GCL subsystems and grouping academics into *networks* of collaborators.

Another example of socio-cybernetics in the model is developing the *micro-informatics* and *algebra* of creative ideas origination within the PRD-PAD-GCL *lattice* such that the *idea grains* or *nuclei* in the rows (from the PRD) and columns (from the PAD) form *idea cells* within the PRD-PAD matrix of possible combinations of ideas in the lattice (Ezepue 2007c). It is hoped that generating ideas this way provides a basis for linking individual performance on the model on the one hand and solutions to grand challenges around international research collaborations among CA players, on the other hand (Raven 1994, 1995, Ezepue 2007a & c, Barrett 2006). For instance, it is feasible algebraically (and hopefully practically) to generate further *idea cells* in a larger lattice for which the z axis represents the *problem space* encompassing the grand challenges.

Imagine that the x axis contains the PRD idea grains and the y axis contains the PAD idea grains. Provided that the combination of the PRD and PAD idea grains into a composite grain (cell) provides a 'necessary and sufficient' solution to the problem grain on the z axis, what we then have is a *solution chain.* This chain provides information about a specific problem and its PRD-PAD solution (not necessarily a unique solution) in the universe of grand challenges potentially solvable within the PRD-PAD knowledge matrix. We are interested in this *geometry* and *algebra* of *problem structuring* and solution as a useful continuation of this research. This verbalized description of what is basically an algebra *of success* shows how the CA model facilitates brainstorming on unstructured problems (Ezepue 2007a).

Explorations of cooperative behaviour amongst collaborating academics (and knowledge workers) in this paper draws from the general framework for understanding cooperative behaviour encapsulated in the Basic Law of Socio-cybernetics, which involves five evolutional phases (ABCDE), namely: **A**ggression (survive or die); **B**ureaucracy (follow the norms or rules of work/behaviour); **C**ompetition (my gain is your loss); **D**ecision (disclosing individual feelings, intentions and choices) and **E**mpathy (cooperation is one unified interest).

This 'framework for all evolutional systems' is illustrated by the CA model and its implications for optimising behaviour at individual, team and organizational levels. Further work will show how to combine results from CA modelling research, the predictions of career progress using the CA model (or autonomically using the CACOS) and these five phases in career counselling. This work will also incorporate personality profiles based on such profiling techniques as the Myers-Briggs Personality Type Indicators, as well as models of performance coaching and mentoring (Ezepue 2007c).

Artificial intelligence and management science

The CACOS software to follow from future work on the CA model exemplifies artificial intelligence and *intelligence amplification* constructs, including *management science* ideas. As a diagnostic tool, it will provide learning insights, control, planning and solutions to career related performance management of knowledge workers.

The range of (AI) tools that would contribute to the engineering of the software include: neural networks for modelling CA production outputs from given inputs; fuzzy systems for reasoning under uncertainty from the resulting data; philosophy of knowledge, knowledge representation, concept reasoning and data mining. (see Jang et al 1997, heuristics and artificial intelligence in finance and investing (http: www.geocities.com/francorbusetti), AI-Tools, the Open Source AI community homepage (http://www.ai-tools.org/), Engelbretch 2005, Berson et al 2000, Bigus 1996, Guidici 2004, CRISP DM 1.0.).

Actor-network theory, social network analysis and organisational semiotics

The literature characterises actor-network theory (ANT) as:

(a) primarily advocating the *agency* of non-humans (e.g. the CACOS and PRD, PAD components of the CA model);

(b) a *materialist-semiotic* method of social theory and research. For e.g. the CA model maps relations that are both material (between things such as PRD, PAD and GCL and year-to-year academic products e.g. conference papers, journal papers, texts, reports etc.) and semiotic (between abstract objects, people and ideas e.g. idea grains/cells, organisational values, performance metrics, academic collaborators and technologies, the CACOS software and the state equations depicting yearly outputs in the model).

A particular tool central to ANT that features in this research is the *sociology of translation,* in which collaborating academics (actors) will attempt to create a forum (network) using four moments of translation:

- *problematization* (in which they decide what problems need solving at individual, team and organisational levels);
- *interessement* (gaining the interests of the actors);
- *enrolment* (getting actors to accept roles emerging from problematization;
- *mobilisation* of allies (in which delegate actors are assured to adequately represent the other members of society so that enrolment implies *active support*).

A key application of these ideas in this research is to *punctualize* the complex system of things, ideas and actors, so that, hidden from view, the CA model and CACOS mechanisms enable a CA player to transact career decisions, international research collaborations as a *unified experience* (Callon 1986, Latour 1987 & 2005, Law 1987, Ezepue (2007a).

A social network is defined as a social structure made of nodes (e.g. individuals, teams and organisations) tied by relations such as values, visions, ideas, financial exchange, and collaborations (http://en.wikipedia.org/wiki/social_network) last accessed 09/06/2007. This definition means that the CA model depicts a (social) network of relations among the model constructs, CA players themselves, research teams and organisations.

Areas of CA research to benefit from social network analysis include: the way individual CAs structure their networks of research collaborations; knowledge management, opportunity recognition across the networks; motivations of individual actors to form the networks; power dynamics, learning and job performance in the networks; optimal size of the networks; evolution of the networks towards increasing cooperation and development of the underpinning fields of specialization (Brandes et al (eds.) 2005, Carrington, Scott & Wasserman (eds.) 2005, Newman 2003).

Semiotics is concerned with how we use sign systems and signalling in constructing and understanding meaning (http://en.wikipedia.org/wiki/Semiotics last accessed 09/06/2007). Locke (1823/1963, p. 174) explains that science can be divided into three parts. This explanation ties up the research on CA modelling into three equivalent parts:

- firstly, the foundational nature of academic enterprise and its pseudo-mathematical representation, based on complex system constructs, and including the *connections* among the constituent parts of the model (Ezepue 2005, 2006 and this paper);
- secondly, the application, action plans and their implication by individual CAs, teams of collaborating CAs, HEIs in which they are employed and wider national and international educational systems, aiming to extract *socio-economic development* from this application (Ezepue 2006, 2007a and this paper); and
- thirdly, ways and means whereby knowledge resulting from the research programme is *produced*, *managed* and *communicated* to concerned stakeholders (Ezepue 2006, 2007, this paper and related future work). We take up a more detailed discussion of (organizational) semiotics in a related paper (Ezepue 2007b), since space does not allow such a discussion in this paper.

The following is an illustration of the way the CA model facilitates intelligent conversations around career performance of CAs (Ezepue 2006b).

Q4 (Ezepue 2006b): ***Do the results [from applying the CA model] demonstrate positive trends against target?***

A CA player may compare the quality and numbers of publications from year to year. Assume the following vector of starting position for a player

$$\bar{p}_0 = (2jp, 2cp, 1dt, 4m)$$

where *jp*, *cp*, *dt* and *m* stand for journal papers, conference papers, doctoral thesis and modules taught. Focusing on the *jp* and *cp* dimensions, for purposes of illustration, we give the position vectors in the next two years of CA activity for the case player as follows

$$\bar{p}_1 = (2jp, 6cp); \;\; \bar{p}_2 = (2jp, 9cp).$$

For a CA player with this output, the answer to Q4 is in the affirmative, but not completely. There is a positive trend in the *cp* output, but the *jp* performance is flat at 2jp. A simple Excel plot shows this as below

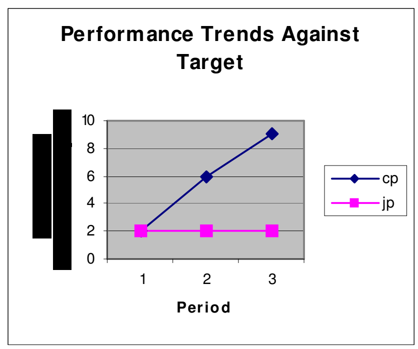

Figure 1: Performance Trend

This kind of self-audit is intrinsic to CA optimisation work and creates awareness of where improvements are needed from period to period.

2. Some notes on CA model, micro-informatics, idea generation, knowledge management and career advancement

As foreshadowed in Section 1, complexity and emergence in the CA programme enhance productivity way beyond what is possible without the CA model as a guiding compass. Using the CA model requires that CAs keep a work diary of activities and reflections around how they deliver the PRD-PAD-GCL complex of CA products and services, a kind of hardwiring of their minds to what it takes to be especially creative in generating new ideas and implementing the ideas speedily. The story is as follows.

Every CA product or service crosses some boundaries defined by the key work segments e.g. learning, teaching and assessment (LTA), primary research domain (PRD), primary application domain (PAD) and general cultural literacy programme (GCL), these are discussed in detail in Ezepue (2005, 2006). We can therefore conceive of CA products as idea *cells* or *grains* in an LTA x PRD x PAD x GCL Cartesian product representing the universe of effort - a grand *work lattice*.

A live cell in this universe is essentially a core idea that has enough *intrinsic intellectual* or *commercial worth*; that is, an idea sufficiently novel to make a product of which it is a *nucleus* able to command acceptance in a prestigious journal or buy-in from a client. Hence, the lattice is akin to a honeycomb of creativity as we permute grains or ideas within it to create a wide range of meaningful ideas. The validity of these ideas is tested by their practical usefulness (external utility criterion or metric) or theoretical academic worth (internal utility or metric). It is therefore clear that a structured approach to creative *hyper-productivity* in this CA game play consists simply in how we juggle the *complexity* represented by the lattice. Juggle it in a sense that provides the operational guidelines for Corporate Academics (CAs) to use it practically in deeply interrogating the PRD, PAD, GCL and related LTA knowledge bases, thereby creating value. This process calls for research collaborations amongst groups of CA players with commanding expertise in the PRD, PAD knowledge bases and with an interest in forming actor and social networks of the kinds discussed above.

Following Ezepue 2006 and 2007, this collaboration could use perspectives from values-based and whole-system change management (Barrett 2006), the psychology of work and human performance, self-awareness/self-efficacy, entrepreneurial intent/mindset, creativity, innovation and entrepreneurship (Bohm & Peat 2000, Bandura 1977, 1986), see also Stenberg (ed). 1999), creative problem solving, efficiency analysis, performance management, strategy making, flawless execution, and social networks e.g. networking for success as in (Flynn 2003).

3. The CA model), international research/academic collaboration, knowledge exchange programmes and grand challenges for improving HEIs and LTA processes in developing economies

Ezepue (2007a & c) explore the application of CA model ideas to wealth creation by CA players. The source of this creative force is the fact that an idea cell or grain is looked at from all *directions* that inform *value creation* from the grain, as a CA player thinks of new results and their translation to value-adding products and services e.g. papers, book chapters, edited books, seminars, personal communications, workshops, training opportunities, short courses etc.

A direction or ray of the work lattice is any of the PRD, PAD, GCL, LTA axes in the lattice or derived angles (initiatives) from which we view the idea grain e.g. for the CA player studied in (Ezepue 2005, 2006) the initiatives include contributing to international education in Sub-Sahara Africa (see also Ezepue 2007a), knowledge transfer, knowledge management, consulting and third-stream income generation initiatives. A related family of papers which capture this calculus of creativity underpinned by the CA model is listed in Ezepue (2007).

A number of research grant proposals related to these efforts are discussed in Ezepue (200a & c); the most foundational of these proposals is listed below for example:

- Cooperation on Model-Based Human Potential Improvement Projects via workshops, training, mentoring and coaching sessions to enable African academics, students, researchers and knowledge workers in the SE&T (and other) subject areas

in order to achieve *excellence* and *academic entrepreneurship* in Research, Teaching and Consulting, at individual staff, research teams, research institutes and overall institutional levels.

Project management, change management and excellent thinking ideas which will ensure success of these challenges are discussed in (Ezepue 2007c).

4. Concluding remarks with comments on the links between on society, organizations and informatics

This paper has reviewed in more technical detail the complex systems underpinnings of the CA model and its applications in developing academic entrepreneurship and career advancement skills among corporate academics/knowledge workers in high-performance organisations.

The paper indicates the challenges in international research collaboration and educational development which the CA model could help resolve, especially in developing economies.

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Viewing Human Organizations as Poly-Emergent Systems and the Importance of Distance

Ron FULBRIGHT
Department of Informatics
University of South Carolina Upstate
Spartanburg, SC 29303 USA

ABSTRACT

Poly-emergent systems are systems producing multiple kinds of emergent behavior. The emergent signature of a system is a plot of emergent behavior against some variable, such as the amount of disorder in the system. Therefore, poly-emergent systems can be viewed as the superposition of multiple emergent signatures. The presence of multiple emergent behaviors complicates observation, study, and control of emergent systems and necessitates *distance* as a discriminating factor. Distance, being a measure of the difference between two observations of an emergent system, makes it necessary to specify the state of the observer in any complete description of emergent behavior. Considering the role of the observer has implications in the management of human organizations because one must be aware of how the organization is monitored. The notion of distance is a new concept for both organizational informatics and complexity theory and may open new lines of inquiry in both fields.

Keywords: emergent behavior, complexity theory, human organizations, poly-emergence

1. INTRODUCTION

The journal *Emergence Complexity & Organization* (ECO), formerly called *Emergence*, publishes papers on the application of *complexity theory* to organizations. In the inaugural issue, [1] describes the general approach of viewing human organizations as emergent systems in which organizational structures and effective strategies spontaneously arise as a natural byproduct of the complex interaction between the individuals. In this view, work processes and leadership must go toward channeling the inherent disorder of such systems into useful directions.

The majority of the work in the field to date takes a concept, originally developed in the complexity theory domain, and applies it to human organizations. In a recent special issue of ECO on complexity and leadership, [3] introduces a new theory called *complexity leadership theory*. This notion centers on the idea that leadership is not a property of an individual in the group, but rather something that emerges as dynamic behavior by virtue of the interactions between members of the group. In the same issue, [6] discusses *generative leadership* focusing on the application of complexity theory ideas to the creation of an environment nurturing collaborative innovation.

This kind of approach presupposes that human organizations are sufficiently like the systems studied by complexity theorists. [4] observes:

> A living human organization is not entirely quantifiable or explainable by the methods of the conventional sciences. The concept of emergent properties or behavior is critical to understanding an organization as a complex, living, nonlinear system.

and this thinking is acknowledged by many other researchers in the field. However, few researchers have investigated what makes humans and human organizations different from those systems studied by complexity theorists. As [5] points out, even fewer have identified new concepts, learned first by studying human organizations, and applied them back to complexity theory.

This paper introduces a new concept, called *poly-emergence*, and discusses two associated ideas *distance* and the *role of the observer*. We show humans themselves, and human organizations alike, produce many different kinds of emergent behavior all of which superimpose on one another forming the bewildering landscape that makes management of human organizations so difficult. Since managers are also observers of emergent systems, we discuss how the vantage point of the observer is important. The importance of the role of the observer has been overlooked in complexity theory. In fact, it may be the absence of considering the observer that has caused us to also miss the concepts of poly-emergence and distance. If this is true, the concepts introduced here may open new lines of inquiry throughout the complexity theory domain.

2. THE NATURE OF EMERGENT BEHAVIOR

Emergent behavior is the global dynamic behavior of a system consisting of a number of interacting parts. [1] defines emergence as "the arising of novel and coherent structures, patterns and properties during the process of self-organization in complex systems." and lists the common characteristics of emergent behavior as:

1. The existence of a global or macro level

2. Novelty (global behavior not evident at micro level)
3. Coherence (persistent structures)
4. A product of a dynamical process (it evolves)
5. It is "ostensive" - it can be perceived

Emergent behavior of a system, or collective, is not directly attributable to the programming or action of an individual. Rather, the global behavior is an emergent property arising from complex interactions and inter-relationships among the components of a system. Emergent behavior cannot be predicted by examining the system's constituent parts alone. As such, emergent behavior is a property of the system at the macro level.

A canonical example of emergent behavior is a flock of birds. Composed of a number of individual birds, a flock, when viewed from an appropriate distance, looks and moves like a single organism. The flock's appearance (size and shape) continually change, yet not in a random way. Rather, a flock's shape is bounded in much the same way a chaotic system is bounded by its attractor. The flock, being observed as an entity in and of itself, has certain identifiable characteristics. A general belief in the study of emergence is that the *whole is greater than the sum of the parts.* Emergent behavior exceeds the capabilities of the individuals. A flock is capable of performing actions not possible by an individual bird. For example, an individual bird is not able to pass around both sides of an obstacle at the same time, but a flock can.

3. THE EMERGENT REGIME

[7] categorizes global behavior of complex systems like cellular automata into four classes based on the properties of the emergent structure arising from them:

Class I: Static Regime – a unique homogeneous state having no dynamical behavior

Class II: Ordered Regime - simple stable structure(s) emerge sometimes exhibiting periodic behavior but do not evolve or propagate

Class III: Chaotic Regime – continual creation of extremely short-lived patterns with no persistence or coherent structure

Class IV: Emergent Regime - persistent evolving and propagating stable structures exhibiting long periodic behavior

As shown in Figure 1, Wolfram classes can be plotted against a measure of disorder (randomness) in a system. Researchers, such as [2], have observed that maximal emergent behavior occurs when a system contains an intermediate amount of randomness. Highly ordered systems tamp system dynamics down too much allowing no emergent structure to arise. Highly disordered systems destroy any emergent structures so rapidly no patterns can persist.

Emergent behavior lies in the *emergent regime* between the ordered and chaotic regimes giving rise to the popular mantra coined by artificial life researchers: "life at the edge of chaos."

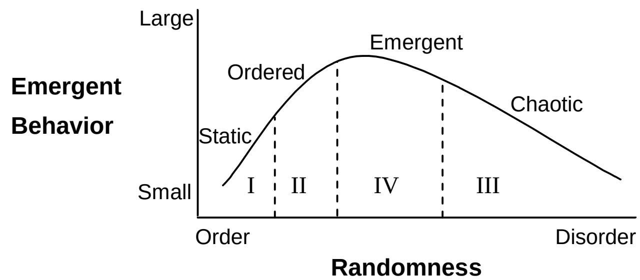

Figure 1 – Wolfram identifies four types of system behavior with Class IV corresponding to the emergent regime lying between the ordered and chaotic regimes and being dependent on the amount of disorder in the system.

4. POLY-EMERGENCE AND DISTANCE

Extending ideas on emergence into other fields, like organization informatics, we find pre-existing knowledge and ideas about emergence incomplete. Specifically, social systems and human organizations are very different than systems traditionally studied by complexity researchers. Human organizations exhibit many layers of complexity and overlapping emergent behaviors. We are finding that we may have missed some key insights by studying simpler systems. One aspect that has been missed is *distance.* Keeping in mind that emergent behavior must be ostensive—must be observable—it should be no surprise that the role of the observer must be specified in order for a description of emergent behavior to be complete.

Plotting emergent behavior, as is in Figure 1, requires certain assumptions:

1- Either the system has only one emergent behavior to observe or all emergent behaviors emerge near the same point.

2- The emergent behavior is independent of the observer. The role of the observer and how the observation of the emergent behavior is made is not specified.

These assumptions should not be made when dealing with human organizations because a group of human individuals produce more than one kind of emergent behavior. This is an example of the notion we call *poly-emergence*.

To illustrate poly-emergence, imagine a space traveler observing the Earth from 100,000 miles away, roughly half-way to the moon. From this vantage point, the space traveler observes oceans, continents, clouds, and entire weather systems moving across the planet. However, intelligent life is not detectable at this distance. No cities, roadways, or manmade structures are discernable. From 10,000 miles out, roughly half-way to geosynchronous orbit, the effects of human irrigation are seen. Cities are visible, but only in gross detail. Weather patterns are still visible on a global scale. From 1000 miles out, rivers and highways can be identified as transportation infrastructures and larger cities can be seen as agglomerations of smaller, artificial, objects. At this distance, intelligent life is evident, but understanding its nature in-depth is impossible.

As the space traveler gets closer still, through 100 miles out, then 10 miles out, then 1 mile out, more detail about human civilization is revealed—intelligent life is visible in all of its glory. From a distance of 1 mile, the altitude of a private airplane, some individual actions of humans are seen. Indeed, the space traveler could hover at this altitude, and over time, discern quite a lot about human activity. At a distance of 1 mile, the space traveler has arrived at an altitude whereby human civilization can be observed in some detail. This is not possible at higher altitudes. However, the traveler has lost the ability to observe global weather patterns. Local weather phenomena, such as thunderstorms, are visible in detail but not the much larger weather front the storm may be a part of. This is true throughout this illustration and is a key insight to the notion of distance. As distance of the observer changes, some emergent behavior comes into view and some falls out of view.

Continuing with the illustration another order of magnitude to 1/10 of a mile brings the observer to the scale of large buildings. At 1/100 of a mile (52.8 feet) the sounds of individual conversations are observable. This opens up a whole new realm of intelligence and social interaction to study. At 1/1000 of a mile (5.28 feet) the observer is at street level and on the scale of individual humans. This is the vantage point from which we humans live our daily lives. From this distance, the space traveler will be able to experience the same things we do in life and fully observe human life in detail.

However, continuing a few more orders of magnitude, through 1/10,000 of a mile (0.5 feet) and 1/100,000 of a mile (0.05 feet), and again to 1/1,000,000 of a mile (0.005 feet) approaches the cellular scale. The observer, for the first time, will be able to observe the intricate workings *inside* the human body. This opens up, again, an entirely new and complex world of emergent behavior to study. But at this scale, not only has the traveler lost the ability to observe global weather patterns, but also the ability to observe human social interaction. The observer could continue on through the atomic level to the quantum level finally ending up at the Planck scale which may well represent the smallest possible observation distance. At each level, whole new worlds of emergent behavior are observable, yet higher-order or lower-order worlds are unobservable. We can conclude from this illustration that to be complete, a description of emergent behavior must specify the state of the observer—in this case, the physical distance of the traveler.

Not only do entire realms of emergent behavior come and go at different distances, the very nature of the emergent behavior at different levels is completely different. For example, the dynamics of weather systems bear little resemblance to the dynamics of human society and even less resemblance to quantum dynamics like Heisenberg uncertainty. Even though the multiple emergent behaviors observed by the space traveler are completely different, they all constitute the single macro system, the Earth. We call systems that exhibit multiple emergent behaviors *poly-emergent* systems. The key insights from this illustration are:

- To observe an emergent behavior, one must observe it from the appropriate distance.
- A system may exhibit multiple kinds of emergent behaviors when observed at different distances.
- To fully qualify any statement about an emergent system, the vantage point of the observer must be specified.

5. EMERGENT SIGNATURES

Each individual emergent behavior in a poly-emergent system can be plotted against a distance scale as shown in Figure 2. Note, this plot looks similar to Figure 1, but the horizontal axis in Figure 2 is *distance* not randomness. In Figure 2, we plot “weather”, “cities”, and “civilization” as three different emergent behaviors recalling from the illustration that large weather systems could be observed only from a relatively high altitude while cities were observable much closer and human civilization dynamics closer still.

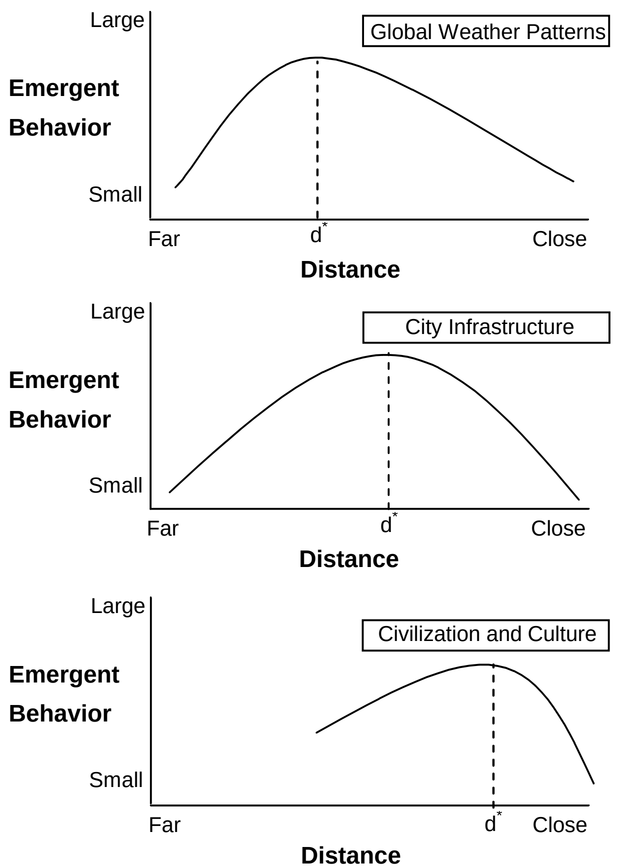

Figure 2 – Different kinds of emergent systems are observable from different distances. As the distance varies, more or less detail about the emergent system is discernable. Plotting against a distance metric yields the system's *emergent signature*.

Each emergent system has an optimal distance from which to observe it. We call this the *emergent point* and denote as d^*. If one observes a system from too far away ($d > d^*$) or from too close ($d < d^*$), less emergent behavior is observed. An observer may be able to detect some emergent behavior, but not all. Recall from the illustration that the traveler could detect cities and transportation infrastructure from altitude, but not observe any human-human social interactions. If one observes a system from very far away from the optimal distance ($d >> d^*$ or $d << d^*$), no emergent behavior is observable. In this case, the observer has passed a threshold where entire realms of behavior are unobservable.

We call the plot of emergent behavior, as shown in Figure 2, the *emergent signature*. In poly-emergent systems, each emergent behavior has an emergent signature so the macro system is characterized by multiple emergent signatures. Figure 3 combines the three plots in Figure 2 and shows the emergent signature for the poly-emergent system, the Earth, by superimposing the individual emergent signatures. Note:

- Multiple emergent points can be detected at different distances.
- At a given distance, multiple emergent systems can be observed, but at different levels of detail.

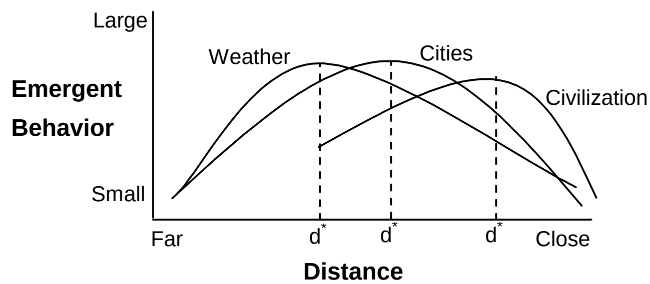

Figure 3 – The *emergent signature* of the ploy-emergent system, the Earth, consists of many different emergent signatures superimposed on each other. Notice that several optimal emergent points are identified when observing a ploy-emergent system. Also note that at a given distance, multiple emergent systems are observed at different levels of detail.

6. THE NATURE OF DISTANCE

In the above illustration, the observer's *physical* distance varied. However, we stress that physical distance is only one kind of distance. In general, *distance* is involved whenever there is disagreement in the description of emergent behavior from two different vantage points. Formally, if an observation of an emergent system, *S*, is made from a certain vantage point, *k*, the observed emergent behavior, E_k is represented by the description, $\Psi_k(S)$ so that:

$$E_k = \Psi_k(S)\,. \tag{1}$$

Any difference in two descriptions defines the *distance* between the descriptions and is given by

$$\text{Distance} = \Delta E = \left|\Psi_i(S) - \Psi_j(S)\right|, \tag{2}$$

where ΔE is the difference between descriptions of emergent behavior observed in system *S* made from different vantage points *i* and *j*.

There are a number of reasons why descriptions may differ. Emergent behavior must be ostensive; therefore any description must be created by an observer. Emergent behavior, then, is relative to the state of the observer and the state of the observer must be specified to complete any description of the emergent behavior.

Some kinds of distance are due to the differences in the observers themselves. Kinds of distance include:

Spatial	Separation in space in any or all of the standard three dimensions—a physical distance.
Temporal	Separation in time, especially critical in emergent systems because future states are largely unpredictable, so the system being observed will always appear different at different moments in time.
Sensory	Observation using different sensory devices, or sensory devices with differing capabilities, will yield different descriptions.
Semantic	Observations made by observers using different lexicons or interpretations will result in different descriptions.
Logical	Disagreement in the observers' logical constructs or capabilities, required for accurate interpretation, will result in different descriptions.
Cognitive	Observers with the same semantic and logical foundations will yield different descriptions if their inductive and deductive capabilities are different.
Political	Human observers, by nature, are situated in socio-political environments that influence cognitive abilities and therefore lead to different descriptions.
Cultural	Humans are influenced by their cultural heritage and this could result in differing descriptions.
Social	Humans are social beings and as such are influenced by their social relationships and allegiances to one another which could factor into the descriptions one makes.
Emotional	Emotional states of human observers cannot be ignored. Intent, anger, jealousy, love, revenge, and loyalty are but a few of the myriad of emotional influences on a human's ability to observe and describe.

Regardless of the nature of the distance involved, each of these represents a dimension across which observation can range. In the above illustration, the observed emergent behavior changes as one ranges through the physical dimension. Not surprisingly, many of these dimensions represent the very aspects of humans that make humans complex subjects to study in the first place. In the next two sections, we discuss the unique challenges behind studying and managing collections of poly-emergent humans.

7. POLY-EMERGENCE IN HUMAN ORGANIZATIONS

[4] draws an analogy with the Pulitzer-prize winning work of Wilson who studied the social structure of ant colonies. Wilson formulated a holistic description of ant behavior by addressing communication and coordination across four levels of organization: whole colony, individual ants, glands and organs, and molecules. Peroff calls for the same kind of holistic approach when studying human organizations.

We see now that Wilson's approach is equivalent to studying ant colonies from four different *distances* with the molecular level being the "closest" and the whole colony level being the "most distant." If Wilson had been studying ants as emergent systems, he would have identified emergent behavior at each level and would have described an ant colony as a poly-emergent system.

A key observation in this paper is that not only is each human individual a poly-emergent system in and of itself, but collections of humans—human organizations—are poly-emergent systems as well. This allows us to make the following predictions:

- Researchers will find numerous emergent behaviors arising out of human organizations.
- Emergent behaviors will be found by analysis along any of several dimensions of human behavior including, but not limited to: emotional, social, cultural, political, and motivational.
- Because each dimension represents the source of varying *distance,* a nearly infinite number of vantage points are available from which to make observations. This will result in different studies showing what appear to be contradictory or uncorrelated results. However, researchers knowledgeable about the relativity of emergence will understand that these are likely to be observations of the same behavior, but merely from different vantage points.
- Realizing that human organizations are poly-emergent systems, practitioners will see that the global behavior of the organization is the superposition of many emergent behaviors. This will open a new chapter in organizational management theory.

8. THE POLY-EMERGENT MANAGER

As an example of the implications of distance and poly-emergence in human organization theory, recall complexity leadership theory [3]. The notion is that hierarchical leadership in human organizations should give way to a self-organized leadership arising naturally from the collective. Our analysis warns that emergent leadership may not be quite so easy to attain as it may seem. Lichtenstein proposes "events" (an interaction between individuals leading to an adaptive change) as the smallest unit of study to monitor in a human organization. However, choosing events as the "grain size" establishes a certain observational *distance*. As a result, we will not be able to observe any lower-order emergent behavior arising from "intra-event" dynamics. Also, we will not be able to observe any higher-order emergent behavior based on patterns or combinations of events. Complexity theory insures us that no matter what the distance, we will observe *some* emergent behavior. However, how do we know that "event distance" is the best vantage point from which to observe the behavior we want to observe—emergent leadership? If "events" do not represent the best distance, we will never achieve the true potential we are looking for. We may think we will have achieved maximal emergent leadership, but, since we will have been observing the organization from the wrong distance, it would be an illusion.

The challenge of the modern manager, the *poly-emergent manager*, is to observe the organization from a number of different distances, realizing that no single dimension yields a complete description of the organization. Only when one is observing the organization's emergent behavior properly can one truly provide the optimum nurturing environment, as described in [6]. The poly-emergent manager tries to tweak dynamics in the organization to drive it into the emergent regime. Organizations operating in the emergent regime will be the highest performers, the most coordinated and adaptable, the best at achieving results—the dream teams.

However, the poly-emergent manager must watch for the *house of cards* phenomenon. Recall how the Earth can be viewed as a superposition of emergent behaviors and recognize some higher-order emergent behaviors cannot exist without certain lower-order emergent behaviors. Even though from an altitude of 10,000 feet we can not observe emergent behavior at the quantum level, the behavior we can observe (local weather systems, cities, etc.) would vanish if the quantum level were suddenly turned off. Without the quantum level, atoms and molecules would not be possible. Without atoms and molecules, cities, clouds, and the weather would also not be possible and the entire poly-emergent system known as the Earth would collapse like a house of cards.

As poly-emergent systems, human organizations can collapse like a house of cards too. We could be fine tuning the organization to the optimal emergent point along one dimension but ignore some other, destructive behavior, operating along another dimension. An example of this might be the hiring of socially or politically unacceptable employees into an organization. The emergent discord, coming as a result of the social and political friction between individuals, could serve to undermine all collaborative interactions, regardless of the quality of the nurturing environment.

9. CONCLUSION

We have introduced a new concept, called *distance*, and defined it as the difference between two observations of emergent behavior in a system. Because of the reliance on an observer, the state of the observer must be specified if we wish to make a complete description of emergent behavior. We have also shown how viewing systems from different distances allows us to observe multiple kinds of emergent behavior. These behaviors are superimposed on one another thereby making up the macro-level system. We have called these systems *poly-emergent* systems and discussed how human organizations are, in fact, poly-emergent. Finally, we demonstrated how employing the wrong distance in our observations, and how the existence of multiple emergent behaviors, complicates the management of poly-emergent human organizations. Introduction of the notions of poly-emergence, distance, and relative emergence are ideas that may lead to new lines of thought and inquiry in organizational informatics, organization management, and complexity theory.

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Integration of R&D-Marketing Interface

Jiancheng GUAN*
School of Management, Fudan University
Shanghai, 200433, PR China
and
Xiangju QU
School of Aeronautic Science & Engineering, Beijing University of Aeronautics and Astronautics
Beijing, 100083, PR China

ABSTRACT

In this paper, we carried out an exploratory empirical study in Chinese manufacturing firms based on an extensive literature review to gain a better understanding of managers' perceptions to R&D-Marketing Interface. We gathered the information about the perceptions of the importance of interface management through surveyed R&D managers and marketing managers for 1258 Beijing firms. Significant differences between R&D and marketing managers' perceptions to some interface variables are analyzed, too. The both sides have a common trend that they positively overestimated their own role and underestimated the role of another side in new product development and innovation processes. The interface of high-tech firms is more harmonized than that of general firms. Results show that the harmonized interface between the R&D and marketing departments is essential to develop new product in an effective manner. Finally, some implications to improve interface relation, especially for the large-and medium-sized state-owned enterprises, are also drawn.

Key words: Integration; Technological innovation; R&D; Marketing; Empirical study.

1. INTRODUCTION

The importance of the R&D/Marketing interface within the firm is explicitly unquestioned for successful innovation. Maintaining an effective interface between R&D and marketing can be vital for successful new product development and innovation [1, 2]. The influence of departmental views seems to be particularly important in the context of assessing NPD processes, because the successful development and implementation of new products requires the integration of specialized knowledge from different organizational units, particularly by the cooperation between Marketing and R&D [3]. Nevertheless, conflicts and disharmonies between these two groups can severely hinder and is even detrimental to new product successes.

During the past several decades, numerous studies have explored the R&D and marketing interface and its role in industrial innovation, particularly focusing on its role in the new product development (NPD) process. The main stream of the research, however, concentrated on industrial firms of Western countries. The research on interface issues between R&D and marketing for economic transition countries, e.g. China, was largely neglected. Until now, no literature on interface issues between R&D and marketing for Chinese firms was reported in international journals, yet.

Multi-centre and government directed R&D activities are obvious characteristic in China [4]. Due to the lack of direct linkages between research and development department and marketing one, it has often been reported that the economic return for most of the R&D investments in China are unsatisfactory. For example, successful R&D commercialization rates are lower in China than that in most Western countries [5]. According to the study of Guan and Gao [6], about 85% of R&D projects aimed at industrial production could not enter into the market-place. One of important reasons for this is that R&D and marketing activities were almost totally separated each other for a long term history. Therefore, harmony of R&D and marketing interface is of particular importance for Chinese industrial firms.

2. SURVEY METHOD

The current study on interface issues related innovation process focused on the Beijing region. Beijing, being the capital city of China, is recognized as the most innovative region in China [5]. It has dozens of top universities and research institutions which possess powerful capabilities in creating new knowledge. Besides, the largest and most active new-tech economic zone in China is located in the Beijing area. Hi-tech firms, in which considerable portions were split

*Corresponding author, Fax: +86 10 82328037. E-mail address: guanjianch@buaa.edu.cn (J. Guan).

from Chinese Academy of Science (CAS) and famous research universities, such as Tsinghua University and Beijing University, are playing an increasingly important role in technology development and economic growth in the whole mainland China. In China substantial parts of innovation policies at national level are formulated based on the experiences and lessons learned in Beijing. Therefore, based on the western experiences in innovation management, interface issues between R&D/Marketing were recently surveyed in Beijing.

After careful discussion, the survey focused on interface issues was designed to have two parts:
1. All of hi- and new-tech enterprises who undertake (at least partly) manufacturing work. In addition, these hi- and new-tech enterprises should be registered by governments at the state or provinces levels.
2. Large- and medium-sized enterprises in manufacturing industries. Determination of the size for enterprises depends on the standard of State Statistics Bureau of the PR China.

In this study, questionnaires were sent to 462 state-owned large and medium-sized enterprises (LMEs) and 1750 high-tech enterprises in Beijing, covering all the manufacturing sectors. All of high-tech enterprises were recognized and acknowledged by Beijing S&T Committee. The respondents for the interface survey consist mainly of the R&D and marketing managers of the surveyed firms. Economic performance was answered by the financial departments of the surveyed firms. Before the mass survey, pilot-tests were conducted for clarity in eight enterprises. Then, the questionnaire was revised based on their feedbacks in terms of clarity of understanding and formats of questions. In order to enhance their correct understanding and avoid ambiguity to the questionnaire, tutorial classes were delivered to the respondents before the survey with the help of Beijing S&T Committee. The usable respondent rates were relatively higher than many similar studies in Western countries with 48.5% (224 firms out of 462) for LMEs and 59.1% (1034 firms out of 1750) and hi-tech firms respectively for the strategies survey. There are also state-owned firms within the hi-tech firms. As described in Table 1, amongst 1258 firms that returned questionnaires, there are 1071 high-tech firms and 187 general firms. Among the 1071 high-tech firms, there are 437 state-owned firms. Namely, the non-state-owned economic types took a dominant position in high-tech firms. Among the 187 general firms, there are 154 state-owned firms. That is, the state-owned economic types took an absolutely dominant position in general firms. In total, there are 591 state-owned firms. After supplement survey and continued telephone contacts during the survey process, 1244 firms in total out of 1258 provided valid answers for the interface survey. For each question answered by the both sides, namely, R&D and Marketing, the valid paired dyads are all over 1210.

Table 1 Sample distribution of respondents

	No. of firms	State-owned firms	Non-state-owned firms
High-tech firms	1071	437	634
General Firms	187	154	33
Total	1258	591	667

Source: Authors' survey

Our data collection method was similar to the ones used by Western researchers, e.g. [3, 7] due to considerations of connection to research mainstream in this area. This means that we focus on the R&D and marketing departments within the same firm or same business unit and not being concerned with the specificity of innovative projects. Briefly, dyads consisting of marketing and R&D managers in each firms or business unit responded to a series of semi-structured questions to provide information on their perceptions on the 4 areas related to innovation and interface management, namely, causes of failure for innovation, firm's mechanism issues of interface, R&D/Marketing interface issues and barriers to communication. The measurement instruments for all the constructs were developed based on previous relevant literature. Subjective measures using Likert-type scale have been widely used in organizational research [8-10]. This study used a 5-point Likert-scale, the common used scale in China, to evaluate the perception statuses of two sides of R&D/Marketing interface. The details for the contents above mentioned and survey results are described respectively as following sections.

3. CAUSES OF FAILURE FOR INNOVATION

The reasons for innovation failure were first investigated. The reasons were divided into two parts, i.e. Marketing-related issues and management control issues. Each part consists of several items that were based on relevant literature, e.g. [3], and aimed at specific Chinese situation. Table 2 indicates the details and surveyed results of reasons for failure of innovation. From Table 2, Chinese managers, including both two sides of R&D/Marketing interface, considered "Project selection & planning" as the most important cause for innovation failure, whereas "Noncompliance with changes in project objectives" was cited most unimportant cause among all listed 7 items. This strongly reflects the remaining track and influence of planned economy. In China, owing to the influence of economic system, the innovative projects of firms, particularly for those radical innovative projects, are often linked to the government S&T programs. Once the innovation projects of a firm are involved into major government's programs and are implemented according to planning and guidance from government's institutions, such as Ministry of Science & Technology of China, Economy and Trade Committee of China, and then the firms can obtain various supports from government, including financial aids, equipments and policy priority, even including human resources. This smoothes research and development process of the innovative project. "Faulty new product strategy" was mentioned as the most important cause for innovation failure among marketing-related issues. Actually, orientation of new product strategy of manufacturing firms in the planned economy was to a great extent dependent on government in China. The findings in the research revealed that the tradition still affect innovation behaviors during current transition. Particularly, R&D that was more influenced by planned economy emphasized more on "Faulty new product strategy" and the perception differences between R&D and marketing departments were statistically significantly. This is an indication of interface problem.

Table 2 Paired Samples Statistics for Innovation Failure, Overall results

Reasons for Failure (N = Paired dyads)	Marketing		R&D		*t*-test
	Mean	S.D.	Mean	S.D.	
1. Marketing related issues					
Faulty new product strategy (N = 1213)	3.93	1.160	4.06	1.093	-3.739***
Underestimation of competitor's marketing strength (N = 1215)	3.32	1.010	3.27	1.027	1.488
Underestimation of competitor's R&D strength (N = 1216)	3.27	1.038	3.27	1.000	.049
2. Management control issues					
Project selection & planning (N = 1217)	4.20	.959	4.21	.951	-.386
Estimates of resource needs (N = 1217)	3.44	1.012	3.44	1.009	-.025
Noncompliance with changes in project objectives (N = 1217)	2.91	1.056	2.95	1.058	-1.204
Development goals were not achieved (N = 1216)	3.47	1.103	3.46	1.080	.272

Remarks: N - sample size (paired dyads); S.D. - Standard Deviation; ***p<0.001; Total samples equal to1244 and there are no matching pairs for 27-31 firms for different items

In addition, the scores of other five items were assigned by both two sides of R&D/Marketing interface to be higher than points 3, the modest important score. This indicates that most of the listed items affected indeed success or failure of industrial innovation. If we split the surveyed samples into general firms, which consisted mostly of State-owned large and medium-sized enterprises (LMEs) (148 State-owned LMEs out of 179 general firms), a different and also interesting profile appears. The results show that Chinese managers of general firms, including both two sides of R&D/Marketing interface, considered "Project selection & planning" as the most important cause for innovation failure and both sides assigned higher importance than overall firms did, whereas "Noncompliance with changes in project objectives" was cited most unimportant cause among all listed 7 items and both sides assigned lower importance than overall firms did. This further more strongly reflects that planned economy remains substantial influence on general firms that consists mostly State-owned LMEs. Particularly, R&D managers of general firms emphasized more on "Project selection & planning" and the perception differences in this item between R&D and marketing departments were statistically significantly.We notice that for general firms there was no significant perception difference between R&D and marketing departments on "Faulty new product strategy" any more, although it was still mentioned as the most important cause for innovation failure among marketing-related issues.

We further divide the samples according to their ratios of innovative sale over total sale. In line with the Chinese convention, a high innovative firm was one which had an innovation sale ratio of greater than 20 percent. In this study, 659 out of the total surveyed firms were regarded as high innovative firms. 585 out of the total surveyed firms were regarded as low innovative firms. Results show that both R&D and marketing from high innovative firms assigned more importance with statistically significance to items "Faulty new product strategy" and "Project selection & planning". The statistic results reflect stronger and more substantial characteristic of planned economy. This implied to some extent that Chinese industrial innovation may be pushed by administration planning. In addition, there is significant difference from those marketing managers between high innovative firms and low ones in the item "Development goals were not achieved". This indicates that managers from high innovative firms recognized more importance of the mentioned reasons for failure to innovation.

4. FIRM'S ORGANIZATIONAL ISSUES OF INTERFACE

Five items were used to evaluate current status of firm's organizational mechanism issues of interface, as described in Table 3. "5" represents highest degree or totally involvement. "3" indicates modest level and "1" lowest degree. It is noticeable that, the item related to R&D and marketing interface was assigned lowest values both by marketing and R&D managers, only a little bit higher than modest level. This also indicates from another side that the R&D/marketing interface problem is an important issue in industrial innovation for the surveyed Chinese manufacturing firms. We find that however there is no significant difference for the organizational mechanism issues of interface between R&D managers and marketing ones for the overview perspective. Whether R&D managers or marketing ones, they were to different extents satisfied with the current communication and interaction within the organization for all the listed organizational mechanism items of interface.

It is interesting when we divide the surveyed firms into two groups according to their technology level. Table 3 indicates that marketing managers of high-tech firms generally satisfied much more with current status of firm's organizational mechanism issues of interface. Same is hold for R&D managers of high-tech firms. There are statistically significant differences in firm's organizational mechanism issues of interface between high-tech firms and general firms. The organizational interface mechanism of Chinese high-tech firms was more harmony than that of Chinese general firms. The same survey indicated that Chinese high-tech firms achieved much better innovation performance (such as innovation sale and innovation rate) as well as better economic performance than Chinese general firms [5]. The more harmony organizational interface mechanism of the high-tech firms could be a substantial factor.

Table 3 Organizational interface mechanism: Marketing

Firm's mechanism issues of interface	High-tech Firms (*N*=1064)		General Firms (*N*=164)		*t*-test
	Mean	S.D.	Mean	S.D.	
I01: Degree to which top managements of firm focused on creating chance for readily communications and interactions of inter-department	3.94	.883	3.71	.921	3.068**
I02: Degree to which innovation profit stimulated innovation activities	3.57	.905	3.21	.992	4.630***
I03: Degree to which you understood responsibilities of Marketing/R&D:	4.01	.827	3.82	.833	2.779**
I04: Degree to which marketing participated in budget decision of R&D?	3.33	1.138	2.69	1.178	6.595***
I05: Degree to which you could independently make decision	3.87	1.150	4.04	1.232	-1.690^{+}

Remarks: N - sample size; S.D. - Standard Deviation; ***p<0.001; **p<0.01;* p<0.05; $^{+}$p<0.1.

5. INTERFACE ISSUES BETWEEN R&D-MARKETING

Partly following Gupta et al's approach [11-13], complementing and integrating the findings of relevant literature above mentioned (e.g. Souder, 1981 and 1989) and taking Chinese specific industrial innovation practice into account, we propose an interface audit framework for evaluating harmony degree of firm's R&D-Marketing interface in this section. Marketing and R&D managers of Chinese manufacturing firms were asked to indicate the degree of involvement achieved in the same 10 areas in the new product development process necessary to achieve successful innovation. The 10 areas include followings.

(1)Degree to which Marketing was involved with R&D in setting new product goals & priorities;

(2)Degree to which R&D was involved into analyzing customers needs;

(3)Degree to which Marketing provided scheduled information to R&D from customers regarding innovative products and competitors' moves;

(4)Degree to which Marketing/R&D was involved into R&D/Marketing's generating new product ideas;

(5)Degree to which R&D was involved in modifying products according to marketing's recommendations;

(6)Degree to which R&D was involved in marketing's training users and service after sale;

(7)Degree to which R&D and Marketing are too-friends (The higher the score, the lower the degree);

(8)Degree to which Marketing provided feedback of market' investigation to R&D;

(9)Degree to which Marketing/R&D trusted another party (R&D/Marketing);

(10)Degree to which Marketing/R&D collaborated each other very early in the NPD cycle.

Statistic results show that Marketing managers perceived that marketing had provided scheduled information to R&D from customers regarding innovative products and competitors' moves, whereas R&D perceived that the degree of that marketing provided scheduled information to R&D from customers regarding innovative products and competitors' moves is not enough. There is significant difference of perception to the issue between the two parties ($T=5.404$, $p<0.001$). In contrast, R&D perceived that R&D was already well involved in modifying products according to marketing's recommendations, whereas marketing felt that the involvement of R&D has still distance. There is also significant difference of perception to the issue between the two parties ($T=-4.488$, $p<0.001$). Similarly, there are significant perceptions with respect to items "Trust each other" ($T=4.381$, $p<0.01$), "Degree to which Marketing provided feedback of market' investigation to R&D" ($T= -2.027$, $p<0.05$) and "Degree to which one party was involved into another party's generating new product ideas" ($T= 2.327$, $p<0.05$). We found that an important perceptual gap exists between R&D and marketing regarding the extent of their involvement and information sharing with each other in the new product development process. The both sides have a common trend that they positively overestimated their own role and underestimated the role of another side in new product development and innovation processes. This indicates there is indeed disharmony between R&D/Marketing interfaces of Chinese manufacturing firms, although it is not as severely as we previously assumed.

Strikingly and interesting, when we divide the surveyed firms into two groups according to their technology level, we find that high-tech firms, whether marketing managers or R&D managers, generally perceived their R&D/Marketing interface is much more harmony than general firms did. There are statistically significant differences in R&D-Marketing Integration achieved as perceived both by Marketing and by R&D Managers between high-tech firms and general firms. The evidences again revealed that Chinese high-tech firms achieved not only more harmony organizational interface mechanism than general firms, but also obtained more harmony R&D-Marketing Integration. This could also be a substantial factor that led to high innovation performance of high-tech firms [5] and may partially explain that the harmonized interface between the R&D and marketing departments is essential to develop new product in an effective manner.

6. CONCLUSIONS

7.

The research on interface management for Chinese manufacturing firms was concentrated at the departmental level, namely, dealing with interface issues between R&D and marketing departments within the same firm or business unit. The empirical analysis of this research reveals the findings listed below.

First, "Project selection & planning" had been listed as most important cause for innovation failure. We didn't find there is any significant difference between marketing and R&D from an overall view. This strongly reflects the remaining track and influence of planned economy. However, there is a strong indication of interface problem in perception to "faulty new product strategy" between marketing and R&D due to R&D's more emphasizing, although it was also mentioned as a second important cause for innovation failure by marketing. By splitting firms into general and hi-tech ones, we found that the statistic results reflect stronger and more substantial characteristic of planned economy. Analysis further indicates that higher innovative firms considered the two reasons mentioned above to be more important than lower ones did. There are statisticly significant perception differences between them. This implied to some extent that Chinese industrial innovation may be pushed by administration planning.

The findings of the research also indicates both marketing and R&D were to different extents satisfied with the mentioned five interface items related to organizational mechanism. Particularly, high-tech firms, whether marketing managers or R&D managers, generally satisfied much more with current status of firm's organizational mechanism issues of interface than general firms did. This implicated that more harmony organizational interface mechanism of the high-tech firms could be a substantial factor to higher innovative performance.

With regard to the interface issues between R&D and marketing departments, we found that an important perceptual gap exists between R&D and marketing regarding the extent of their involvement and information sharing with each other in the new product development process. The both sides have a common trend that they positively overestimated their own role and underestimated the role of another side in new product development and innovation processes. The perception differences are with high significance. Furthermore, high-tech firms, whether marketing managers or R&D managers, generally perceived their R&D/Marketing interface is much more harmony than general firms did. There are statistically high significant differences in R&D-Marketing Integration achieved as perceived both by Marketing and by R&D Managers between high-tech firms and general firms. Except for very few factors, the perceptions of high-tech firms to importance of interface management are significantly higher than those of general firms. This may partly explain why high-tech firms achieved better innovative performance [5] from interface management perspective. This also implicates that the general firms should timely reform their management structure and redesign their management mechanism. By doing so, the better communication channels between R&D and marketing within the general firms should be set up in order to provide them common incentive mechanism. It is urgently necessary and desirable to avoid severe disharmonies between them through various management methods because rigid management mechanism may be one of important reasons that cause lower efficiency in the innovation activities for those State-owned firms.

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First, Assume a Monopoly:
The Failure of Vertical Foreclosure Theory on the Never-Was-Neutral Internet

Douglas A. HASS [†]
Director of Business Development, ImageStream
J.D. Candidate, 2008, Indiana University—Bloomington School of Law
Bloomington, Indiana 47405 U.S.A.

ABSTRACT

Internet service providers and their customers have understood and debated the concepts of net neutrality since the beginning of the era of dial-up bulletin board systems. Commentators have only recently joined the debate, and often overlook history. No commentator, legislator, or regulator can be certain how networks and technologies will evolve over the next decade—especially when they misunderstand how those networks evolved over the last one.

This paper refocuses the net neutrality debate by challenging the application of vertical foreclosure theory to today's non-neutral Internet access and content markets. The paper finds that the current policy fascination with non-existent net neutrality is ill founded. Disclosure and a broader focus on both network and content providers' non-neutral traffic policies would better enable the market to choose technologies and business models dynamically while still providing regulators with a potential enforcement mechanism.

Keywords: net neutrality, FCC, broadband, Internet, monopoly, economics, vertical foreclosure

INTRODUCTION

A shipwreck stranded a physicist, a geologist, and an economist on a deserted island with only a carton of canned food to eat. Each scientist applied the insights of his discipline to solving the problem of opening the cans. The physicist suggested dropping rocks off a high cliff to open the cans. The chemist suggested using polished rocks and the sun's rays to heat the cans until they split open from internal pressure leaving the food accessible and cooked. Then, the economist spoke, "Gentlemen, assume we had a can opener . . . ."

Proponents of net neutrality regulation generally argue that Internet access providers threaten the innovative, largely regulatory-free Internet, and that government action is necessary to prevent the destruction of the global network's benefits. Opponents tend to argue that regulations would ruin innovation, fail in practice, or be doomed in principle. While commentators have alternately argued for or against the nebulous "net neutrality" concept, the vast majority have done so from theoretical perspectives rather than technical ones. Like the stranded economist, commentators on both sides ignore the facts on the ground, and first assume a monopoly. As a result, the debates have discussed nonexistent "end-to-end" neutral network models, [1] purely theoretical monopoly-controlled networks, [2] or value judgments about whether non-neutrality or government intervention causes the most "harm" to Internet consumers. [3]

Relatively few treatments come from technical perspectives that explain the history of non-neutrality on the Internet, or the enduring power of end users and technological innovation. This paper highlights what Internet network administrators have always known: net neutrality is not—nor was it ever—the status quo. Acknowledging this reality refocuses the net neutrality debate on end users, rather than networks. By analyzing Internet history, testing monopolist theories against real world Internet markets, and exploring important economic arguments, this paper attempts to illuminate the value of a uniform disclosure solution that protects provider innovation yet leaves market power in the hands of consumers.

Specifically, this paper focuses on the application of vertical foreclosure theory by Dr. Barbara van Schewick. [4] Vertical foreclosure theory fails in application online, and its misapplication represents a significant danger to innovative Internet access and content markets. Dr. van Schewick makes fatal assumptions about the existence of monopolies in the access market, and overstates the likelihood of vertical foreclosure even if those monopolies were to emerge.

Legislators and administrative agencies have no way to predict future technologies or their impacts. Net neutrality legislation as envisioned by Professor Lawrence Lessig, Dr. van Schewick, and others ignores the history of consumer power to foster continued innovation and prevent access provider harms. Regulatory approaches that aim to stifle particular practices or network architectures often make little technical sense, and are unacceptably subject to political whims. Instead of adopting specific neutrality regulations—whether narrowly tailored to last mile networks or broadly viewed from the perspective of overall consumer welfare—this paper advocates a uniform disclosure regime. Categorized, detailed disclosures would enable the market to choose technologies and business models dynamically, yet still provide regulators with a potential enforcement mechanism.

1. THE HISTORY OF NET NEUTRALITY

The broad concept of net neutrality covers a range of issues over a longer period than most commentators recognize. [5] While the FCC may have only joined the debate in recent years, the Internet community, its standards bodies, and market participants have debated these issues for over two decades. Decisions made before regulators took notice impact today's debate in many ways. Standards bodies built non-neutrality into networking protocols long before the commercialization of the Internet. Discussions about acceptable use, user restrictions, tiered access plans, and pay-by-usage are at least as old as the pre-Internet bulletin board systems that flourished during the 1980s and early 1990s. By the mid-1990s, the burgeoning Internet service provider industry had largely replaced the offline BBS as the focal point of neutrality and content filtering debates. The Internet community's successful—and regulation-free—resolution of these difficult neutrality issues not only requires reframing today's discussions about network neutrality, but also provides important lessons for legislators and regulators considering new regulatory regimes.

CIX and the absence of monopoly power

The 1990s saw the first major carrier and consumer skirmishes over net neutrality issues. The battles tread familiar ground: disputes over equal access and arbitrary consumer content restrictions.

Various pundits and experts have offered doomsday warnings for years. In 1997, a group of Internet providers argued that termination of peering agreements "may be just the opening . . . skirmish in the long-predicted move [by Tier 1 providers] acting as a closed cartel to change the fundamental economics of the Internet . . . [that] will cascade down to the pocketbooks of all users and smaller . . . ISPs." [6] In 1994, Internet journalist Gordon Cook warned that Tier 1 providers would soon dominate the market and force higher usage-based pricing and the elimination of free peering points like CIX. [7] Legislators, too, have fanned these fears. Senator Ron Wyden (D-Or.) used similar language in 2006, claiming that "[c]reating a two-tiered system could have a chilling effect on small mom and pop businesses that can't afford the priority lane, leaving these smaller businesses no hope of competing against the Wal-Marts of the world." [8]

Preferential access, present from the commercial foundation of the Internet, does not represent a fundamental change to business models or Internet economics. Cook and others in the mid-1990s may not have foreseen the power of individuals to shape Internet governance, given the comparatively limited scope of the commercial Internet at the time. However, both academics like Professor Lessig and Dr. van Schewick and legislators like Senator Wyden have the benefit of history. Their scenarios fail explain clearly how the "Wal-Marts of the world" could hope to buy discriminatory access on thousands of provider networks around the world to create a priority lane, or why a meshed, worldwide network would eschew opportunities to circumvent any discriminatory "lanes" that individual carriers tried to build. As the next section recounts, organizations like CIX have found that creating a discriminatory lane leads to irrelevance, not dominance. A telecommunications oligopoly has not materialized at any point in the existence of the tiered access model. Despite dire predictions, the non-neutral Internet access model has arguably fostered—or at worst failed to hinder—innovation in Internet networking.

The relatively few attempts to impose access blocks have had no measurable effect on innovation and growth of Internet networks, services, and content. Three events illustrate this absence of power: CIX's 1994 attempt to isolate non-members, the 2006 decision by AOL to eliminate its walled garden content, and the separate panic over a technical glitch at Craigslist that same year.

CIX: The first (failed) attempt to monopolize

In 1994, CIX decided that the rapidly expanding size of routing tables—lists of instructions stored by routers and other Internet-connected devices about the available paths to different networks—would soon overwhelm the capacity of their routers to store them. Among other services, CIX primarily provided connectivity for its members. All members were required "to interconnect with all other CIX members . . . directly or indirectly through the CIX router—at no additional cost to member networks." [9] Prior to November 1994, non-CIX members could still exchange routing tables at the CIX router and with other CIX members without paying CIX's $7,500 annual membership fee. [10]

Following a vote by the board of directors, CIX President Bob Collet announced on November 1st that CIX would impose filtering beginning on November 15th. [11] A key member of CIX resigned in protest on the same day, and the announcement fueled a significant debate. [12] COOK Report editor Gordon Cook warned providers that failing to pay CIX's membership fee to avoid the filtering amounted to "a double barreled round of Russian roulette. . . . Joining the CIX is obvious [sic] the safest thing for non member ISPs to do." [13]

The commercial Internet community in 1994 was miniscule compared to today's global network of providers. As the primary exchange point for commercial Internet traffic, customers and backbone providers depended on CIX. However, CIX learned quickly that it had little power to impose filters, despite its market power as the primary facilitator of the commercial Internet in the United States. [14] CIX quickly faded into obscurity. Its decision served to encourage the major backbone providers to build new platforms and offer to downstream customers ways to interconnect and bypass CIX's network altogether. As the COOK Report explained, "with the CIX router foundering and seen as a place to avoid, many providers began to get interested in MAE-East [another routing information exchange point] as an alternative." [15] By 1997, CIX membership had stalled at approximately 150 members, and faced defections by major founding members MCI and UUNET. [16] By 2001, CIX had decommissioned its router and exchange point. [17] CIX needed content and customers to survive, a network truth as important today as it was then.

In contrast with the nascent commercial Internet of 1994, today's consumers, access providers, and businesses can choose from a host of broadband options and dozens of providers of bandwidth and other niche services. A market once in *actual* danger of domination by a handful of founding players has evolved into an innovative marketplace replete with services and players of all types and sizes.

2. WHY CIX COULD NEVER HAPPEN TODAY

If you see smoke, assume a raging forest fire

Despite repeated failures by supposed Internet access monopolists to exert vertical pressure on Internet content providers, net neutrality proponents cling to monopolist theories. Monopoly power has yet to emerge. Recent research advocating neutrality regulation makes erroneous assumptions about the market power of broadband access providers, while evidence shows that today's providers wield far less power than the failed CIX did in the early days of the commercial Internet.

Broadband providers would face a public relations and economic disaster similar to the one that CIX endured if they attempted to completely block or even severely restrict access to sites or services that their customers desired. Researchers Anton Wahlman and Brian Coyne of asset management firm Needham & Company, a private asset management firm, argue, "[c]onsumers will gravitate to pipe providers that do not restrict their activities. . . . Any pipe provider who tries to restrict uses of the pipe to favored services (voice, video, or data) in a 'walled garden' will likely be at a severe or impossible disadvantage, with consumers leaving for other pipes." [18]

While Wahlman and Coyne make their argument in the context of the value of a "dumb pipe" in the broadband market, their argument applies equally to any pipe: smart or dumb, edge or backbone. Broadband networks exhibit strong direct and indirect network externalities [19] and bandwagon effects. [20] Under these theories, a network's value increases proportionally with the number of its users. [21] The increased interconnectivity of the Internet generates substantial benefits for users, broadband providers, and content providers.

Time Warner's AOL unit exemplifies the disadvantages of Wahlman and Coyne's "walled garden." AOL, after peaking at 27.7 million subscribers in 2002, slid to under 18 million in 2006. [22] The company, famous for its proprietary, subscriber-only content, abandoned its pay-for-content model as its former users increasingly migrated to other dial-up and broadband providers. By jettisoning its Internet access business and releasing its content freely, AOL has built a business model better positioned to succeed on an increasingly large and interconnected Internet. AOL's decision perfectly illustrates the substantial benefits to users, broadband providers—and even AOL itself—that increased numbers of users provide.

The fate of erstwhile Internet giants CIX and AOL provide two concrete examples, but the market has swiftly addressed even the *hint* of restriction as well. In early June 2006, writer Tom Foremski wrote on his popular SiliconValleyWatcher blog that Cox Cable—one of Professor Lessig's "duopoly" broadband providers—had blocked access to popular classified advertisement site Craigslist. [23] Other online net neutrality activists immediately jumped on the story to criticize both Cox for their alleged actions and lawmakers for failing to protect net neutrality. [24] Senator Wyden, a sponsor of net neutrality legislation, [25] went even further. He penned a Wall Street Journal editorial on net neutrality, and cited Cox as an example of why legislation was necessary. [26] He claimed, as bloggers had, that Cox was blocking access to Craigslist to boost its own classified advertising business. [27] Cox had not blocked Craigslist, though, and quickly announced the real reason for the inaccessibility: a technical glitch in the way Craigslist served data from its Web site coupled with a bug in third-party security software distributed by Cox to its customers. [28] The Cox/Craigslist incident was one of several protests over allegedly discriminatory behavior in 2006. [29] Unwanted regulatory attention aside, even the hint of inaccessibility or overly restricted access creates a firestorm of negative publicity today. As it did with CIX and threatened to do with Cox, the market would correct or bypass any discriminatory practice. Faced with an inability to deliver content to customers, major content providers would seek alternate delivery avenues.

The failure of vertical foreclosure theory online

Commentators including Daniel Rubenfeld and Hal Singer [30] and, more recently, Dr. Barbara van Schewick [31] have suggested that—despite the experiences of CIX, AOL, and Cox—broadband providers could exert vertical pressure on content providers. Under this vertical foreclosure theory, Cox would theoretically use its monopoly power to force Craigslist, Google, eBay, or other similar content aggregation providers out of the market in favor of Cox-provided services. While broadband providers have launched limited services into content aggregation markets, their efforts have met with high inherent barriers to entry. [32] In February 2007, end users conducted nearly seven billion searches on the Internet, nearly half with market-leader Google. [33] The current search engine industry leaders—Google, Yahoo!, Microsoft (MSN.com), and IAC/Interactive's Ask.com—dominate the market with 91.7% of all searches in comScore's qSearch rankings. [34]

Despite significant evidence that vertical foreclosure has failed to emerge, monopolist theories still find favor among proponents of net neutrality regulation. Dr. van Schewick [35] depends largely on the theory of "internalizing complementary efficiencies" (ICE), [36] the research of Joseph Farrell and Michael Katz into rent extraction in systems markets [37] and Michael Whinston's economic study of monopolists' ability to exclude competitors from complementary markets through tying. [38] Her synopsis of Farrell and Weiser's theory is sound: "If the presence of independent producers of complementary products generates additional surplus, the monopolist may be able to capture some of that surplus through its pricing of the primary good. In this case, the monopolist will earn greater profits when its rivals are in the market than when they are not. In this case, the monopolist does not wish to steal sales in the secondary market, but takes its profits by charging a higher price for the primary good." [39]

However, Dr. van Schewick's application of this theory is not. While van Schewick purports to apply this and other theories to the Internet, her applications focus entirely on theories of what *could* happen in a monopolist-controlled network rather than what *does* happen on the competitive Internet. [40] Her theory makes two fatal assumptions about the Internet access market that debunk its application. Dennis Carlton's research into monopolists' exclusionary conduct [41] identified two critical elements that van Schewick assumes away. Carlton explained that monopolists could only extract profits from the secondary market if the secondary market is subject to economies of scale. [42] As applied to broadband Internet access providers, van Schewick's theory fails both of Carlton's tests. The failure of AOL's walled garden and the emergence of Google and other search engines illustrates that the secondary market in Internet content is not subject to economies of scale in the traditional sense. Economies of scale (or, more correctly, economies of *demand*) apply to individual market participants as well as the Internet market—access companies, content providers, and consumers—as a whole. The standardization of online contracts to eliminate costly bilateral negotiations, [43] courts' tendencies to give a structural pass on potential intellectual property violations to content and access providers like Google, Netcom, and Network Solutions, [44] and similar phenomena illustrate the broader economies of demand that apply to the entire Internet. The drive to lower search and transaction costs to increase network effects overshadows any particular firm's drive to exploit narrow economies of scale within individual markets.

More importantly, van Schewick's model requires that Internet access providers hold a monopoly in the primary market. Net neutrality proponents often cite the "broadband duopoly" in support of this element of Carlton's exclusionary theory. [45] However, van Schewick, Lessig, and others mistakenly conflate *market* power with *monopoly* power.

Carlton explains the difference by using the example of a monopoly resort owner. [46] Guests at the hypothetical island resort are required to purchase all meals at the resort. As long as the resort holds a monopoly, it fully exploits the secondary meal market. The resort exploits economies of scale by requiring guests to purchase all meals at the resort, rendering any non-resort restaurants unprofitable and forcing them out of the market. [47] The monopoly resort then can exploit island residents who did not demand the primary good (lodging at the resort) but are nonetheless subjected to the monopolist resort owner's control of the supply of meals. [48] However, Carlton's model requires that the firm be a monopolist in the resort market. If the resort did not hold a monopoly, it could not exclude outside restaurants from the market. Guests could simply stay at another resort that did not have the onsite meal requirement. In an island resort "duopoly," resort owners would hold *some* pricing power but lack the *significant* (i.e. monopoly) power over meal pricing to exclude all restaurants.

The failure of vertical foreclosure to emerge extends beyond the traditional cable and telephone company broadband players and beyond even the access market. Largely blocked by regulatory hurdles from directly entering cable TV markets, Verizon and AT&T have both released IPTV services to compete with entrenched cable TV service. [49] Google has bypassed both cable and DSL technologies to invest in a broadband over power line provider. [50] HughesNet offers satellite broadband. [51] Fixed wireless technologies have gained increasing traction in many urban and rural markets, [52] often aided by government grants in rural areas with limited broadband choices. [53] Manufacturers aid in limiting the power of the traditional cable and DSL providers as well. Cellular chipset maker Qualcomm recently announced a new chipset for their market-leading EV-DO broadband wireless technology that offers 9.6 Mbps speeds, [54] rivaling the fastest of the wired broadband services. Intel, Motorola, and Samsung have backed the new WiMAX wireless standard, leading to Sprint's 2006 announcement of its impending deployment of a new nationwide network based on WiMAX. [55]

The recent decline in cable and DSL provider market share [56] strongly suggests that this purported duopoly lacks the monopolist's ability to exclude rivals. While broadband providers undoubtedly have some market power to set prices, evidence shows that the market exhibits significant innovative flexibility and pricing power falls well short of a monopoly. Even a purely price-based analysis supports the conclusion that broadband providers lack the prerequisite monopoly pricing power. The price of DSL service from Verizon has decreased from $49.95 per month for a 768 Kbps download ADSL service in 2001 (plus the cost of a modem rental) [57] to just $14.99 per month (with a free modem) for the same 768 Kbps connection in 2007. [58] AT&T cable broadband pricing has fallen from $45.95 in 2001 [59] to as little as $33 per month in 2007 with AT&T successor Comcast. [60] The price of cable modem service in 2007, priced per Mbps based on the bandwidth offered to customers, has declined to less than 25 percent of 2002 levels. [61]

While today's dominant content providers depend on broadband providers for content delivery to customers, broadband providers could not survive without content from Google, eBay, or Yahoo driving demand for broadband service. Companies like Cox and Verizon have far less market power and influence today than CIX or other early commercial providers did. Markets have adequately addressed, and will continue to address, harmful provider actions and will continue to develop innovative service offerings, provided regulators do not squelch market responses with onerous regulation.

3. WHY DOING NOTHING NOW, OR ACTING POST-HARM, COULD FAIL

A simple hypothetical illustrates the difficulty that legislators would face applying net neutrality regulations. Any regulatory regime would need to separate actual discrimination that harms the market from inevitable transient performance issues that users encounter online daily. Assume that regulators discover that Sinister Cable's customers can no longer access Internet television service from NetTube, a popular upstart content provider, due to excessive jitter. [62] Among partisan regulatory commission members, [63] two theories emerge. One side believes that Sinister Cable has configured software on their set-top boxes to inject network delay with the goal of derailing NetTube's service in favor of its own. If true, Sinister Cable's actions would violate the net neutrality regulations and cause a concrete harm in the market.

Other regulators argue that Sinister Cable is not behind the problems for NetTube subscribers. They point to evidence that Sinister Cable's service configurations are nondiscriminatory, and that a bug in third party software licensed by Sinister Cable caused unforeseen problems with NetTube's unique IP television protocol. Sinister Cable, in fact, has worked for months with the third party and posted software patches long before any of its customers complained to regulators. The company and some of its cable provider brethren also present the agency with a wealth of peer-reviewed scientific evidence showing that, while its shared cable architecture offers higher speeds, it suffers from more variability in packet delivery as a result. With the software problem fixed, the jitter problems appear to dissipate enough for the NetTube service to function. These regulators argue that net neutrality and concrete harm regulations should not hold Sinister Cable liable for software bugs and architecture limitations beyond its control.

The debate quickly devolves into a political power struggle, a non-neutral outcome that could result in significant concrete harm of its own. Worse yet for policy makers, Sinister Cable's motives remain private. While the company might not have taken any deliberate or obvious steps to create the problem, it did not fret over NetTube's service problems. The company took several months to release a patch, and then did so without fanfare, leaving NetTube customers without service until media attention revealed the patch's existence. Sinister Cable could return to quietly managing its cable network so that jitter remains a problem.

Astute readers will recognize that this situation closely mirrors the Cox/Craigslist situation described earlier. [64] Craigslist configured their servers in a non-standard way, exploiting a third party's software bug. Cox released a full patch months after its third party provider found the bug, [65] and Cox customers have not reported similar problems. For its part, Cox denied that it had ever considered interfering with Craigslist, just as Comcast claimed that its selective edit of a Nightline broadcast was an encoding error by ABC. [66] A network provider that wants to cause network disruptions to gain an advantage over competitors can easily do so and present plausible reasons for its decisions. Laws and regulations cannot act as divining rods, locating the true intentions of an Internet service or content provider.

On the other hand, providers who choose an entirely "neutral" policy and perform no service differentiation could easily violate net neutrality regulations. For example, a company with no policy could degrade VoIP by allowing that traffic to intermingle with other data. VoIP packets are typically small (often 64 bytes) to minimize the effects of any potential data loss on a conversation. Web or e-mail servers typically optimize for efficiency and break data down into the largest packet size possible (often between 1400 and 1500 bytes). In a network that does nothing to differentiate between VoIP streams and other packets, the 64-byte packets could be queued for transmission behind larger 1500-byte packets. On slow or congested networks, the delay caused by the time to transmit larger 1500-byte packets introduces jitter. [67] The delays caused by commingling data would have a similar effect on VoIP as a purposely-induced transmission delay. To regulators, Sinister Cable and the "neutral policy" provider would look the same.

In some cases, such as the FCC's decision to sanction Madison River Communications for openly blocking VoIP, [68] regulators would easily discern anticompetitive strategies and weak technical justifications. Hard cases, such as the Cox/Craigslist issue and the hypothetical situations posed above, would result in arbitrary—and possibly incorrect—decisions. Regulators would struggle to distinguish between Cox Communications, who had no intention of discriminating but implemented a software update that nonetheless caused discrimination, and "Sinister Cable," who might falsely claim that it follows nondiscriminatory practices, but in fact seeks out reasons to discriminate.

Improving market response to service differentiation by informing end users

Law and economics theory traditionally found a market failure in one of several general situations, including "when [market] players do not have symmetric and full information relevant to their market activities." [69] Most famously, then-FCC Chairman Michael Powell labeled this information disclosure requirement as the fourth "Internet Freedom" to which consumers are entitled. [70] Two years earlier, state regulators had identified the same need for accurate and complete consumer information about Internet services. The National Association of Regulatory Utility Commissioners (NARUC), which represents state regulatory agencies and officials, adopted a Resolution Regarding Citizen Access to Internet Content at their November 2002 meeting. [71] The resolution recognized the possibility that "some providers of broadband service or facilities may have an incentive to restrict Internet access to favored news sources, and if they chose to do so, it could significantly harm free and open information exchange in the marketplace of ideas." [72] Therefore, NARUC resolved, in part, that broadband users should "[r]eceive meaningful information regarding the technical limitations of their broadband service." [73]

The same year, Internet standards makers also recognized the importance of meaningful information. RFC 3260, [74] released in April 2002, clarified several terms in the original Differentiated Services RFC. Specifically, the RFC noted the importance and function of the Traffic Conditioning Agreement (TCA). "A TCA is 'an agreement specifying classifier rules and any corresponding traffic profiles and metering, marking, discarding and/or shaping rules which are to apply . . . .'" [75] The RFC drafters separated the TCA from other concepts, since the term "implied considerations that were of a pricing, contractual, or other business nature, as well as those that were strictly technical." [76]

The TCA concept, if adopted by regulators, would both avoid onerous government regulation and address the concerns of net neutrality advocates that providers could act discriminatorily. [77] Throughout Internet history—squabbles with CIX, the rise of spam filters and antivirus software, complaints about discriminatory actions by providers, and even the net neutrality debate's prominence—users have held the greatest sway over the market. While innovators and entrepreneurs have shaped tastes, users have governed officially and unofficially. Providing detailed information to users about traffic policies that could affect Internet service on their connections would ensure that the balance of power remained on the side of consumers.

Regulators or legislators could model a "Traffic Control Disclosure Act" (TCDA) on the Fair Credit and Charge Card Disclosure Act. [78] That Act emphasizes a "more detailed and uniform disclosure . . . with respect to information." [79] A proposed TCDA would strive to provide detailed information about provider practices. Internet service providers and content providers alike would disclose, in a reasonably consistent manner, certain specifics of their service offerings and traffic control policies in a uniform table. If designed to provide relevant information, this disclosure would help consumers more easily compare different service offerings. Given the vociferous and vocal opposition to the most egregious differentiation policies, public disclosures would likely discourage all but a few standard classes of service differentiation.

With public comment and regulatory oversight, the disclosure table can evolve as advancements in technology dictate and consumer tastes change. For example, the proliferation of unsolicited commercial e-mail (spam) has led providers to block external access to the ports used by mail servers, [80] a type of filtering developers of the mail protocols likely did not see necessary years ago. A TCDA must accomplish three primary goals:

Notice: The Fair Credit Act provisions provide sensible guidelines for the TCDA framework. Any content or Internet service provider must post their disclosure conspicuously and prominently on their Web site. Any solicitations by Internet service providers for dial-up or broadband access, or by content providers for pay services, must include the data in a tabular format determined by regulators. [81] In any telephone or in-person solicitations for Internet service "the person making the solicitation shall orally disclose the information described" in the table. [82] Any provider offering a service for pay must notify customers of any changes to the policy.

Choice: The TCDA must inform consumers of the choices available to discontinue service penalty-free after a short trial period. The provider must also notify customers of their rights to reject any changes in network policy changes and cancel penalty-free, regardless of contract duration or prepayment.

Education: TCDA disclosure gives consumers the ability to obtain easily understandable and accurate information about traffic control policies, applications, and technology advancements. Companies that implement service differentiation schemes will have an opportunity to explain the benefits of the technologies to consumers. The regulatory oversight agency can act as a forum for information and education about technologies and consumer options. In addition, regulators can address any market failures to disclose and maintain policies accurately and clearly.

Unlike laissez-faire approaches that attempt to react ex post to market failures, or cumbersome regulations that try to read institutional minds or dictate network policies, a TCDA would embrace openness and transparency. A disclosure regime would compel providers to make public their service differentiation policies and practices. Individuals do not have a right to neutrality, but to the knowledge of how service differentiation policies could affect the services they purchase from Internet service or content providers.

As last mile networks change, the TCDA would encourage niches could to organize vertically. A gaming provider may offer consumers a wireless connection built for maximum performance with every major online gaming network, but otherwise offering degraded performance for other applications or content providers. A TCDA would give consumers clear, concise information about that vertical integration, and the choices they necessarily make when selecting one service over another. Net neutrality regulations banning service differentiation would ban this type of vertical innovation.

The role of watchdog regulators

Informed end users, even empowered Internet users, still need watchdog regulators in the future. Informed users generally cannot act to benefit their future selves. Users will rarely consider the collective, long-term consequences of their individual market actions. Similarly, informed end users cannot account for externalities. For example, imagine a world in which everyone uses the Internet to access the Daily Show. A bias in favor of delivering Comedy Central's content could be a market success. Informed end users would get differentiated Internet services geared toward delivering John Stewart to the desktop. In that sense, end users would get what they want.

Once the economies of demand push the market to introduce this Daily Show bias, how does this affect users in the future after John Stewart loses his comedic edge? What happens to the venture capitalists who want to start up a new Daily Show competitor, but fear they will not get quality access to Internet consumers? The social benefit of innovation could arguably morph into a costly externality. Net neutrality proponents' worst fears could come true.

Vertical foreclosure theory is sound, its application to the Internet access and content markets is not . . . for now. The non-neutral Internet of 2007 features empowered consumers, an uninterrupted history of failures by companies to establish monopoly power or achieve vertical foreclosure, and the ever-widening deployment of broadband technologies. However, the rapid pace of innovation and change in the Internet access and content markets could create an entirely new landscape in short order. The next Internet protocol or hot "killer app," could rewrite the rules, reinvigorating the regulation discussion. A largely regulatory-free, non-neutral Internet will always need regulators and commentators to watch for warning signs of potentially harmful market power. [83]

CONCLUSION

The largely academic NSFnet did not evolve into the commercial Internet because of neutrality or nondiscrimination. Entrepreneurs, scientists, academics, and a wave of consumer demand beginning with early technology adopters drove network expansion and the proliferation of broadband technologies—while discriminating and prioritizing from the earliest days and within the most basic technologies. Both the Internet's history and solid economic evidence suggest that this innovative culture will continue unabated, if regulators resist the urge to tinker. The Internet's content and service suppliers have developed numerous new technologies and industry sectors over the past 20 years. Innovation has often has required, and customers have increasingly demanded, non-neutrality, tiered access, and other service differentiation. Net neutrality regulation, in the direct form of neutrality mandates or through indirect ex post enforcement, will discourage innovators and strip consumers of their power to shape service offerings.

From the Internet's earliest days, consumers have efficiently balanced providers' levels of service differentiation to foster continued innovation without the heavy hand of regulation. Regulators should create incentives for consumers to continue to govern. Government enforcement, therefore, should focus on disclosure of provider practices. This paper presents the framework for a simple, clear, uniform disclosure modeled on existing law that can address net neutrality proponents' concerns without jeopardizing regulators' agnosticism for the market's direction.

Tomorrow's networks will need a combination of simplicity and complexity, openness and differentiation. As they have since the invention of TCP/IP, networks will also need end users to strike the proper balance between that openness and differentiation. By acting to eliminate imperfect information, government regulators can foster an even more robust market governed by well-informed consumers.

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[1] *See* Lawrence Lessig, *The Architecture of Innovation*, 51 DUKE L.J. 1783, 1789 (2002).

[2] *See* Barbara van Schewick, *Towards an Economic Framework for Network Neutrality Regulation*, 5 J. TELECOMM. & HIGH TECH. L. 329 (2007); *see also infra* note 40 (detailing van Schewick's use of theoretical markets, rather than Internet markets, to test monopoly theories).

[3] *See* Christoper S. Yoo, *Network Neutrality and the Economics of Congestion*, 94 GEO. L.J. 1847 (2006).

[4] van Schewick, *supra* note 2.

[5] *E.g.*, Yoo, *supra* note 3, at 1855-56.

[6] Postings of Dennis Brumm et al. to ba.internet (May 4, 1997), *available at* http://groups.google.com/group/ba.internet/browse_thread/thread/99c7a3a80b74d0de/.

[7] COOK Network Consultants, *Executive Summary: IX Board Enforces Routing – Path Routing Filters to Go Up Nov. 1, 1994*, THE COOK REPORT, Aug. 1994, at 23, *available at* http://cookreport.com/backissues/august94newsletter.pdf.

[8] Press Release, Senator Ron Wyden, Wyden Moves To Ensure Fairness of Internet Usage With New Net Neutrality Bill (March 6, 2006), *available at* http://wyden.senate.gov/media/2006/03022006_net_neutrality_bill.html.

[9] CIX, About the Commercial Internet eXchange, http://web.archive.org/web/19970413033334/cix.org/CIXInfo/about-cix.html. Without reading this section further, readers can deduce from this citation's URL the result of CIX's routing policy decision. The only available link to this information about CIX comes from archive.org, a non-profit archive of historical Web pages and other digital collections, and not a current CIX site.

[10] COOK Network Consultants, *CIX On Again Off Again Filtering: What's at Stake?*, THE COOK REPORT, Dec. 1994, at 4, *available at* http://cookreport.com/backissues/dec4newsletter.pdf.

[11] Posting of Gene Hastings to North American Network Operators Group (NANOG) Mailing List (Nov. 2, 1994, 12:15:35 EST), *available at* http://merit.edu/mail.archives/nanog/1994-11/msg00020.html; Ellen Messmer, *IP Service Providers Face Traffic Shutdown*, NETWORK WORLD, Aug. 22, 1994, at 5.

[12] Postings of Rich Braun et al., to ne.org.neci.general (Nov. 1, 1994), *available at* http://groups.google.com/group/ne.org.neci.general/browse_thread/thread/f02eec7dd620501b/.

[13] COOK Network Consultants, *supra* note 7, at 7.

[14] *See Management of NSF Network Hearing Before the H. Subcomm. on Sci. of the H. Comm. On Sci., Space, & Tech.*, 102nd Cong. (testimony of Mitchell Kapor, Pres. of Electronic Frontier Foundation and Chairman of CIX).
[15] COOK Network Consultants, *supra* note 10, at 4.
[16] Kenneth Cukier, *CIX Unfazed as ISPs Shun its Router*, COMMUNIC'NS WEEK INT'L (March 10, 1997).
[17] E-mail from Farooq Hussain, CIX, to Randy S. Whitney, UUNET (Jan. 11, 2002, 09:36:02 EST), *available at* http://www.farooqhussain.org/projects/Shutdown%20email.pdf.
[18] ANTON WAHLMAN & BRIAN COYNE, EQUITY RESEARCH NOTE: THE DUMB PIPE IS THE ONLY MONEY PIPE 5 (Needham & Co. Inc., 2003), *available at* http://www.vonage.com/media/pdf/res_12_15_03.pdf.
[19] Brett Frischmann, *An Economic Theory of Infrastructure and Commons Management*, 89 MINN. L. REV. 917, 971-72 (2005).
[20] JEFFREY H. ROHLFS, BANDWAGON EFFECTS IN HIGH-TECHNOLOGY INDUSTRIES 30-31 (2001).
[21] As Professor Yoo explains, net neutrality proponents tend to overlook portions of this theory. Yoo, *supra* note 3, at 1891.
[22] Anick Jesdanun, *AOL Shifts Strategy with Free Offerings*, ASSOCIATED PRESS, Aug. 2, 2006, *available at* http://abcnews.go.com/Technology/wireStory?id=2264677.
[23] Posting of Tom Foremski to SiliconValleyWatcher, http://www.siliconvalleywatcher.com/mt/archives/2006/06/craigslist_is_b.php (Jun. 6, 2006). Foremski originally claimed that Cox was using a purposefully configured "blacklist" to block access to Craigslist, a statement he later retracted.
[24] *E.g.*, Posting of Matt Stoller to MyDD, http://www.mydd.com/story/2006/6/14/214831/479 (Jun. 14, 2006, 09:48:31 EST); Save the Internet.com, http://www.savetheinternet.com/blog/2006/06/14/discrimination-in-disguise/ (Jun. 14, 2006, 23:07 EST).
[25] Wyden, *supra* note 8.
[26] Sen. Ron Wyden, Editorial, *Why We Must Protect Internet Neutrality*, WALL ST. J., Jun. 17, 2006, at A11.
[27] *Id.*
[28] *See* Posting of Richard Bennett to The Navel of the Internet, http://bennett.com/blog/index.php/archives/2006/06/17/know-nothing-claims-about-site-blocking/ (Jun. 17, 2006, 22:20 EST).
[29] *E.g.*, Mark Hachman, *BellSouth Says It's Not Blocking MySpace*, PC MAGAZINE, Jun. 2, 2006, http://www.pcmag.com/article2/0,1895,1971082,00.asp; Caroline McCarthy, *Did Comcast Really Sensor the 'Sleepy Repairman' Video from 'Nightline'?*, CNET NEWS, Jul. 18, 2006, http://news.com.com/2061-10802_3-6095431.html.
[30] *See* Daniel L. Rubinfeld & Hal J. Singer, *Vertical Foreclosure in Broadband Access*, 49 J. INDUS. ECON. 299 (2001).
[31] *See* van Schewick, *supra* note 2. Dr. van Schewick cites Rubinfeld and Singer's vertical foreclosure theory with approval throughout her article. *E.g.*, *id.* at 335 n.13.
[32] *The Un-Google*, ECONOMIST, Jun. 17, 2006, at 65.
[33] Press Release, comScore, comScore Releases February U.S. Search Engine Rankings, (Mar. 21, 2007), *available at* http://www.comscore.com/press/release.asp?press=1255.
[34] *Id.*
[35] van Schewick, *supra* note 2 at 335, 342.
[36] Joseph Farrell & Philip J. Weiser, *Modularity, Vertical Integration, and Open Access Policies: Towards a Convergence of Antitrust and Regulation in the Internet Age*, 17 HARV. J.L. & TECH. 85, 114 (2003).
[37] Joseph Farrell & Michael L. Katz, *Innovation, Rent Extraction, and Integration in Systems Markets*, 48 J. INDUS. ECON. 413 (2000).
[38] Michael D. Whinston, *Tying, Foreclosure, and Exclusion*, 80 AM. ECON. REV. 837, 840, 850-52, 855 (1990).
[39] van Schewick, *supra* note 2 at 345 (citing Farrell & Weiser, *supra* note 36).
[40] *See, e.g.*, van Schewick, *supra* note 2, at 345 (under the heading "Application to the Internet," discussing the "the hypothetical [monopolist-controlled] network that is the focus of this analysis" rather than the Internet); *id.* at 346 (under the heading "Application to the Internet," discussing a hypothetical local telephone company and its revenue sources); *id.* at 359 (under the heading "Application to the Internet," discussing situations under which providers "may be able to force" rivals from the market and citing hypothetical examples); *id.* 360 (under the heading "Application to the Internet," suggesting "conditions underlying this theory may well be present in the Internet context" and that monopolists, if they exist, "may be able to drive [their] rivals" from the market, but citing no evidence of this actually occurring).
[41] *See, e.g.*, Dennis W. Carlton, *A General Analysis of Exclusionary Conduct and Refusal to Deal—Why Aspen and Kodak are Misguided*, 68 ANTITRUST L.J. 659, 664-65 (2001).
[42] Carlton, *supra* note 41 at 664-68. Carlton also adds a third element that does not affect the analysis here.
[43] For example, users do not negotiate the terms of use for every Web site they visit online. These online contracts of adhesion are preferable to the exceedingly high transaction costs associated with individually negotiating each contract term.
[44] The "structural pass" refers to the unwritten rule that modern courts tend to give great latitude to Internet content and access providers to ensure the continued functionality and structure of the Web and the Internet. *See, e.g.*, Gov't. Emps. Ins. Co. v. Google, Inc., 77 U.S.P.Q.2d (BNA) 1841 (E.D. Va. 2005); Religious Tech. Ctr. v. Netcom On-Line Commc'n. Servs., 907 F. Supp. 1361 (N.D. Cal. 1995); Lockheed Martin Corp. v. Network Solutions, Inc., 141 F. Supp. 2d 648 (N.D. Tex 2001); Lockheed Martin Corp. v. Network Solutions, Inc., 194 F.3d 980 (9th Cir. 1999).
[45] *E.g.*, H.R. 5273, 109th Cong. § 2.8 (2006).
[46] Carlton, *Exclusionary Conduct*, *supra* note 41 at 667-68.
[47] *Id.*
[48] *Id.*
[49] Marguerite Reardon, *Verizon's TV Dreams*, CNET NEWS, Oct. 13, 2005, http://news.com.com/2100-1034_3-5894645.html; Marguerite Reardon, *Laying a New Path to Your TV*, CNET NEWS, Dec. 28, 2006, http://news.com.com/2100-1034_3-6146207.html.
[50] Dawn Kawamoto, *Google Invests in Power-Line Broadband*, CNET NEWS, Jul. 7, 2005, *available at* http://news.zdnet.com/2100-1035_22-5777917.html.
[51] HughesNet Services, http://www.hughesnet.com/ (last visited Apr. 15, 2007).
[52] FCC, HIGH-SPEED SERVICES FOR INTERNET ACCESS: STATUS AS OF JUNE 30, 2006 (2007), at tbl. 1 *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-270128A1.pdf [hereinafter *FCC High-Speed Services*]. Fixed wireless providers reported a 72.97 percent increase in subscribers from June 2005 to June 2006. The FCC report notes

that many "[s]mall providers of high-speed connections . . . serve rural areas with relatively small populations." *Id.* at 2.
[53] The USDA's Rural Utilities Service program has funded numerous fixed wireless deployments in markets underserved or unserved by incumbent cable and DSL providers. *See, e.g.*, USDA Rural Utilities Service, http://www.usda.gov/rus/ (announcing recent grants and loans); Press Release, Wireless Communications Association, Closing the Gap on the Digital Divide (Sept. 2003), *available at* https://secure.wcai.com/pdf/2003/rural_mtvernonnetSept.pdf (announcing USDA Rural Utilities Service grant to Mt. Vernon Net, a rural Illinois Internet provider).
[54] Press Release, Qualcomm, Qualcomm Demonstrates Significant EV-DO Milestones with High-Capacity VoIP Over Rev. A and High-Speed Data Over Rev. B, *available at* http://www.qualcomm.com/press/releases/2007/070323_demonstrates_significant_ev_print.html.
[55] Press Release, Sprint Nextel, Sprint Nextel Announces 4G Wireless Broadband Initiative with Intel, Motorola and Samsung (Aug. 8, 2006), *available at* http://www2.sprint.com/mr/news_dtl.do?id=12960.
[56] *FCC High-Speed Services*, *supra* note 52 at tbl. 1, 3. Cable modem market share fell from 63.2 percent in 2003 to just 44.13 percent of all high-speed lines in 2006. DSL providers, roughly flat as a percentage of residential subscribers, *id.* at tbl. 3, slid from 38.45 percent overall in June 2005 to 34.94 percent in June 2006. *Id.* at tbl. 1. The big winners appear to be mobile wireless providers. These providers have blossomed from a 0.89 percent share in June 2005 to 17.05 percent in June 2006. *Id.*
[57] Tom Spring, Verizon Joins Broadband Price Hike Parade, PC WORLD, May 2, 2001, http://www.pcworld.com/resource/article/0,aid,48945,00.asp..
[58]Verizon, Verizon High Speed Internet Plans, http://www22.verizon.com/content/consumerdsl/plans/all+plans/all+plans.htm (last visited Apr. 16, 2007).
[59] Spring, *supra* note 58.
[60] Comcast, The Comcast Triple Play, http://www.comcast.com/tripleplay-s/ (last visited Apr. 16, 2007). Comcast offers the $33 per month package for customers ordering a voice, video, and data package. *Id.* Comcast also offers a package at the same price for the first year for data-only subscribers who subscribe online. ComcastOffers.com, http://www.comcastoffers.com/ (last visited Apr. 12, 2007).
[61] The standard rate for Comcast service is $42.95 per month for 6 Mbps, or $7.16 per Mbps. Comcast, Help – FAQ, http://www.comcast.net/help/faq/index.jsp?faq=Connection118073 (detailing the speed/price packages available for customers). AT&T Broadband limited its customers to 1.5 Mbps for $45.95—nearly $31 per Mbps. Larry Dignan, *AT&T Broadband Opts for Tiered Pricing*, CNET NEWS, Aug. 1, 2002, http://news.com.com/2100-1033-947559.html.
[62] In lay terms, jitter simply refers to the gaps in delivery times between data packets. Services such as IP voice and video are sensitive to delays between packet deliveries. Repeated half-second pauses in packet delivery, for example, would render video streams unwatchable. Excessive jitter would be akin to having a conversation with someone who stopped talking for a few seconds after every third or fourth word.
[63] Unfortunately, partisan wrangling often is not hypothetical, another danger in leaving regulation of the nebulous Utopian concept of "net neutrality" to the political capriciousness of Congress or the FCC.
[64] *See supra* notes 23-28.
[65] The original fix was a beta patch. The full release came out several months later. *See* Foremski, *supra* note 23.
[66] McCarthy, *supra* note 29.
[67] In non-technical terms, an undifferentiated broadband network is a crowded highway tollbooth. Your car has an automated toll payment transceiver, so you can clear the booth without slowing down. Unfortunately, you are sandwiched among several large tractor-trailers that must stop at the booth, pay cash, and make change. Even though the interstate system is completely neutral, the nature of the traffic on the road nonetheless affects your ability to avoid travel delays ("jitter").
[68] *In re* Madison River Comm., LLC, 20 F.C.C.R. 4295 (2005).
[69] Niva Elkin-Koren & Eli M. Salzberger, *Law and Economics in Cyberspace*, 19 INT'L REV. OF L. & ECON. 553, 555 (1999).
[70] Michael K. Powell, *Preserving Internet Freedom: Guiding Principles for the Industry*, 3 J. TELECOMM. & HIGH TECH. L. 5, 12 (2004).
[71] NAT'L ASS'N OF REG. UTIL. COMM'RS, RESOLUTION REGARDING CITIZEN ACCESS TO INTERNET CONTENT (2002), *available at* http://www.naruc.org/associations/1773/files/citizen_access.pdf.
[72] *Id.*
[73] *Id.*
[74] Dan Grossman, IETF Network Working Group, RFC 3260: New Terminology and Clarifications for Diffserv (2002) [hereinafter RFC 3260], *available at* http://www.ietf.org/rfc/rfc3260.txt.
[75] RFC 3260, *supra* note 74.
[76] *Id.*
[77] Although he has never developed the concept, Professor Wu has signaled his agreement with the idea of increased disclosure. *E.g.*, Posting of Tim Wu, to Public Knowledge, http://www.publicknowledge.org/node/494 (Jun. 28, 2006, 11:38 EST).
[78] Fair Credit and Charge Card Disclosure Act, Pub. L. No. 100-583, 102 Stat. 2960 (1988) (codified at 15 U.S.C. §§ 1610, 1637, 1640 (2000)) [hereinafter Fair Credit Act]; *see also* 12 C.F.R. § 226.5a (disclosures for credit and charge card applications and solicitations).
[79] Fair Credit Act, at Preamble.
[80] *E.g.*, Declan McCullagh, *Feds to Fight the Zombies*, CNET NEWS, http://news.com.com/2010-1071_3-5715633.html; Cox's War Against Spam, http://www.cox.com/sandiego/highspeedinternet/spamfaq.asp, (last visited Apr. 15, 2007).
[81] *See* Fair Credit Act § 2(a) (amending 15 U.S.C. 1637 § 127(c)(1)(A)).
[82] *Id.* (amending § 127(c)(2)(A)).
[83] An example of the functioning early warning system is the scrutiny of Google's 2007 purchase of DoubleClick and the wave of consolidation in the Internet advertising market that Google's announcement of the deal touched off. The FTC has announced an investigation, and major advertising industry associations have urged a "careful, wide-ranging, and comprehensive perspective" in evaluating the deals. Abbey Klaassen & Ira Teinowitz, *4A's, ANA Weigh in on Google-DoubleClick, Online Ad Deals*, ADVERTISING AGE, May 31, 2007, http://adage.com/digital/article?article_id=116994. *See also* Abbey Klaassen, *String of Digital Deals Leaves Ad World Baffled*, ADVERTISING AGE, Jun. 4, 2007, http://adage.com/digital/article?article_id=117073.

"Gram Unayane Tathya Projukti"- Secure Data Transmission at Low Cost Using the E-board Software for the Virtual Class Room.

Abhijit Hazra, Department of Computer Science, JIS College of Engineering, India
(Email:abhi_bubai@yahoo.com)
Debashis Sanki, Department of Computer Science, JIS College of Engineering, India
(Email:debashis.sanki@gmail.com)

Abstract

The advent of powerful hardware and advances in high-speed networks enabled synchronous learning, with teachers and students being geographically distributed but connected via internet. Compared to traditional distance learning, this allows a higher degree of interactivity and collaboration. We have created a tele-teaching environment, called e-board, which will provide facilities equipped with computers and audio devices enabling students to take online training anywhere in the world.
Through this e-board software teacher and students who can be any where in the world can still be inside a virtual classroom. The concept is same as that of a real class room The teacher will login to his/her e-board software and invite students to attend the class. Consequently the students get the invitation and a soft phone starts ringing. The students who are interested to attend that particular class will accept the call by pressing a call-accept button. As the teacher begins teaching, a white board will automatically open at the terminal of the teacher as well as at the terminal of the every students. Teacher can communicate with the distributed students through voice (VoIP). On the other hand the student can ask questions (doubt clear) through voice and/or through text if permitted by the teacher. Basically this is the way teacher-student usually communicates in side a real life class room.

1. Introduction

Training -- the last thing considered, but always the first thing that's needed -- isn't expensive, but the investment is priceless.
All across the world, leading institutions are harnessing the Internet to breakdown barriers and multiply learning opportunities. This e-board helps these institutions realize the full power of the Internet for education. My vision is limitless in its possibilities— to enable educational institutions to create true Networked Learning Environments in which any student located at anywhere around the globe can attend a class. This Distributed Learning System (DLS) provides digital training facilities equipped with computers and audio equipment enabling rural students to take digital training anywhere in the world.
In India -- a leading provider of outsourcing services -- the IT industry is not only one of the fastest-growing sectors, it's also the great hope for the country's future development. However, just a small proportion of India's citizens have access to modern technology. The vast majority still live in rural villages, where basic civic infrastructure and communication continue to present a challenge. High quality teaching and training facilities are not available there. Veteran teachers/instructors are never ready to go to rural sector for training (due to their busy schedule). So the challenge is to reduce this digital divide -- proving equal learning opportunity to every individual through internet- "the information super highway". Our mission is noble and vision is limitless in its possibilities— to enable educational institutions to create true Networked Learning Environments in which any student located at anywhere around the globe can attend a class. As most of our (INDIA) villages are already networked through land telephone lines, availability of broadband internet connection at a very cheap rate (of around Rs: 300 pm) will knock their door very soon. And soon they will start enjoying the grace of e-serve. As computer performance on low-cost personal computers increases and availability of internet bandwidth increases these types of systems allow teachers to provide students with unique on-line collaborative learning opportunities in the areas of language, science, computer graphics, and other fields. Our online virtual environment will provide the ability to create a context of communications among students and between the teacher using voice communication, text chat, and whiteboard presentations which allows for immersive environments to be created so that the students and instructors can interact as if they were at their Institute. This needs broadband internet connection (256 kbps) .This online teaching-learning software allows users on Windows system to avail popular features as integrated real-time voice (Through VoIP), graphics presentation to be displayed on the white board and tools to highlight certain

important areas in the diagram along with text chat.

3. Virtual Class Room

The teacher's desktop can run on any standard VNC server. It offers the desktop environment, which is familiar to the teacher. In our installation, we use a VNC server running on the teacher's machine in his office. Because of the stateless client design of VNC, the state of his/her graphical user environment will be the same when he/she disconnects and reconnects later. This offers the ability to prepare a lecture and start the presentation software even a day (or more) before the lecture is done. In order to do the presentation the teacher just starts his/her presentation using a full screen VNC viewer, which lets him/her remotely control his/her machine. The TTT server is connected to the teacher's VNC server just as another (shared) VNC client. However, one, which does not send any input events, as the teacher should have exclusive access to his/her presentation. The VNC server sends frame buffer updates to both, the teacher's VNC client and the TTT server. So both see the same desktop. The TTT server also grabs audio supplied by the teacher's and combines audio and desktop to a complete lecture. Furthermore, the TTT server listens for connecting TTT clients. A short initialization is done via TCP. It consists of the initialization of the RFB protocol and the multicast addresses for the lecture transmission. Now the TCP connection ends and the TTT client join the multicast groups to receive and display the desktop and audio data (UDP transmissions). The online students are now part of the audience.

4. Supported Technology with performance approval:

The reason of using technology to support the software(Virtual class room using e-board) is tested and we got enormous success about the quality of transmission of lecturer most important thing is we are using free software to minimize the cost of teaching in the rural area . Here is the attachment against the prove of transmit ion quality of software.Feasibility study performed on voice Skype.Since my aim is to provide voice conference over low bandwidth internet connection(as I already mentioned that my customer will be the rural students with poor IT infrastructure) so I have tested the quality of voice calls for low bandwidth connection.In order to simulate such situation I have flooded my LAN with ping packets(Icmp echo-requests packets) and the size of the packets increasing at a fixed rate.Under this situation we ran Skype, and tested the quality of Sound.

I use the s/w Flood ping Break point Tester fig 2.and fig 3 to test the performance of Skype over heavy congestion.It works in the following way:

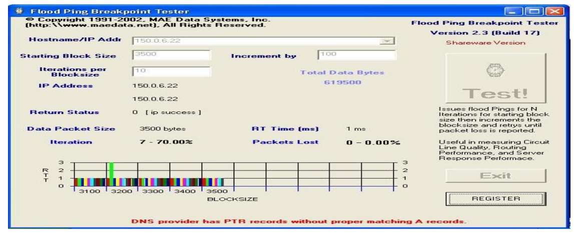


Fig 2

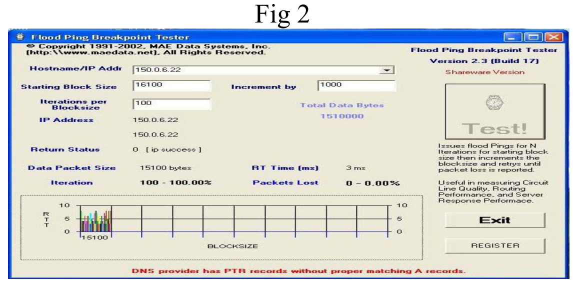


Fig 3

Then we have tested the quality of voice with increasing the no of conference participants.Currently free version of skype support maximum5conference articipants.So we have started with 2 party cionference and tested the performace and then we have increased the nio of participants and repeat the same experiments,Still the voice quality is excellent.

5. Performance Analysis

We implemented an analyzer that compares a set of replayed sessions and extracts interactive response times for various input events. The analyzer looks for similar screen updates between the replayed sessions; for example, if the user opens a menu in the recorded session, the analyzer would find the times at which the menu opened in the different replays. Interactive performance of a conventional Linux machine without the use of VM ware by evaluating the interactive performance effects of different disk I/O schedulers in Linux 2.6. For the first three experiments, we used VM ware's GSX Server to run the system to be measured. VM ware simplifies the task of making an identically configured system for each experimental run. It also provides an efficient and platform-independent VNC server that is connected to the virtual machine's console. These experiments were done on a Think pad T42p laptop with a 2.0 GHz Pentium M processor, 1GB of memory and a 7200rpm 60GB hard drive. For experiments with VM ware virtual machines, we used the VNC recorder to record a user session in a virtual machine containing Microsoft Windows

XP and Microsoft Office 2003, and another virtual machine containing Fedora Core 1 Linux and Open Office. Both sessions lasted about 6 minutes and consisted of a user creating a presentation, either in PowerPoint or Open Office Impress. These sessions was replayed in a variety of environments and the resulting session logs analyzed for interactive performance.

Effect of Processor Speed

We used the Enhanced Speed step capabilities of the Pentium M processor to vary the processor speed from 300 MHz to 2.0 GHz and replayed both the PowerPoint and Open Office sessions in each of these scenarios. A point to note here is that the Pentium M processor running at a reduced speed does not accurately simulate the performance of an older processor that normally runs at that speed.

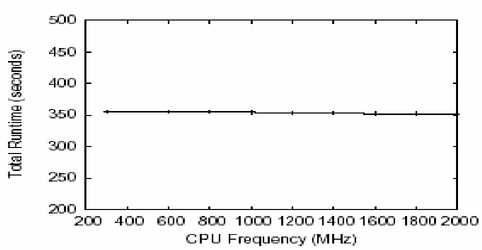


Figure 4: Total running time of a Microsoft PowerPoint session at various processor speeds

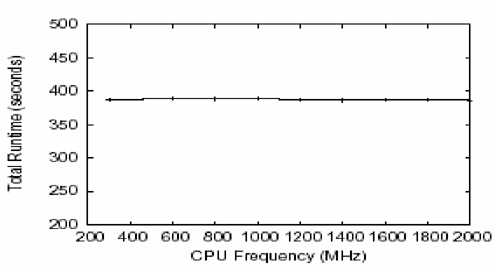


Figure 5: Total running time of a Linux Open Office session at various processor speeds.

This is because other characteristics of the processor, such as cache size and memory bus speed, remain unchanged. Figures 4 and 5 show the total running time of the PowerPoint and Open Office sessions for various processor speeds. The running time stays more or less the same, with the difference between fastest and slowest times being less than 1%.However, the interactive response times of individual events are very different for different processor speeds. Figures 6 and 7show a CDF plot of the response times for sessions replayed under two different configurations: a simulated 300 MHz system and a 2.0 GHz system. The CDF plot shows the fraction of time that the system's response to user input was within a given value. For instance, a point with an x-axis value of 1 second and y-axis value of 90% would indicate that 90% of the time, the interactive response time was within 1 second. These figures clearly show that both PowerPoint and Open Office running at 300 MHz respond much slower than running at 2.0 GHz, and a user would find it to be significantly sluggish. For example, in the Linux Open Office environment the response time at the 40th percentile when running at 300 MHz is about five times the response time as when running at 2.0 GHz. The slowdown is further illustrate by Figures 8 and 9. These figures show the ratio of response times of events in Open Office and PowerPoint running at 300 MHz, to the response times of the same events while running at 2.0 GHz. The Open Office plot shows that most of the events are slowed down by a factor of two to factor of five, while for PowerPoint the slowdown is much more modest. This shows that Open Office running under Linux requires more CPU resources than PowerPoint under Windows XP. To compare across a range of processor speeds, we plot the 25th, 50th, and 75th percentile response time latencies at various processor speeds in Figures 10 and 11. From these figures, we see that there is a minimum processor speed (between 300 MHz and 600 MHz) below which the interactive performance of office workloads de-grades rapidly. Increases in processor speed beyond this point provide a gradually diminishing increase in returns, as is to be expected.

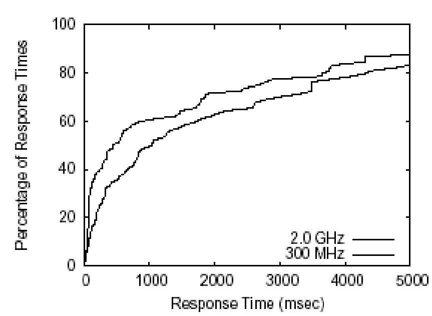


Figure 6: CDF plot of interactive response times for Microsoft PowerPoint under different conditions: on a 2.0 GHz machine and on a simulated 300 MHz machine. Each line shows the fraction of interactive response times (vertical axis) that are within a certain value (horizontal axis).

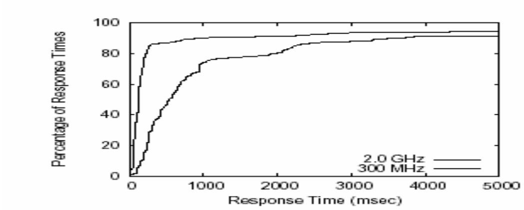


Figure 7: CDF plot of interactive response times for Linux Open Office under different conditions: on a 2.0 GHz machine and on a simulated 300 MHz machine. Each line shows the fraction of interactive response times (vertical axis) that are within a certain value (horizontal axis).

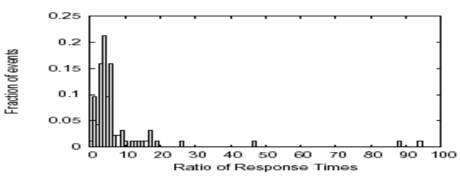


Figure 8: Histogram of the ratio of interactive response times for Linux Open Office on a simulated 300 MHz machine and a 2.0 GHz machine.

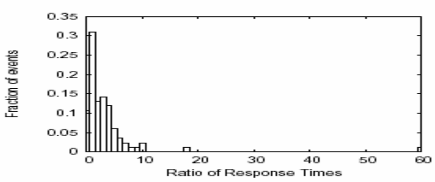


Figure 9: Histogram of the ratio of interactive response times for Microsoft PowerPoint on a simulated 300 MHz machine and a 2.0 GHz machine.

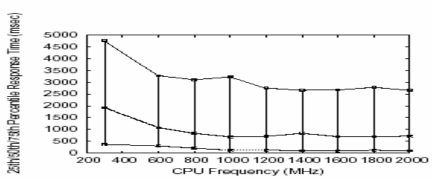


Figure 10: 25th/50th/75th percentiles of the interactive event latencies for Microsoft PowerPoint at various processor speeds.

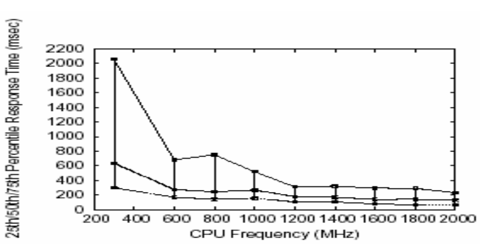


Figure 11: 25th/50th/75th percentiles of the interactive event latencies for Linux Open Office at various processor speeds

Effect of Disk I/O

We measure the effect of disk I/O on the interactive performance of Microsoft Windows and Linux systems by injecting background disk activity and replaying the PowerPoint and Open Office sessions. We wrote a small utility that performs background disk I/O at a specified rate. Each disk I/O is a 32 KB read from the disk. Figures 12 and 13 show the total run times for various disk I/O rates. As in the previous experiment, the differences in total run times are very small. In Figures 14 and 15 we can see the distribution of interactive response times in two sessions: one with no extra background disk activity and the other with a rate of 100 disk I/Os per second. The response times for the latter session are higher than the ones in the former session. Although the interactive response times of the system are noticeably different in the two cases, the total runtime remains the same, underscoring the need for an interactive performance measurement tool like VNC play. chine with 4GB of memory, running Fedora Core 3. The system was configured to run a standard graphical login session on a VNC server for the purpose of this experiment.

For each replay session, a test user account was created from scratch and the machine was rebooted to clear the buffer cache. This ensures that the test machine is brought back to the same state at the beginning of each experimental run. For this experiment, we recorded a user session lasting about 8 minutes. This consisted of a user creating a simple presentation in Open Office Impress, developing a small program in the Develop integrated development environment, and changing his desktop background. The Linux system was configured with a different I/O scheduler on each experiment run, and we injected heavy background disk activity. The session was replayed to analyze interactive performance. We tested the anticipatory, deadline, cfq, and noop schedulers that are present in the Linux 2.6 kernel.table1.

Scheduler	Total Runtime (min)
anticipatory	14.1
cfq	7.7
deadline	7.5
noop	7.4

Table1. Total running time of the user session with various I/O schedulers

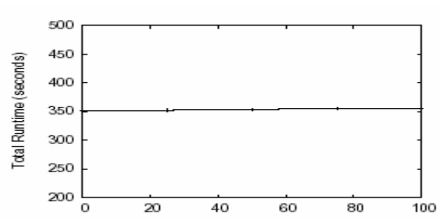


Figure 12: Total running time of the PowerPoint session at various disk I/O rates

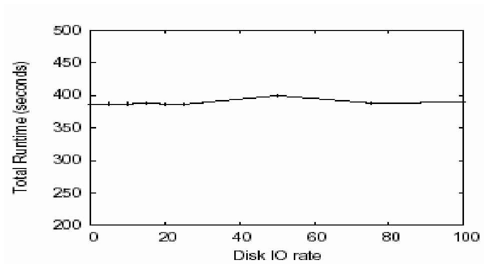


Figure 13: Total running time of the Open Office session at various disk I/O rates

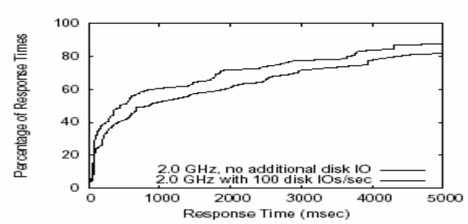


Figure 14: CDF plot of interactive response times for Microsoft PowerPoint under different conditions: on a 2.0 GHz machine with no additional disk IO and on the same machine experiencing 100 additional disk I/Os per second. Each line shows the fraction of interactive response times (vertical axis) that are within a certain value (horizontal axis).

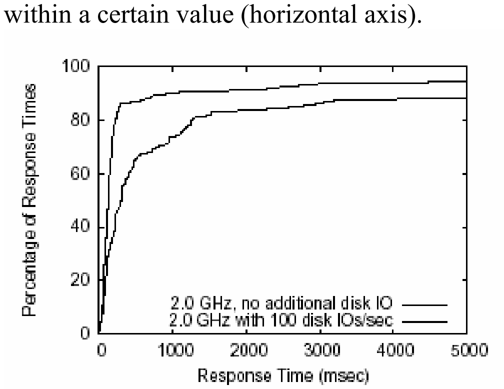


Figure 15: CDF plot of interactive response times for Linux Open Office under different conditions: on a 2.0 GHz machine with no additional disk IO and on the same machine experiencing 100 additional disk I/Os per second. Each line shows the fraction of interactive response times (vertical axis) that are within a certain value (horizontal axis).

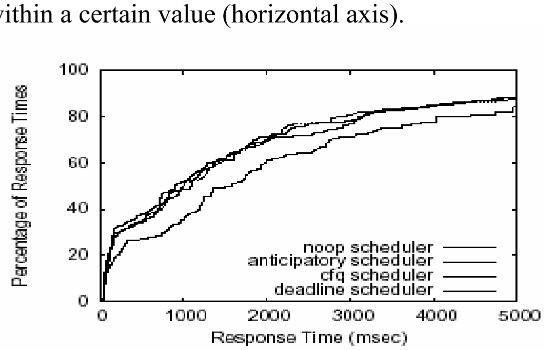


Figure 17: CDF plot of interactive response times for a desktop Linux workload using different disk I/O schedulers and a heavy background disk I/O load.

6. Architecture of the "The Virtual Class room

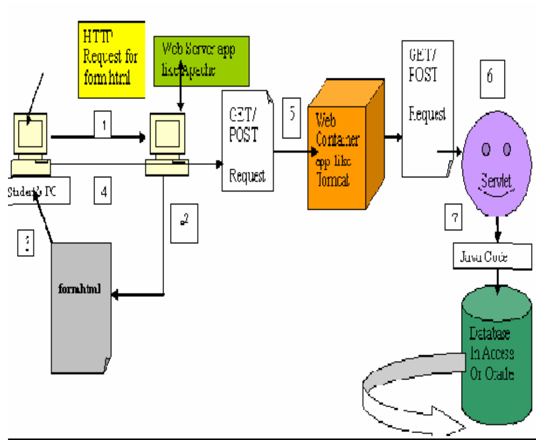


Fig 18.

18.1.The Students makes a request for form.html page to the Web Server.

18.2. The Web Server gets the request and forwards to it to the Web Container Tomcat.

18.3. The Container retrieves the form.html page.

18.4The container returns this form.html page to the browser of the student's PC where they put the information like Student's name, Skype_id and the I.P. address of his/her machine and press the submit button.

18.5. The browser sends those data (HTTP POST / HTTP GET) to the Container.

18.6. The Container finds the correct Servlet based on the URL, and passes the data to that Servlet.

18.7. The Servlet calls the Appropriate Expert for help.

18.8. This Expert class stores the data to the database.

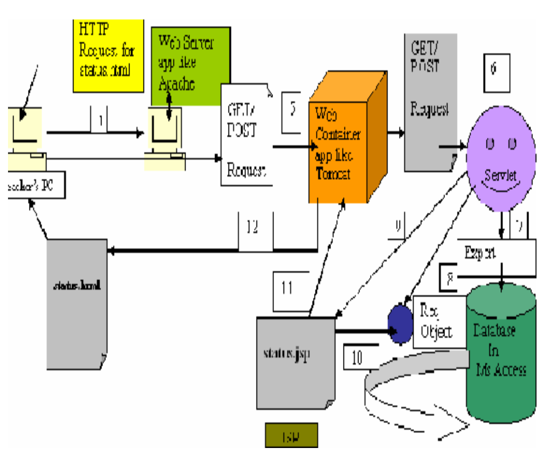
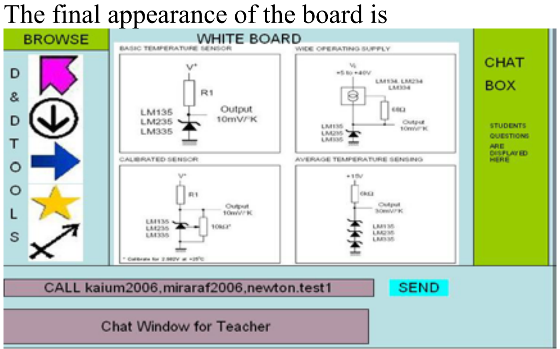


Fig19

7. Teacher gets the status of the Registration for a particular class:

19.1. The Teacher makes a request for status.html page from the server. This page will contain the information about students who are successfully logged in to the virtual class room and wants to join a particular class. This page will contain a table which stores the name of the students, their skype id and the ip address of their machine. Basically this information is a dynamic one and hence the requested one is a dynamic page.
19.2. The web server receives the status.html page and forwards it to the web container like Tomcat. The container finds the correct Servlet based on the URL, and passes the request to the Servlet.
19.3. The servlet finds the appropriate Expert for help.
19.4. The expert class consults with the internal database and retrieves the current status information from the database whisc servlet adds to the request object.
19.5The servlet forwards the request to JSP.
19.7The JSP gets answer from the request object.
19.8The JSP generates a page for the Container. The container returns the status.html to the teacher.
The final appearance of the board is



8. Conclusion

Our mission and vision of the project will be "Gram Unayane Tathya Projukti". In conclusion we can say that this distributed learning program will enable people in rural areas to take advantage internet-'the information super highway' and the opportunities in IT. Our commitment to bridge the digital divide and make a difference in the lives of the rural people by bringing them to the main stream of high tech society .More over it is a new approach to teaching-learning system and to effect qualitative change in the teaching-learning process, it is necessary to generate qualitatively different teaching-learning environments, pedagogical practices and organizational infrastructures. The opportunity for institutional leaders is to adopt a proactive stance, and to generate an organizational development strategy appropriate to the ethos of their particular institution, which will lead to the new technologies becoming a structurally integrated part of the process of teaching. This project will be very helpful to the people if revolutionary changing effect like broadband internet connection reach in the rural areas.

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A Combined Method for Evaluating International and Domestic Scientific Papers and Its Application

Ying HE
School of Management, Beijing University of Aeronautics and Astronautics
Beijing, 100083, PR China
and
Jiancheng GUAN[1,2] *
[1]School of Management, Fudan University
Shanghai, 200433, PR China
[2] School of Management, Beijing University of Aeronautics and Astronautics
Beijing, 100083, PR China
and
Xiangju QU
School of Aeronautic Science & Engineering, Beijing University of Aeronautics and Astronautics
Beijing, 100083, PR China

ABSTRACT

The paper aims to provide a combined method to evaluate both international and Chinese scientific papers. According to the modified impact factor, we rank the SCI journals and CSTPC journals based on Bradford's Law. A new indicator --- Relative Score (RS) is proposed to measure a journal's relative impact. Using the method established in this paper, we measure the scientific papers, including both SCI-papers and CSTPC-papers, produced by the key projects in Information Science and Technology of NSFC. The findings indicate that CSTPC journals generally have lower quality and less international visibility than SCI journals. It is also concluded that in Information Science and Technology, Chinese research does not belong to the mainstream international research, and most research papers are not suited to be published in the best international journals. The results of the correlation analysis indicate that the correlation coefficient between the RS and the SCI-IF is higher than the coefficient between the RS and the CSTPC-IF. Therefore, SCI-papers are more important than CSTPC-papers in the combined evaluation.

Key words: SCI, CSTPC, impact factor, combined evaluation, Bradford's Law

1. INTRODUCTION

As an international database, the Science Citation Index (SCI), produced by Thomson Scientific, is an important tool which provides a system of scientometric indicators and is the main source to measure a country's research performance from the view of international orientation, international visibility and impact at the international research frontier [23,24,30]. Researchers in non-western countries, however, publish most of their studies in domestic journals that are seldom covered by SCI or other ISI's databases [1,2,6,12,14,19,25,31]. Colleagues found that Chinese journals, even those indexed by SCI, still suffer from low international visibility [17,26,27]. Most Chinese scientific papers are published in domestic journals, except for a small part of high quality and strong impact that is covered by SCI [20,21]. Therefore, how to conduct appropriate evaluation of scientific research performance from both national and international perspective has been an increasingly hot subject in Chinese research communities and science policy makers [20]. As a result, some scientometric indicators and methodologies have been applied in the evaluation process [16, 17].

In our previous work [15], we have attempted to unify the international and domestic scientific article-production of China by introducing a new indicator --- the Combined Impact Factor (CIF), and also have used the CIF as a measure in evaluating the research performance of the key projects in the Information Science & Technology of National Natural Science Foundation of China (NSFC). The results indicated that there are big differences in terms of the CIF between the sub-disciplines. The two referees of our paper [15] suggested to make further approach in order to explain why

*Corresponding author. Tel.: +86 10 82338109; fax: +86 10 82328037. E-mail address: guanjianch@buaa.edu.cn (J. Guan).

there are such big differences between the topic areas in terms of outputs per unit of input and the differences are due to differences between the fields, or also (partly) due to differences in the composition of the databases. Indeed, several open questions remain after our previous work: does the CIF introduce noticeable biases for the evaluation? Is there any more rational instrument to deal with the issue of evaluation of two different sets of papers than the CIF?

In this article we continue exploring appropriate methods to combine the domestic and international scientific publications for facilitating the evaluation of the scientific research for the peripheral countries. We apply Bradford's Law [3,4] to a combined evaluation of the international and domestic scientific outputs. The basic principle of Bradford's Law is referred as "a small number of journals account for the bulk of significant scientific results" [13]. Bradford's Law gives a good basis in determining the core journals [5,8,11,22,29] and in investigating the concentration related problems in a bibliography [7,9,10]. JIN et al. assessed the Chinese SCI-papers and the Chinese domestic papers indexed by Chinese Science Citation Database (CSCD) in a comprehensive model on the basis of Bradford's Law [18,20]; VON UNGERN-STERNBERG has classified the journals indexed by five databases for comparisons based on Bradford Law. Taking Bradford's Law into account [32], DE ARENAS et al. analyzed the Mexican research performance in health sciences and determined the distribution of the Mexican scientific papers in the area in terms of impact factors [6]. Since it has been proposed by ROUSSEAU & VAN HOOYDONK that there is a direct linear relation between journal production and impact factor [28], the study classifies the journals in terms of the impact factor by employing Bradford's Law and provides a tool for further assessing the quality of the scientific outputs of the key projects in a matter of combination.

In order to compare the journals' quality in different ranks classified via Bradford Law, we propose a quantitative parameter that can indicate the relative quality of the journals. We call this parameter Relative Score (RS), since it identifies the relative score for the journals in each rank.

2. CLASSIFICATION OF THE JOURNALS

In order to combine the domestic and international journals, we first specify the samples. For example, in our previous work [15], we unified the different categories in the SCI and the CSTPC databases into 23 category groups, which totally include *3724* SCI-journals and 955 CSTPC-journals respectively, altogether 4679 journals. In each category group we draw a list of the journals in a descending order in terms of impact factors. It should be pointed out that the list includes both the SCI-IF for the journals in the SCI database and the Unified Impact Factor (UIF) --- a weighted CSTPC-IF --- for the journals in the CSTPC database. UIF is an indicator defined in the previous study [15], to make the domestic articles comparable with the international ones.

In each category group, according to Bradford Law, we separate the ranked journals into five ranks by dividing the total values of impact factors into five equal parts. The value of RS can be achieved based on the Eqs. (1) – (3).

$$MIF_i^j = \frac{1}{n_i^j}\sum_{l=1}^{n_i^j} IF_{il}^j \tag{1}$$

$$MIF_i = \frac{1}{N}\sum_{j=1}^{N} MIF_i^j \tag{2}$$

$$RS_i = {}^{MIF_i}/_{MIF_5} \tag{3}$$

$$i = 1, 2, ..., 5; \quad j = 1, 2, ..., 23 .$$

Since the journals are listed by their impact factors in a descending order, in each of the five ranks, we also can obtain a sub-list of the impact factors in a descending order. MIF_i^j indicates the mean impact factor of the journals in the i^{th} rank ($i = 1, 2, 3, 4, 5$) for the j^{th} category group ($j = 1, 2, \cdots N$). N is the number of the category groups resulted from combining the SCI-category and CSTPC-category. In our previous work, we specified 23 category groups to combine the SCI and CSTPC journals. n_i^j is the amount of the journals in the i^{th} rank for the j^{th} category group. IF_{il}^j represents the impact factor of the l^{th} journal in the i^{th} rank for the j^{th} category group. If the l^{th} journal is indexed by SCI, IF_{il}^j is the SCI-IF; otherwise, if the l^{th} journal is indexed by CSTPC, IF_{il}^j is the UIF. Thus in Eq(2), MIF_i is the mean value of the impact factors in the i^{th} rank ($i = 1, 2, 3, 4, 5$) and gives a measure of the journals' quality in the i^{th} rank from a multi-category point of view. Finally, taking MIF_5 as the baseline, we define the Relative Score for the journals in each rank by comparing the MIF_i ($i = 1, 2, 3, 4, 5$) to MIF_5.

3. A CASE STUDY

Sample description

In our previous work, 58 key projects in total started from 1991 to 1999 and finished from 1994 to 2001 were collected, and these projects are further divided into five sub-disciplines --- Automatization, Optics, Computer science, Electronics, and Semi-conductor. Totally, the 58 key projects have produced 561 papers in 143 SCI journals and 1691 domestic papers in 150 CSTPC-journals. These journals are integrated into 23 category groups [15].

We downloaded SCI-impact factor (SCI-IF) of each journal in 2000 from web-based version of Journal Citation Report (JCR) (http://www.isiknowledge.com), and obtained the impact factors of domestic papers covered by CSTPC (CSTPC-IF) in 2000 form *Chinese S&T Journal Citation Reports 2001* (CSTJCR) complied by ISTIC (Institute of Scientific and Technical Information of China).

Results

According to the models (1-3), we divided these 4679 journals mentioned above into five ranks. The results are depicted in Figure 1.

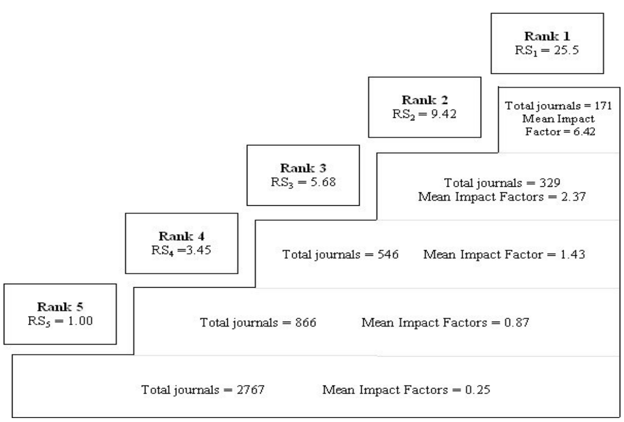

Figure 1. The division of the journals both in SCI and in CSTPC

In Figure 1, the total number of the journals listed in each rank shows a pyramid profile clearly. That indicates the existence of the core journals which own the highest values of impact factor. Taking the key projects into account, we find that all of the CSTPC-journals (150 journals) are listed in the bottom rank. This first supports the fact that the Chinese journals are still rather "local" and suffer from a low international visibility [23,27].

With respect to the SCI-journals published by the key projects, the numbers of the journals in each rank also show a pyramid distribution. Once each journal's RS is determined, Table 1 displays the total values of the RS and the distribution of the papers in each sub-discipline. If the value of RS in the 5th rank is normalized as 1, the value of RS in each rank can be achieved by comparing the mean impact factor of the rank to that of the 5th rank.

Therefore,

$RS_1 = 25.5$, $RS_2 = 9.42$, $RS_3 = 5.68$, $RS_4 = 3.45$, *and* $RS_5 = 1.00$

Remarkably, amongst the *143* SCI-journals in which Chinese scientists in the area of Information Science &Technology published their research results, only 5 out of them list in the 1st rank. This indicates that China's Information Science & Technology research is still not well connected to mainstream science [17]. Among the five sub-disciplines, Automatization gains the highest value of the total RS, and computer achieves the lowest value. In order to avoid evaluation biases resulted from the projects number in different sub-disciplines, the RS value per project could be used to measure the average output at the level of project from a combinative viewpoint. In terms of the average RS per project, Semi-conductor attains the highest RS value per project (109.77) among the five sub-disciplines, followed closely by Automatization (104.62). Computer is still the least productive sub-discipline measured by the average RS value per project. Compared to the other sub-disciplines, Semi-conductor produces the most papers in the higher ranks --- Rank 1 and Rank 2, and Automatization develops far more papers in the bottom rank. In computer, almost all papers are published in the journals of Rank 5, with an exception of 2 papers in Rank 3. Therefore, the key projects in Computer produce low quality papers in terms of the new indicator RS. This is consistent with the evaluation results by the CIF [15] and shows to some extent robusticity of the evaluation results by the CIF.

Table 1 The total values of RS and distribution of the papers in each sub-discipline

	Total Papers	Total RS	RS per project	Paper numbers in each rank				
				Rank 1	Rank 2	Rank 3	Rank 4	Rank 5
Automatization	794	1150.78	104.62	2	19	29	24	720
Optics	445	1103.89	68.99	2	51	27	45	320
Computer	290	298.25	24.85	0	0	2	0	288
Electronics	328	612.38	68.04	1	16	25	16	270
Semi-conductor	395	1097.65	109.77	4	57	25	49	260
Total	2252	4262.95	73.50	9	143	108	134	1858

Source: NSFC and authors' calculation

Considering the high performance projects, we rank the 58 key projects in a descending order according to the values of the RS and the CIF [15], respectively. Table 2 gives the paper counts and the Relative scores, as well as the CIF values of the top 10 projects in two boxes, respectively. The results of combination based on the RS and the CIF are similar in the context of the high performance projects. We find seven out of the ten top projects simultaneously appearing in the two boxes although the rankings of them vary to some extent. In the RS box, half of the top ten projects belong to Automatization; and in the CIF box, the distribution of the top projects shows an even profile in the four sub-disciplines, except for Computer. It was concluded from our previous work [15], Automatization is the domestically most productive sub-discipline, measured on average articles per project. Accordingly, compared to the CIF, the new indicator RS lays more stress on the domestic outputs.

Table 2 Top ten projects according to RS and CIF

Combination based on RS Model					Combination based on CIF Model				
Project ID	Sub-discipline	SCI-PAP	CSTPC-PAP	Relative Scores	Project ID	Sub-discipline	SCI-PAP	CSTPC-PAP	CIF
69736010	Semi-conductor	65	12	336.21	**69736010**	Semi-conductor	65	12	113.97
69635010	Automatization	28	203	325.87	**69738020**	Optics	46	14	91.65
69738020	Optics	46	14	291.82	**69636010**	Semi-conductor	32	38	72.88
69334010	Automatization	21	154	242.52	**6913001**	Electronics	26	2	40.7
69636010	Semi-conductor	32	38	224.12	**69635010**	Automatization	28	203	36.42
69435010	Automatization	27	40	140.87	**69435010**	Automatization	27	40	34.84
6913001	Electronics	26	2	139.09	69837020	Optics	29	23	34.23
69236010	Semi-conductor	16	64	126.14	69631030	Electronics	15	4	31.79
69134010	Automatization	13	61	125.33	**69334010**	Automatization	21	154	24.97
69735010	Automatization	14	90	120.94	69789802	Optics	11	13	24.77

Source: NSFC and authors' calculation

Previous findings identified there is a significant and positive correlation relationship between the SCI-IF and the CIF for the evaluated projects and the correlation existed between the CSTPC-IF and the CIF is very weak [15]. A correlation analysis at a level of individual project for the new indicator RS is further carried out in order to explore the relationship among the new indicator and other indicators. Processed by SPSS 12.0 software, the results of the Pearson Correlation are displayed in Table 3. It is found that there is a positive and significant correlation relationship between the RS and the SCI-IF, as well as the RS and the CSTPC-IF, and the correlation coefficients are 0.811 and 0.529 both at significant levels $p<0.01$ for the two pairs (Sig.(2-tailed) = 0.000), respectively. Therefore, we again verify that the RS is more related with the CSTPC-IF, i.e. the domestic output, and less related with SCI-IF when compared with the CIF.

Table 3. Correlation between four indicators

	N	Mean	S.D.	Correlation	sig.(2-tailed)
SCI-IF	58	12.65	21.51	0.811**	0.000
RS	58	73.50	77.84		
CSTPC-IF	58	9.89	12.24	0.529**	0.000
RS	58	73.50	77.84		

Source: SPSS 12.0 software

4. CONCLUSIONS

This paper focuses on the combined evaluation of Chinese domestic and international scientific article-productions based on Bradford Law. A new indicator, Relative Score (RS), is proposed in the study to show the relative impact of the journals in each rank and enable the quantitative measurement of the research papers. Comparing the method of the RS to that of the CIF, which is another indicator we suggested in our previous work to assess the scientific research from an integral perspective [15], some differences are summarized. The RS is established based on the important bibliometric law – Bradford's Law, while the CIF is just calculated directly from relative impact factors of the journals. Therefore, for developing countries, both the RS and the CIF can measure the scientific output from a combinative perspective. Moreover, the CIF is an indicator to measure the total output of a project, a researcher, or an institute, whereas the RS is an indicator that can also specify the relative importance of a journal. That is, the RS can more intuitively reveal the relative positions of the domestic and international journals. Based on the RS, The major findings are summarized as follows:

1. In general, the consistent trends of the evaluation results between the CIF and the RS are found. That is, Semi-conductor is the most productive sub-discipline, and Computer is the least in terms of paper outputs from a combination viewpoint.
2. More emphasis is laid on domestic publications in terms of the RS than in terms of the CIF. The RS is more related with the CSTPC-IF and less related with the SCI-IF when compared with the CIF. Therefore, the RS provides a new scientometric approach to combine the domestic outputs with the international outputs in scientific evaluation. The RS should also be an appropriate proxy indicator used to evaluate the publication performance for those scientific periphery countries, in particular for those developing countries.
3. The findings by employing the RS indicate that the Chinese journals are still rather "local" and suffer from a low international visibility and China's Information Science & Technology research is still not well connected to mainstream science.

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A Cost-Effective Approach for Migrating Enterprise Electronic Mail Systems

Emmanuel Omojokun
Department of Computer Information Systems
Virginia State University
Petersburg, VA 23806, USA

Adeyemi Adekoya
Department of Computer Information Systems
Virginia State University
Petersburg, VA 23806, USA

Ephraim Eyob
Department of Computer Information Systems
Virginia State University
Petersburg, VA 23806, USA

ABSTRACT

Electronic mail (E-mail) is one of the most utilized application software systems in modern-day organizations. The major messaging application programs used in the enterprise are IBM Lotus Notes also known as Domino, Microsoft Exchange Servers, and Novel GroupWise. For various reasons – such as high cost of maintenance, undeliverable e-mail issue and loss of attachments, companies find it necessary to either migrate to newer versions of their messaging software or migrate to entirely different software. In either case, the process must be carefully planned, well designed and properly implemented to avoid disaster. In this paper, we present a cost-effective approach for migrating a particular messaging software. Our approach was implemented and tested for the migration of GroupWise 5.5 to Exchange Server 2003. We present our success story and lessons learned from the case. A six-week and one-year post migration system-audits indicated that the organization derived several benefits including significant cost savings as a result of this particular approach. Chief information/technology officers and e-mail administrators will benefit immensely from the "best practice" strategy hereby presented.

Keywords: Messaging Software, Migration, Mailbox, Email, GroupWise, and Exchange 2003.

INTRODUCTION

Messaging software systems tend to be the most utilized application programs in organizations. However, they are also in the top list of computer network components that can cause a low Return on Investments (ROI) because of high cost of maintenance, interoperability problems with other applications and operating systems, low network bandwidth, lack of security and un-scalability problems. Common problems associated with corporate messaging software include: frequent loss of e-mail attachments; delivery and storing e-mail messages that are infected with viruses on corporate e-mail servers, thus propagating viruses to users' desktops; ability to send e-mails and the undeliverable e-mail issue. These problems among others, may necessitate or even compel an organization to migrate from its current messaging software to another or to upgrade to a newer version of the existing e-mail software.

Migrating from one messaging system to another is a difficult task that requires careful planning, analysis, design and implementation. To do otherwise can lead to significant loss of revenue for an organization. In this paper, we present a cost-effective approach for e-mail migration. The approach was implemented and tested for the migration of GroupWise 5.5 to Exchange Server 2003. Also presented are the benefits and the lessons learned from this particular case.

LITERATURE REVIEW

Several researchers have studied electronic mail migration, but most had focused attention on the implementation, at migration time, of security measures such as the prevention of virus and spam. Examples are Zhenhai Duan, Yinfei Dong, Kartik Gopalan [1], Lee Benjamin [2], and Network Engines [3]. On the other hand, real-world migration from one e-mail software to another and upgrading from an older version to a newer version has been discussed by Ferris Research [5] and the Radicati Group[6]. Ferris Research presented data on e-mail migrations by associating monetary value with each migration cost element (labor, hardware, software, tools, travel and training). They did not address post-migration cost and it was determined that the typical industry migration cost is $282 per mailbox.

Whereas, Radicati Group [6] presented an assessment of the acquisition and the operational costs of migration to Microsoft Exchange 2003 in enterprise environments. The Radicati Group surveyed many corporations and government organizations across the globe, to analyze and establish migration cost information. The typical industry's migration tasks include the acquisition of hardware and software, migration (labor), administration, storage, downtime and training. In addition, the Group determined the cost of maintaining Exchange 2003 annually for a period of three years after migration. For the first year, the Radicati Group obtained a maintenance cost of $136.67 per mailbox; and $92.20 for each of the second and third years.

THE MIGRATION APPROACH

Our approach is simple and it was deigned primarily to cut costs. It emulates the traditional systems development life cycle (SDLC) methodology – planning, analysis, design, systems installation, configuration and implementation "best practices" approach. The methodology is presented in a step-by-step process below:

- Evaluate the current information technology environment of the organization
- Select the right messaging software.
- Select the right server hardware and server operating system that is compatible with the messaging software. For example, GroupWise messaging software runs only on server hardware with NetWare server operating systems. Also, Exchange 2003 is not supported by Windows NT 4.0, but rather – by Windows Server 2003.
- Select the right migration tools.
- Develop a migration plan, procedures and schedule.
- Execute the plan.

A more detailed description of the migration approach follows:

Evaluate the current environment

It is important to evaluate the current infrastructure to determine problems associated with the current messaging software. The evaluator must check for the following:

- Legacy servers and unreliable platform
- Inadequate server storage
- Lack of good redundancy for servers and other systems modules.
- Not securing in-coming and out-going e-mail messages from spam and viruses.
- Inadequate network bandwidth
- Lack of using industry standard servers

The above issues must be corrected during migration in order to have a problem free environment for the new messaging application.

Select the right messaging software

To select the appropriate messaging software, a thorough understanding of available enterprise messaging systems and the enterprise-wide information systems infrastructure is important. This is because any decision to select new messaging software should consider the following criteria: interoperability issues – ease of integration with current infrastructure, stability and robustness of the software, return on investment, reliability, ease of use, total cost of ownership, and security.

Select right server hardware and Operating System

Based on reports of the evaluation phase, a decision should be made whether or not new servers and operating systems will be required. If necessary, recommend the acquisition of the correct infrastructure to replace legacy hardware servers and operating systems. For example, Exchange server 2003 is not supported on a Windows NT server. Therefore, an organization running Windows NT server must upgrade to Windows Server 2003 operating systems before migrating to Exchange 2003.

Develop a migration plan and execute it

Developing and executing a migration plan involves several steps. In the first step, the team should generate a list of messaging software components that will be migrated. The Chief Information/Technology Officer and the end-users are the best sources to generate the required data. The importance of this exercise cannot be over-emphasized given that enterprise messaging systems consists of several components and features that may not always be of interest to all users. Commonly used messaging software components include inbox (mailbox), sent (outbox), personal address book, contact lists, calendars, personal distribution list, archived e-mail messages, tasks, reminders, user settings or preferences, folders and subfolders, attachments, and bulletin boards.

The second step of the migration plan is to select an appropriate migration tool. Several migration tools are currently available to facilitate the process. While many of these tools have the capability to perform the migration automatically without any intervention, others require attention during the migration process. Typical migration tools include E-mail Shuttle by Compusven, [8], UniAccess by ComAxis Technology [10], Microsoft Exchange Migration Wizard [11], and Transend Migrator [13]. In addition, some of the messaging software systems include free migration tools that are also available for use by the migrating team. For example, Microsoft Exchange server 2003 has Exchange wizard migration tool that comes free with the software. It is essential to note that some migration tools may have the advantage of un-attended migration process but, they are very usually expensive, complicated to setup, and also may require additional server hardware. Other tools that are relatively simple and easy to setup and use, in most cases, require performing the mailbox migration on each of the users' desktops. Therefore, a good knowledge of the tool is inevitable and critical.

The third step is to develop the procedures for setting up and configuring all new hardware servers and operating systems that may be needed and then, design the directory services on the new servers. The fourth step is the development of the procedures for installing the new messaging software on the appropriate server(s), migrating user accounts and setting up security measures. The next step is the deployment of the client software on users' desktops. The last step is to test the entire installation and train the users. Our approach described above was successfully applied to a real world case that is presented in the following sections.

SCOPE OF A CASE STUDY PROJECT

This case study was performed on the Housing Finance Agency of a state government. The mission of the agency is to encourage and expand homeownership and rental housing opportunities in the state. The agency has about 50 employees. Their need was to implement a messaging software infrastructure upgrade. Our team came as consultants to assist the agency to accomplish this task. During the evaluation phase, we discovered several problems and issues which assisted the Chief Technology Officer (CTO) to determine the scope of the project. They include the following:

- The majority of the organization's applications ran under Windows Server operating systems while the messaging software was the only application that ran on NetWare platform. This evidently caused increased maintenance cost due to the fact that both Windows and Netware network administrators were kept by the agency.
- Hardware servers were aging, servers had insufficient storage capacity and therefore, users were required to delete from their mailboxes, e-mail messages that were more than 15 days old.
- Each user had multiple logins – one to the primary domain controller, and the others were to each application including the e-mail server. Users were not pleased about this.
- The organization was running GroupWise 5.5 which Novell had ceased to support since 2002.
- Most in-coming e-mail attachments were not delivered to the intended mailboxes.
- Spam messages were not controlled.

In order to cut costs and also reduce the total cost of ownership of the agency's e-mail system, we strongly recommended that migration from GroupWise messaging software to Exchange was inevitable. This would eliminate the cost of maintaining NetWare servers. Therefore, the project requirement and scope were simply stated as follows: "Perform the migration of the organization's messaging software from Novell GroupWise 5.5 to reliable e-mail software that would eliminate the problems listed above. In addition, we were required to provide training to users at the end of the migration."

CASE STUDY IMPLEMENTATION

In line with the approach described earlier, the project progressed by selecting the right messaging software. Microsoft Exchange Server 2003 was selected as the new messaging software because it interoperates seamlessly with the Windows 2003 server's active directory and it is compatible with the company's desktop applications. Moreover, since Exchange runs on Windows server operating systems, therefore, selection of Exchange eliminated NetWare platform and the cost of maintaining multiple platforms by the organization. Based on the results of our evaluation and analysis of the current infrastructure, we recommended the purchase of two new servers to replace two very old ones. The two new servers were utilized as follows: one new server was needed for the Exchange 2003 messaging software and the other server replaced the aging primary domain controller (PDC).

Two Compaq Proliant ML 370 G3 hardware servers were acquired running Windows Server 2003 operating systems. The decision to select Compaq servers was based on the well-known robustness and high fault tolerance features. The servers were configured with the following main components: Pentium IV with dual Xeon processors, 4.0GB random access memory (RAM), two network interface cards for better performance, and six slots of SCSI hard disk storage – each slot containing 72GB hot pluggable hard disk drives. Software items included two server licenses of Microsoft Windows Server 2003 installed on the PDC and the Exchange hardware server as the underlying operating systems; one server license of Exchange server 2003 with 50 client access licenses; Veritas backup software; and one server license of Computer Associates' E-trust anti-virus/anti-spam software with 50 client access licenses.

The implementation progressed by designing an Active Directory (AD) and policies for the new hardware that served as the new primary domain controller – taking into consideration, the structure of the organization's network. Installation phase proceeded by setting-up Windows Server 2003 on the PDC and configuring AD on it. Subsequent steps are as follows: a) setup and configure Internet Information Services (IIS) on the PDC because Exchange relies heavily on AD and IIS; b) install a new server-based anti-virus software on the PDC and deploy clients version from the server to all desktops; c) setup and install the other new server hardware as a member server with Windows Server 2003 as its underlying operating system; d) install and configure Exchange Server 2003 on the member server; e) install and configure Microsoft Outlook on each client; f) migrate individual user inbox, calendars and other messaging related folders from the GroupWise server to the new Exchange Server using UniAccess migration tool from ComAxis [10]; g) test all servers and desktops and h) provide training to users.

Although our case involved migration from GroupWise 5.5 to Microsoft Exchange Server 2003 and, in spite of the fact that Exchange Migration Wizard is capable of automatically performing the users' mailboxes migration phase, it is evident from [8] that third party migration tool may be preferred over the free Exchange migration wizard. We utilized UniAccess because of its simplicity, low cost, ease of use, and its suitability for the size of the organization that is of interest to us in this case. UniAccess requires that the migration of each user's e-mail folders and inbox be performed from the user's desktop or from any workstation using the user's network domain login account. First, the user would login to the primary domain controller (PDC) that contains the Active Directory (AD). This is because UniAccess tool is user's profile dependent for the migration to be performed as expected. Secondly, once the user has logged in, and has been authenticated by the PDC as a network authorized user, the user or migrator will run the tool separately on each messaging folder that is on the GroupWise server creating a personal storage outlook (.PST) file that is converted to the corresponding folder name in Outlook installed on the user's computer. The same procedure applies to inbox, calendars, contact lists and other messaging related folders that will be migrated.

SUCCESS STORY

The migration project from GroupWise 5.5 to Exchange Server 2003 with Outlook client was very successful. This was evident from the fact that the messaging infrastructure for the organization was not disrupted during the migration period; the entire migration was completed ahead of schedule and without incurring any additional cost. In addition, the administration and users' pleasant experiences and overall satisfaction after the migration, revealed a very successful migration effort. Moreover, a six week post migration system-audit indicated that the organization derived several additional direct benefits. They include the following:

- Increased employee productivity.
- Reduced information technology (IT) administrative overhead because the network administration became less cumbersome. NetWare platform has been completely eliminated.
- Savings derived for not supporting and administering multiple network operating system platforms.

The total cost of the migration from GroupWise 5.5 to Exchange 2003 is presented in the Table 1. There were no costs associated with user disruptions (also known as down-time due to migration) because the conversion from GroupWise to Exchange infrastructure was performed after hours and on weekend when the organization is normally closed.

Table 1: Migration and One Year Maintenance Costs

ITEM	QTY	UNIT PRICE	MIGRA. COST	FIRST YEAR MTCE COST
Server Hardware	2	2,600	5,200	0
Exchange Software Server License	1	800	800	0
Exchange Software Client Access License (Non-profit Organization)	50	17	850	0
Other Software: Anti-Virus, Anti-Spam, and Mailbox Migration Tools	50	15	750	300
Implementation Labor: Fixed Contract Price	1	3,500	3,500	0
User Disruptions. There were no user disruptions since Conversion was performed after hours and on weekend	0	0	0	0
Training	20	50	1,000	0
Exchange Maintenance (User Support, Server Backup, Mailbox and Hardware Maintenance). Fixed Contract Price	N/A	N/A	N/A	3,600
TOTAL			**$ 12,100**	**$ 3,900**
Cost Per Mailbox			**$ 242**	**$ 78**

The table also contains the cost of maintaining the messaging software for the first year.

LESSONS LEARNED

In spite of the success stories, a couple of lessons were learned from the project. These are:

- Establish a compromise between what users want to migrate and what the CTO would like to be migrated before migration begins. In this implementation, users wanted every folder and all messages in GroupWise to be migrated to Exchange. Whereas, the CTO would allow only twenty most important and job-related e-mail messages and their address books to be migrated. A decision to migrate all users' folders and messages was eventually taken. Migrating old messages accumulated for several years could result in storage waste.

- Configure Exchange Server Spam Filtering as soon as the migration is completed. In less than 24 hours after the migration was completed, the Exchange server was filled with over six hundred thousand spam messages. The Exchange server was configured to store spam messages in "Bad" folder automatically. We had to move the "Bad" folder to a larger disk volume away from the systems' volume, then carefully deleted the spam messages and configured the spam filtering feature of the Exchange Server 2003. This incident was detected on time and was corrected before the entire systems volume was populated with spam messages. Otherwise, the e-mail server could have shut down when the entire system disk storage is fully utilized. That is, there was no down-time associated with the situation.

SUMMARY AND CONCLUSIONS

Migration from one e-mail application software to another is an arduous task that must be carefully planned, well designed and properly implemented in order to avoid failure. Moreover, lowering the total cost of ownership should be highly taken into consideration. We presented an approach for migrating from an existing e-mail infrastructure to another, implemented our approach on a real-world case and discussed the lessons learned from the case study. The solution is very cost-effective based on Table 1. This strategy's migration-cost of $242 per mailbox is much lower than the typical industry migration price of $282 per mailbox. Also, the first year maintenance cost of $78 per mailbox is significantly lower than $136.67 presented by the Radicati Group [6]. Chief information officers, network engineers and administrators planning to embark on similar project, should benefit from our approach, experiences and lessons learned.

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Trickster Fiddles with Informatics: The Social Impact of Technological Marketing Schemes

M. Louise RIPLEY
Associate Professor of Marketing, Women's Studies and Environmental Studies
School of Administrative Studies, Atkinson College, York University
Toronto, Ontario M1E 4W6 Canada
and
Beverly DAVIS
Associate Professor of Organizational Leadership and Supervision
Lafayette College of Technology, Purdue University
South Bend, Indiana 47903 U.S.A.

ABSTRACT

"Information is power if and only if you have the knowledge to know what it means, the will to use it, the ability to apply it, and access to a channel of communication" [1]. We see this in current fields of research as varied as Marketing, Philosophy, and Communications Studies, and in current issues about who owns and controls technology. But a character from a far older tradition helps explain many problems in society today with technology: Trickster, the mythical character who confuses fact with fiction, makes good use of *Technoism*, a term coined by Davis [2] in 1999 to denote suppressed skepticism and blind compliance with the chaotic and uncontrolled progression of technology in our lives that leads to a dangerous split between the "haves" and "have-nots" of the technology world. This paper will discuss the use of Technoism to give the public and users of technology a false sense of power and control over their lives when in fact they are being duped into a financially motivated campaign of consumer exploitation. The paper makes some recommendations for establishing a conscience in the use of technology.

INTRODUCTION

Trickster, a character who appears in different forms in most mythologies, is usually a mischievous deity who breaks the rules. Deliberately confusing fact and fiction, Trickster makes of the world an opportunity for artifice and recreation to suit his purposes [3]. It can be difficult to distinguish between the myth of crafty Trickster and the reality of clever Marketer promoting to an unsuspecting public as we watch the tyranny of technology as a survival necessity convince us that we must have the latest gadget and supposed time-saver, assuring us that we will be losers if we do not invest in the most up-to-date technological wonder. The latest example of this can be seen online in Apple's iPhone, "combining three amazing products – a revolutionary mobile phone, a widescreen iPod with touch controls, and a breakthrough Internet communications device with desktop-class email, web browsing, maps, and searching – into one small and lightweight handheld device. iPhone also introduces an entirely new user interface based on a large multi-touch display and pioneering new software, letting you control everything with just your fingers. So it ushers in an era of software power and sophistication never before seen in a mobile device, completely redefining what you can do on a mobile phone" [4].

If U. S. President John F. Kennedy was right forty-five years ago that technology has no conscience of its own, it is even more so today, with increasingly complex and able machines available to process the increasing amount of information now deluging us. As we manipulate e-mail, a cell phone, instant messaging, and a Blackberry while simultaneously signing on to check out Face-Book and You-Tube and Google a quick definition, interrupted occasionally by the ringing of the landline telephone while the television competes with the stereo for our attention, we may perhaps be forgiven for forgetting that technology's ultimate purpose was not to be an end in itself. Indeed today's elaborate division of labor has been said to have the purpose of keeping any one worker in the technology sector away from any sense of responsibility for its impact on the final user [5].

Technology has good and powerful uses, particularly with respect to information processing in an age of too much information, and it will continue to affect our lives in a positive manner, but its impact on those lives when exploited by clever marketers reminds us of the dark side of the proliferation of information and the accompanying increase in the use of technological gadgets to try to gain a sense of control. This paper will discuss Trickster's use of the term *Technoism* hand-in-glove with Marketer to give users of technology a false sense of control over their lives when in fact it is the marketers of technologically-based consumer goods who are in control. The paper makes some recommendations for establishing a conscience in the use of technology.

TRICKSTER TOYS WITH TECHNOISM

Beverly Davis introduced the term Technoism to the business world at the 2001 conference on *Emerging Issues in Business and Technology* [6] and the authors have explored its use by Trickster at an EIBT conference. The term derives from the same family of "isms" that includes racism and sexism, and denotes a suppressed skepticism and blind compliance with the chaotic and uncontrolled progression of technology that leads those who "have" the latest technological gadgets to look down on and discount as less able in all other areas of life those who "have not" such gadgets. Trickster's role, working with Marketer, is to convince an unsuspecting public that they will be left behind if they do not purchase the latest gadget, silencing any critics of uncontrolled technological progression by creating a fear that they will be ostracized by the techno-savvy if they dare to raise a voice of criticism. Slade called this the ***social cascade***, where "a few people engage in certain acts and then other people soon follow these leaders … either in an effort to be right or simply to gain social approval [and] eventually a majority of the population commits to the new behavior" [7]. Technoism becomes a great tool for Trickster because through its use, he manages to convince us that as human beings we can transform the chaotic into a normalizing and comforting illusion [8].

This is not a rant against technology, for in an age of information processing as complex as we face today, technology is a necessity in our lives. Where we see the work of Trickster is in what marketing professionals have taught us to accept as normal: poor product quality, unreadable instructions, excessive packaging, non-recyclable components, non-interchangeable parts, and a pathetic lack of customer service. Furthermore, these expensive gadgets often require acquisition of further technology in order to use them properly and are often outdated at their time of purchase. Meanwhile, marketers delude us in captivating television advertisements with a comforting promise of how technology will save us time and help us gain power and control over our lives. Trickster and Marketer convince us that technology offers a normalizing of chaos when in actuality technology has become the source of much of the chaos in our lives, often simply adding another layer of useless information.

One of our most valued commodities today is time, and Trickster and Marketer try to convince us that we can manipulate time with technological products. Common marketing ploys found in the *Fortune Technology Guide* taunt readers with phrases such as: "Power and Productivity" ask, "When is good enough not good enough?" and convince us that "What You Want Is What You Need." Marketers define those things without which we will lose out in the game of life in terms that promise Groundbreaking Innovation, Impressive Performance, and Extreme Systems. They use increasingly complex phrases, meaningless to the general public, like Digital Zoom and Hyper-Threading Technology, hoping to overwhelm us with a sense that we must get to the store and buy whatever it is that is being advertised [9].

Trickster and Marketer also convince us that technological products are the answer to our need for control. A simple radio is now advertised to let you "Stay one step ahead of Mother Nature." It is no longer enough to have a remote control; we now need an "infrared remote extender." No longer happy with just a television and a DVD player (Trickster assumes you are not so far behind that you still use a VCR), you now need a Bell ExpressVu Model 5800 that "combines an integrated digital satellite receiver and a Personal Video Recorder so you get the most out of your TV viewing" [10]. One ad even tries to excuse its use of such phrases with the clarifying statement, "In plain language, it means your [product] will deliver amazing performance" [11].

Trickster does not limit himself only to technology in technological devices. Advertisements for products in current magazines show us a hardware store that no longer has a paint counter but a "Color Solutions Center," a moisturizing cream that uses the technology of lipids, an anti-aging cream whose ingredient that stimulates the synthesis of collagen has been proven through "in vitro" tests, and a refrigerator that talks, with the reassurance that now we can "keep everybody in the loop at the touch of a button."

TRICKSTER TACKLES PRODUCT LIFE CYCLE

As competition increased dramatically in the 1990s and consumers became better educated, knowledge-based industries particularly sought new ways of conceptualizing competition [12]. One solution was to know what consumers would need before they knew it themselves. Researching why marketing research tends to play such a small part in new product development, the Marketing Science Institute concluded that one major reason is that consumers cannot ask for products they do not know exist [13]. In his recommendations for finding "really new products," Lehmann comments that although "the best technology is unknown," once found, it will "spawn new markets for add-ons, supporting products, and accessories," making the search worthwhile [14].

Trickster watched this search and found an exceptional new toy in the personal computer. Like technology itself, the personal computer has been a boon to life-style improvement in the last thirty years, but it also has brought us to a state where we frequently are unable to function without it. Donald Norman, a cognitive scientist who has made a career of examining technology from the point of view of the everyday user, offers as examples people's increasing lack of ability to do basic arithmetic skills because of the electronic calculator [15, p.75], and the plane that can no longer be landed when its high-level systems fail [16].

Traditionally, as product life-cycles evolved, we expected and usually received better quality, more focus on improvement, and more value for our consumer dollars [17]. Yet technological innovation seems to violate these principles as Trickster and Marketer continue to sell us newer, faster, more complicated products. Walter Kirn put Old Economy products into New Economy terms when he asked us to consider what it would be like if "One-inch-thick steel would only be one-inch thick on weekend nights and holidays. During weekday business hours, it would only be one-third of an inch, and if one carried the steel outside one's own area, it would cost six times as much. Refrigerators would chill eggs and butter for only three or four hours before they crashed and required a call to an 800 number" [18].

The average age of durable goods in developed countries has been declining over the last decades, mainly due to deliberate reduction of product age through reduced durability, difficulty of repair, and obsolescence brought about by the very technology that created the products in the first place [19]. For most products, lifestyle changes lead to a demand for better quality goods and a greater emphasis on environmental issues of recycling and pollution. But the lifestyle for innovative goods is one of "fast consumption and quick replacement" [20]. The consumer decides to get rid of a product not because it is no longer reliable or efficient but simply because a newer product is being introduced, and the consumer's perception of that reliability and efficiency is greatly influenced by the marketer, whose main job often appears to be to get consumers to discard and replace goods.

All this is rich territory for Trickster who delights in disrupting the life-cycle of technology. In a traditional product life-cycle, Innovators and Early Adopters [21] are the first purchasers, willing to pay more to be first to experience it. Later Adopters wait until the product is a little less risky, not quite so expensive, and provides more value and convenience. With technology, however, the cycle never completes. Technology innovators continually seek to meet Early Adopter needs, and technology process improvement is never achieved. Rather than making a product that will truly meet the needs of the customer, quality and customer satisfaction are sacrificed for a continuous flow of "gotta-have" gadgets.

The effective component of this disruption of product life-cycle is the Late Adopter, who typically waits until a product is proven, considerably less expensive, and much more convenient. But Trickster uses the Technoism phenomenon to encourage Late Adopters to buy products with little value and quality that are out-dated as soon as they leave the store. Faced with the threat of being left behind in the fast-paced technology age, most typical Late Adopters jump on board without considering proven functionality, quality issues, or value.

TRICKSTER AND TECHNOLOGICAL CHAOS

With the media convincing the public they need every possible technological tool to stay in the loop and each tool being touted as better than the last, some have pondered whether technology exists "solely for its own sake" [15, p. ix]. For example, the top of the business ladder of success is achieved only by those climbers who conform and "stay in the loop." Technoism silences the ambitious who are now wired to the office "24/7," creating a blind compliance with the concept that in the new economy, everyone must be connected to work at all times. Here Trickster tricks us twice: employees are convinced they must be available through technology at all hours in order to serve the customer, yet customer service is at an all-time low. The American Consumer Service Index is down to 72.9%, as customer service becomes a tangle of telephones, e-mail, and websites where the customer feels lied to and betrayed [22].

In a survey of 27,000 *PC World* readers about PC support [23], satisfaction was at an all-time low, with the majority of complaints centered on longer waits on hold and less knowledgeable technicians. Technoism flourishes here as the public, now dependent on technological advances, accepts poor service as a fact of modern life and assumes that any problems in its use arise from their own lack of expertise. Ellen Goodman, a nationally syndicated columnist, complained recently that it has come to the point where every upgrade actually downgrades the quality of life and where watching television now requires the training and skill of a pilot at the controls of an Airbus [24]. Dell Computer reports having many more novice users requiring more assistance with more complex computers [25], yet customer service appears to be deteriorating as the Austin Texas Better Business Bureau reports a 48% increase in complaints about Dell's technical support [26].

Trickster grins ear-to-ear as Marketer convinces more and more low-end consumers, Late Adopters, to upgrade to new and better products, and to attribute any problems they experience to their own personal lack of technical knowledge. Goodman suggests that perhaps technology should be making equipment to fit the consumer instead of the other way around, but this would violate principles for marketing scientific goods set out as early as 1933 at the Chicago World's Fair, where the motto was, "Science finds, industry applies, man conforms" [15, p. ix]. It would leave no motivation for marketers whose main task seems to be to continue to encourage us to purchase new technology to manage our old technology, a concept known as "buying up" and observed in "Technology-on-Technology" (T-on-T) purchases. Trickster laughs again as we continue to purchase more technological goods to manage already existing ones in order to make our lives even more efficient. There is no better example of this than the e-mail phenomenon. A typical worker, from receptionist to CEO, handles an average of 204 messages per day in e-mail, answering machine, and voice-mail [27]. One CEO admitted he deletes 80% of his e-mails without reading them.

Trickster laughs up his sleeve as he mixes us up, gleefully watching as Marketer claims that technology will save time and help us gain power and control over our increasingly technologically controlled lives, while all the while the increase in technology itself contributes hugely to our feeling out of control. With wireless technology (T-on-T) tying us to the office or to using our home-time to answer e-mail, as many CEOs confess to doing, the exploding use of wireless e-mail devices generates even more e-mail which creates a need for T-on-T-on-T to manage the explosion of the additional e-mail created through T-on-T [28]. Marketers now even offer ways to control our lives electronically while driving our cars, including dashboard PCs. There are now so many electronic gadgets in cars that there is talk of legislation to limit them for the sake of road safety.

NORMALIZING, COMFORTING ILLUSIONS

The feeling of loss of control over circumstances can be frightening. Technology was supposed to make our lives easier. Marketers promoted Personal Data Assistants and other planning devices as a way of organizing our lives. Automated operator systems were designed to improve customer service so we would spend less time "on hold." Laptop computers promised us "24/7 take-home-work" capabilities so we could gain control of our work projects. Technology has transitioned us into a "knowledge era" where almost limitless information is at the fingertips of anyone, anywhere, anytime, yet given the small black transformer necessary to connect each of these devices to a source of electricity, we often cannot even find wall space to plug them all in [15, p. 66].

Again we find Trickster working with Marketer to create an illusion of gaining control by acquiring more goods. Too many e-mails? Switch to virtual private networks to make communications even faster. Too many voice-mails? Purchase the Voice-Mail Notification System. No time to visit aging parents and let them hear their grandchildren's laughter? Purchase a picture frame from Radio Shack with a built-in ten-second computerized message. Trickster is right there, using Technoism to put fear into the hearts of anyone who might question whether faster technology is the answer to the stress in their lives, silencing critics and tricking the public into faster lifestyles requiring the consumption of more goods and convincing any wary consumers that they will be seen as techno-phobic if they do not buy those goods.

It is no wonder that health care systems are staggering under the costs of treating stress-related illness and companies are losing millions of dollars each year in person-hours as employees take off sick or succumb to alcoholism and drug abuse. In many ways, today's excessive stress is about too much information from too many sources, and the subsequent sense of loss of control. An astonishing fact in a 2002 American Demographics survey is that 69% of 1,300 full-time working adults admit to staying in contact with the office while on vacation. Whether at work, at home, or on vacation, corporate ladder-climbers, even while complaining about the stress and increased workloads attributable to technological advancement, accept each new and improved technological intrusion into their personal lives as a normal part of how a society functions. Technoism imposes a deafening silence on those who might complain, and Trickster once again helps Marketer to allow consumers to help exploit themselves.

Somewhere during this massive transformation, technology managed to gain for itself the control we sought over our lives. Our gadgets require constant attention, from changing batteries to synchronizing all our various electronic toys [15, p. 70], and the very tools we embraced to help us maintain power and control in our lives have turned on us and now control us. Trickster, hand in hand with clever Marketer, has turned the tables on us while we were busy answering our e-mails.

NEED FOR EVALUATION OF TECHNOLOGY

Technology has enriched our lives in many ways; few could dispute the technological benefits of communicating globally in seconds, accessing the world through the Internet, or being able to process the amount of information we are required to process every day. Without critical assessment of its development, however, technology becomes a chaotic intrusion in our lives offering us only an illusion of control and normalcy, an illusion never challenged by skepticism because Trickster continues to use Technoism to fool us into believing that we are keeping ahead of the game. But just as the Industrial Era ushered in workplace regulation and union demands for safer and healthier environments, so too might InfoTech pollution actually help to highlight employee well-being issues that never existed before, such as computer stress and the incredible current level of invasion into our private lives [29].

In 1972, the U.S. Congress established the Office of Technology Assessment (OTA) to help deal with problems of adaptation to technology but it was shut down by downsizing in 1995. There are movements now to revive a similar kind of office [30], and we recommend this for all countries: a workable technology-assessment process that can effectively bridge the gaping chasm between science/technology and policy. Vary Coates, former Senior Associate for the Office of Technology Assessment, predicts growing public indignation about technology's unanticipated effects and suggests that people will eventually become unwilling to leave all decisions to technical experts and will increasingly expect governments to intervene on their behalf [31]. Would a technology assessment system reveal the deception of Trickster and his embrace, and ours, of Technoism? Will exploitation by Marketer be managed and regulated? Will critics be allowed to speak out against workplace intrusion in private lives through technology? Will this lead to the end of Technoism? A strong government-backed office may be our best hope.

CONCLUSION

Technology has a powerful and positive effect on our lives, but its impact when exploited by clever marketers shows us the dark side of the technological world. Trickster has been enjoying our preoccupation with new technology for a long time. Pascal noted as far back as 1670 how intrigued humankind is with new things. Thomas Beddoes wrote in 1832, "Consumption may be regarded as a vast pit-fall, situated on the high road of life, which we have no sense enough of our common interest to agree to fill up, or fence round; heedless fathers and mothers are for ever guiding their sons and daughters directly into it" [32]. By the end of the 1800s, people already were complaining of information overload as "a serious problem" [33]. Maslow observed in his studies of Sociology that once basic needs were met, it was possible for people to buy more goods to satisfy higher level needs. Vance Packard had already noted in 1955 the "over-consumption and the anti-durability bias of a mass consumption society" [34].

Technology started as soon as our earliest ancestors picked up a stone to use as a tool. It is important to remember the actual meaning of technology. Even technology-driven Wikipedia defines it as "a species' use and knowledge of tools and crafts" [35]. It is not technology itself that is to be feared but what we as societies make of it, and, while recognizing the tremendous contribution of technology to our lives, we need to recognize that somewhere on the road of technological advancement, we have allowed technology to take control of our lives, bringing about the very chaos we once attempted to control through its use. Trickster uses our fear of technology and of being seen as technologically ignorant to work with clever and exploitative Marketer to convince us that we must have the newest and best technological gadget simply to keep up. Early Adopters need little convincing but the typical Late Adopters are foregoing quality and value and embracing the inundation of technological progression in a rush to avoid being seen as ignorant of the great gifts of technology. It is all-or-nothing with Trickster, who uses Technoism not only to convince an unsuspecting public that they must purchase more goods, but also to silence critics with the fear of being labelled techno-phobic when these digital purchases turn out to offer poor quality and substandard customer service.

Technology is barely sociable now [15, p. 134], and if we are going to live in harmony with it as the gadgets gain even more power over our lives, there must be methods to assess it. Voices calling for government-backed offices to adequately assess technology must be heeded. The public must overcome the effects of Technoism and speak out for more evaluation and regulation. We need formal processes by which to examine, analyze, anticipate, and offer guidance to the public so they can utilize positive examples of available technology and make educated decisions about technology in their lives. Successful evaluation and regulation of technology render Trickster powerless by exposing Marketer's exploitation of consumers and by demanding quality technological products while making his friend, Technoism, a thing of the past.

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E-Government and FOSS Policies in Indonesia

Sar Sardy [*], Muhammad Asvial [*], and Ade Jamal [¶]

[*] Electrical Engineering Department, University of Indonesia, Kampus FTUI, Depok 16424, Indonesia
Phone: +62 21 7270078, Fax: +62 21 3918115, email: {sardy, asvial}@ee.ui.ac.id
[¶] Dept. of Informatics, University of Al-Azhar Indonesia, Jakarta Selatan,
Phone: +62 21 7244456, Fax: +62 21 7244767, email: adja@uai.ac.id

ABSTRACT

The role of Information and Communication Technology (ICT) for the Indonesian development is very important, especially in the application of e-government to support good, clean, transparent governance, and public service's improvement as a whole.

Free Open Source Software (FOSS), is also an interesting inter-operable ICT system, to be used and developed for making the self-made and legal software, which will have the promising benefits in the country, not only for the government but also useful in the public sectors, industries, human resources, etc.

Both issues were launched by our government, while some constraints or obstacles are found during their implementation. This paper will discuss about e-government and FOSS policies in Indonesia, based on the available supported data, and recent efforts in the issues that made by educational institutions like universities.

This paper will be divided into three parts: part 1 about the ICT's role for Indonesian development; part 2 about e-government and FOSS policies; part 3 about the implementation with some discussions on specific condition and situation; and finally it will be closed by the conclusion.

Keywords: ICT, e-government, FOSS policies.

I. THE ICT ROLE FOR INDONESIAN DEVELOPMENT

The ICT's role in the world of knowledge based economy nowadays is obviously admitted as the third wave paradigm from Toffler's theory. It consist of the agrarian age as first wave, the industrial age as second wave, and the post industrial society or information age as the third wave.

The past UN general secretary, Kofi Annan, said that "information and knowledge will be playing a lead role in the world economy of the future -the post industrial or advanced industrial society – comparable to that of traditional production factors in the past, such as steam or electricity" [1].

One important issue in this information age is information overloaded, so ones should be able to distinguish what kind of information that suitable to their own needs. Fig.1 shows how data impacts to the development. The data which have meanings called information; then it may create knowledge and by using of reasoning with some values it will produce development outcomes.

Knowledge here can be treated as the capacity to recognize patterns and actionable values in pieces of information or events, and to use the information productively in various and appropriate ways, including the ability to innovate -that is, to restructure things and processes so as to produce useful effects, products, and services [1].

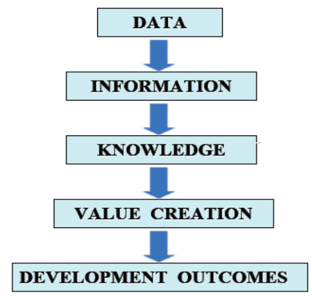

Fig.1. Flow of data that impact to development

The society in this information age is well known as knowledge based society, where beside the ICT infrastructure, then human resources plays a significant role. In this respect, Indonesia has a lot of thing to do, as reflected by the following HDI (Human Development Index) rank table, from UNDP [2].

Table 1. HDI Rank for some countries [2]

HDI Rank	Life expect.	Education	GDP	HDI
Norway (1)	0.90	0.99	0.99	0.956
United States (8)	0.87	0.97	0.98	0.939
Germany (19)	0.89	0.95	0.94	0.925
Singapore (25)	0.88	0.91	0.92	0.902
Brunei (33)	0.85	0.87	0.88	0.867
Malaysia (59)	0.80	0.83	0.75	0.793
Thailand (76)	0.74	0.86	0.71	0.768
Philippines (83)	0.75	0.89	0.62	0.753
China (94)	0.76	0.83	0.64	0.745
Indonesia (111)	0.69	0.80	0.58	0.692

Source: UNDP, HDI, 2002

Table 2. Some indicators for Indonesia and Malaysia [2]

Indicators	Indonesia	Malaysia
Population, million	220	22
Land Area, sqr km	1919	329
GNP, billion USD	221.9	98.2
Scientists and Engineers in R & D, per million peoples	130	160
PC, per 1000 peoples	4.8	42.8
Internet Hosts, per 10.000 peoples	0.54	19.4
Growth Competitiveness Rank	72	29
Business Competitive Rank	60	26
Tech. Achievement Rank	78	20

Comparing to Malaysia, Indonesia stands behind too far, as shown in the Table 2. However, if we take a look in absolute number of PC ownership, internet access, the difference is not so wide.

The following figures are some suitable national indicators for ICT, including telephone lines and cellular subscribers. The growth of these three indicators is shown in Fig. 2a→c, for five Asian countries.

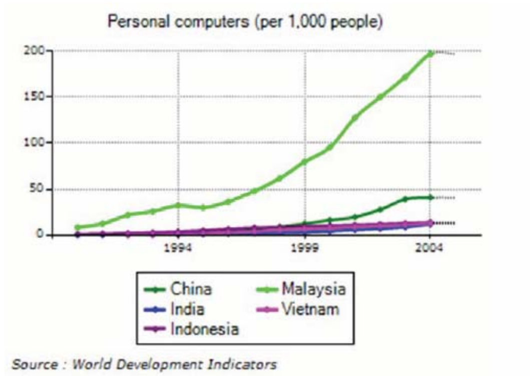

Fig.2a. Personal Computer per 1000 peoples [2].

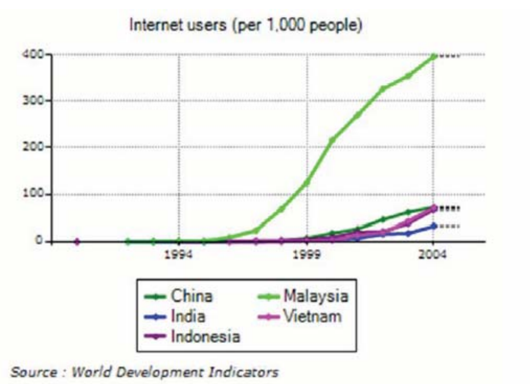

Fig.2b. Internet users per 1000 peoples [2].

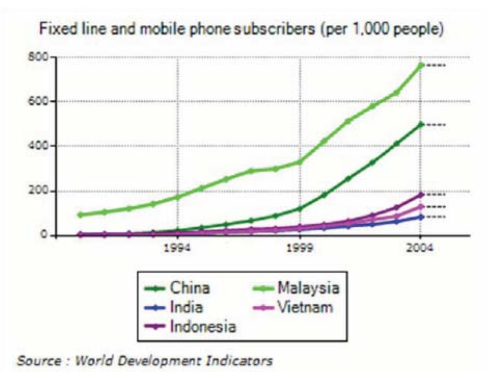

Fig.2c. Fixed line & mobile phones subscriber per 1000 peoples [2].

We can notice that there is a significant increase around year 2002 in internet users and phone subscriber in Indonesia, while PC's ownership increases steadily. The low number of internet users and phone subscribers is strongly related to the availability of telecommunication infrastructure. The growth and increasing demand for cellular, fixed, internet and broadband can be shown in Fig.3 (source from Dept. of Communication and Information Technology).

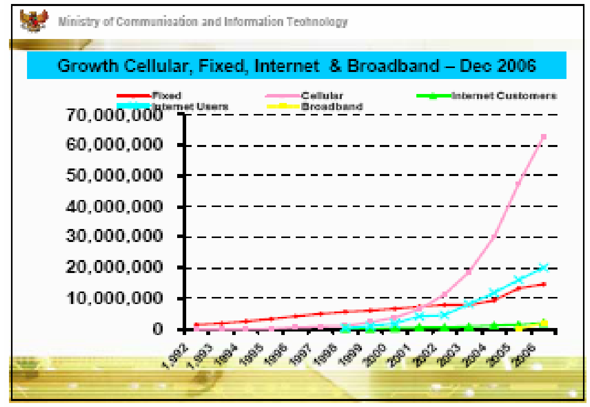

Fig.3. The growth of cellular, fixed, internet & broadband [3].

According to [3], the demand forecast in 2010 for internet users is 80.2 millions, for broadband users is 2.5 millions, for fixed phone is 31.2 millions, and for mobile phones is 112.1 millions. Therefore, Indonesian government has committed to develop a new infrastructure by issuing a mega project called Palapa Ring, that is a backbone network using optic fiber cable under the sea, which forming seven rings around Indonesian islands as shown in Fig.3. The implementation of this mega project is planned to be started in 2008 and will be completed in 2011 [4].

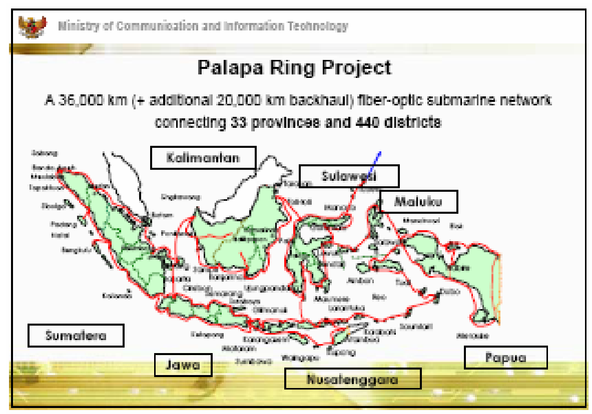

Fig.4. Palapa Ring Project throughout the Indonesian islands [3].

Furthermore, government has set up a council called "National ICT Council", chaired by the President. This council has following main roles:

- Strategic direction and ICT policy,
- ICT development approval,
- ICT implementation performance measure, and
- Facilitation and incentive scheme for ICT industry development.

II. E-GOVERNMENT AND FOSS POLICIES

The use of ICT to increase the efficiency, transparency and accountability process has been recognized by the president of Republic Indonesia, Megawati Sukarnoputri. In June 2003, it was declared the Instruction of President, where all government level beneath, from Ministry level to regional government should take any necessary action for applying a national wide e-government [4]. Regardless all constraint and limitation, this very progressive instruction has been obeyed by many government offices, especially in the provinces and district governments, called as regional.

Considering that the scope of e-government is not limited to regional only, but national wide, the Ministry of Communication and Information Technology has designed a blueprint as a guide for developing e-government [5]. This blueprint is built based on service functionality approach, in which the regional government must fulfill. This functional approach is drawn in schematic structure, which basically consisting of six function modules, namely the Government Function Framework, as in Fig.5.

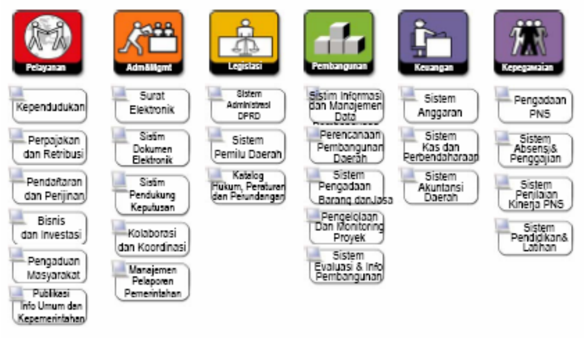

Fig.5. The e-Government Function Framework [5].

The six major function modules in the figure consist of services, administration & management, legislation, development, finance, and human resources. One important issue in e-government development is budgeting. Every government budgeting should be proposed by executive to legislative for approval. Due to lack of ICT awareness by some legislative members, difficulties arose in the very costly ICT budgeting approval. Sometimes the problem is found earlier in the executive side. A full support and commitment from executive leader in every government office is needed, since ICT has less priority than other sectors such as health and education. Budgeting leads another problem, because e-government project cost must be planned not only for procuring ICT infrastructure and its content, but it must also consider the cost for human resources, information culture, standardization and management.

It is anticipated that the FOSS can minimize costing of its infrastructure. Furthermore, FOSS provides an alternative solution for system that is independent from software vendors. Within framework of promoting OSS (Open Source Software) in Indonesia, in June 2004, five Dept. Ministers: Minister of Communication and Information Technology, State Minister of Research and Technology, State Minister of Administration Reforms, Minister of Justice and Human Rights, and Minister of National Education had signed an agreement known as IGOS, stand for "Indonesia, Goes Open Source"[6]. This agreement is a kind of spirit to endorse government sector as private and public sector for utilizing OSS. The OSS is increasingly adopted by government, not only because of its practicality and economic value, but also because of its social and political benefit [7].

III. IMPLEMENTATION

In order to implement the e-government, Ministry of the Dept. of Communication and Information Technology has proposed a systematic development plan through four realistic steps, as follows [10]:

1. *Preparation phase*: developing website for every government institution as tools for information and communication.
2. *Growing phase*: building web-portal for public information which has interactive capability with the public users.
3. *Maturing phase*: building web-portal for public service, e.g. electronic transaction
4. *Utilization phase*: building application for general services including *Government to Government* (G2G), *Government to Business* (G2B), *Government to* Consumers (G2C).

In complementary with the above plan, the Dept. of Research and Technology has also issued an Indonesia's Roadmap to e-government, which consists of three (near, medium, and long) terms and five (preparation, presence, action, participation, and transformation) phases, as shown in Fig. 6.

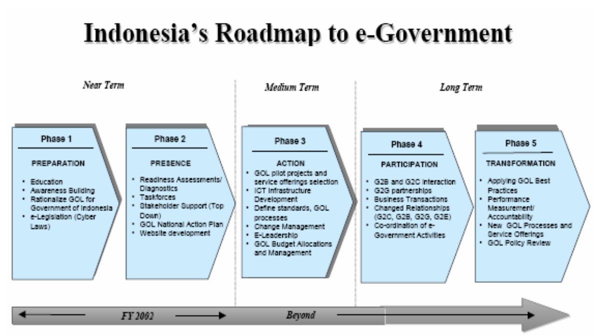

Fig.6. Indonesia's Roadmap to e-government [5].

In order to promote OSS in the society, the Dept. of Research and Technology has announced grants for SME (Small Medium Enterprise) which intent to develop products using OSS [8][9]. Furthermore, this Dept. will takes the role as a driving force in IGOS spirit, by giving support in many OSS national wide activities, as the Roadmap of IGOS 2005-20010, shown in Fig.7.

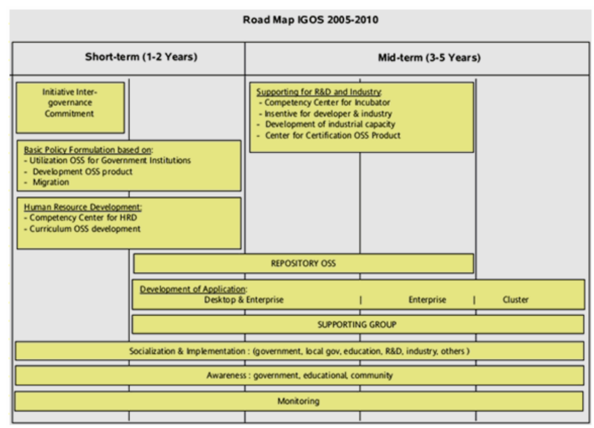

Fig.7. The Roadmap of Indonesia Goes Open Source [6].

Some constraints on implementation of e-government have been also noted by the Dept., such as [11]:

- Lack of quantity and quality HRD
- Missing IT master plan,
- Insufficient IT infrastructure,
- Insufficient IT budgeting due to lack of awareness in ICT necessity, and
- Lack of support a commitment from (regional) government in e-government development.

Although these constraints and difficulties, e-government has been applied in some regional government. The applications spread variously from website consisting of information about tourism, economic and financial aspects, and natural resources to online government services such as personal registration for ID card.

Government website **go.id** is the first step of e-government. About 70% of 472 regional governments (provinces and cities) have already developed their website. They expect this website will further develop into e-government portal [10].

Registration for personal ID card is one of the public service by every regional government. Government of Palembang city has initiated the implementation of online registration since July 2006. The goal of online registration for personal ID card, known as KTP in Indonesia, is to fasten the public service and to enhance the transparency on the revenue from registration [**www.palembang.go.id**].

In Sragen (Central Java), using e-government the process for extension of the ID card takes only one hour time, while it took more than one day or two manually [11].

Some regional government, provide all information needed for any government permit, likes work and investment permit. For example in **www.pemkot-malang.go.id**, all data about permit, its procedure, requirement, duration, related cost and other information to shorten and fasten the whole process of permit.

Another implementation of e-government that interesting to be noted is "one roof service for permit". For example the case in Gorontalo province where there are seven public services offices, they build one-roof services for these seven offices, including the management information systems. The benefit is felt by investor, while in 2004 they had to fill 65 forms for industrial permit, now it is only two forms must be filled [12].

It is obvious that e-government application has been implemented in many regional governments for internal use or for public services. The problem is that there is no standard in application or operating system they use. Some of them have used open source based application, for example, regional government in Jembaran, Bali, has started e-government in 2002, and used open source [11]. Though the OSS is more and more getting places in e-government, it is still Microsoft Offices as the most used productivity tools [10].

Educational institutions take their own roles in the OSS activities in Indonesia. By its educational nature, OSS has its own place in the academic atmosphere. To emphasize the spirit of promoting OSS and to enhance the networking between researchers in higher education, ten universities have signed MOU for POSS network, i.e. networking for utilization of OSS [11]. This MOU was signed and witnessed by Minister of Research and Technology in Bali, within the 8th Asia Open Source Software Symposium.

University of Indonesia launched INHERENT (Indonesian for Higher Education Network), using local backbone, and GDLN (Global Distance Learning Network), using international backbone. The STEI Bandung Institute of Technology also held an ICT symposium called eII2007 (e-Indonesia Initiatives) in Jakarta, on April 25-26, and the University of Gajahmada in Jogyakarta has also arranged a seminar called JGOS (Jogyakarta Goes Open Source) on May 2007. As an enterprising private university, University of Al-Azhar Indonesia (UAI) is also involved in the POSS (Pusat Open Source Software) in Indonesia.

IV. CONCLUSION

Based on the above discussions, some conclusions can be drawn as follows:

1. E-Government and FOSS, both are a "must" that have to be implemented by Indonesian Government. The Government has been aware about them, and has also already made the roadmap for their implementation.

2. The constraints on implementation primarily lay on the budget for set up the infrastructure, lack of human resources, and the change of cultural habit from traditional to modern working condition.

3. Due to the wide of geographical areas, Indonesia may facing with a digital divide problem that has to be solved, where some provinces or districts still have "wide gap" in the ICT's infrastructures and capabilities.

4. The Universities, higher education (private or government), research institutions, will takes an important role in human resources development, therefore the intense collaboration among the Academician, Businessman, and Government, called "ABG cooperation" is seriously anticipated.

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Directions of the Development of Information Society in Serbia

Ninoslava SAVIĆ
Department for Informatics, Novi Sad Business School
21000 Novi Sad, Serbia

ABSTRACT

This paper considers the information society development in Serbia in the context of European environment. Serbia, which plans a membership in the European Union (EU), has accepted the European model of development of Information Society. This model includes top-down policy in implementing the leading Initiatives of the EU Commissions. On the national levels, the governments of the European countries conduct the development. As a member of the Stability Pacts eSEE group, Serbia has signed the document called eSEE Agenda for Developing the Information Society, which obliged her to regional cooperation in the complex process of transition towards the Information Society. This paper also considers the Action Plan of the Strategy for Development the Information Society in Serbia. One of the main priorities from the Strategy's Action Plan is the construction of the common methodology for monitoring and evaluating the information society development. It is important that this methodology adopts the European standards and in the same time answers the needs and development possibilities of Serbia. The paper defines the main steps in creating the common model for monitoring and evaluating the information society in Serbia. While this priority from the Action Plan is still not accessible, it is necessary to include the research institutions and other important development factors in finalizing this complex job.

Keywords: Information Society, eEurope, eSEE Initiative, National Strategy for an Information Society in Serbia, Monitoring and Evaluating of Information Society.

1. INTRODUCTION

Serbia is one of developing countries, which, in domain of global development strategy, waits for the membership in the EU. An important part of the country's global development strategy is the strategy that defines the complex process of transition toward an information society. In this context, Serbia has chosen the European model for developing of information society. As a member of eSEE (electronic South East Europe) group of SEE Stability Pact, Serbia has signed international documents (*eSEE Initiative*, *eSEE Agenda for the Development of the Information society*) [1], [2] which obliged her to implement the European model and standards in developing of information society.

2. THE EUROPEAN MODEL FOR DEVELOPMENT AN INFORMATION SOCIETY

The European model for development an information society represents a top-down strategy. The process of building the information society in Europe is conducted by the main bodies and Commissions of the EU responsible for development. The top level bodies of the EU periodically announce documents, called Initiatives, which consists of the main directions and suggestions for process of creating an information society in Europe. These Initiatives defines list of priority objectives with deadlines for an actual period, for all countries that decided to go together through this complex process. On the national level, this Initiatives are then implemented by the governments and ministries of European countries. Through management in development process, this model ensures international cooperation and mutual coordination. Also, conducting from the top of the EU leads to minimizing digital divides between the countries on the different levels and with the different development possibilities [7].

The main Initiatives that define the European way to a modern information society and to a knowledge based economy [3] are:

- *Lisboa's Declaration* (launched on the European Council in Lisboa in 2000. The goal, that European economy should become the most dynamic and the most concurrent knowledge based economy in the world, was set),
- *eEurope Initiative* (1999. "eEurope – an Information Society for All", Action Plans eEurope (2000.), eEurope 2005 (2002.) [5], last Action Plan is "i2010 – European Society for Development and Employment") [6],
- *eEurope+ Initiative,* (2000. for the countries candidate for the membership in EU) [4],
- *eSEE* (*electronic South East Europe) Initiative,* (2001. for the countries of SEE region with all its differences) [1],
- *NISPs (National Information Society Policies).*

3. NATIONAL STRATEGY FOR AN INFORMATION SOCIETY

NISPs with its Action Plans are a political possibility for all governments around the world to conduct and influence the development of information society. NISP defines a common starting point for all relevant subjects that are involved in development procedures in a specific country. NISP ensures that a transition process toward an information society will be coordinated in all phases. For a single country, NISP ensures national consensus about main development goals, priorities and steps for their implementation. NISP is the factor of making easier complex connections that exists between different factors in society: technology, government policy, human resources, institutional and economical factors.

Fortunately, during a very difficult time of its development, Serbia succeed to create such important document. The document called *National Strategy for an Information Society in Serbia* was adopted in Parliament of Serbia in December 2006. Action Plan, as a part of this document, defines a list of strategic priorities followed by concrete initiatives, goals, responsibilities and terms [8] (for different domains of information society).

4. STRATEGIC PRIORITIES IN DEVELOPING AN INFORMATION SOCIETY

The following strategic priorities are pointed out as a part of general requests for the constitution of a modern information society Serbia:

Perform e-Readiness assessment, which means realization of the following functions:

- study international ICT-related indices,
- evaluate availability of data and institutional capacities,
- develop organizational framework and provide resources,
- assess the current strategic information systems projects,
- study social aspects of information systems development.

E-Readiness assessments are significant for the complex process of designing country global e-Strategy. First, by providing informations for determining sectors on which to focus the country's strategy (what to do). Second, e-Readiness assessments provide data about the current level of information-communication technology (ICT) development for a specified country, against which the progress of the strategy can be measured (how much of it to do).

Develop sector e-Strategies, with main objectives to:

- develop guidelines for sector ICT policy and planning,
- propose plans for sector e-Strategies,
- organize work groups and develop strategies.

Integrate ICT in sustainable development, with specific list of goals to:

- develop environmental information system,
- develop national spatial data infrastructure,
- promote the further development of the European Environment Information and Observation Network (EIONET) for the collection, monitoring and reporting of environmental data compatible with ongoing networks in Europe.

Institutional and legislative framework

In the domain of institutional and legislative framework there are the following strategic priorities:

Build institutional framework for the information society development

The adequate institutional framework is prerequisite for the successful implementation of the National Strategy for an Information Society. The process of its development should be focused on the following objectives:

- develop the legal framework for the new institutions regarding information society development, establish the Government Centre for Informatics,
- establish the Information Society Committee,
- assess the current status within the Governmental bodies,
- establish Information Society Council,
- enable intensive consultations with key stakeholders in the process of defining the institutional framework regarding the Information society forum,
- establish the Information Society Forum in close cooperation of all stakeholders in the country.

Create legislative framework for information society, with main objectives to***:***

- create and adapt set of lows concerning human rights,
- ratify and implement the Council of Europe convention on cyber crime,
- create and adapt set of lows concerning e-Government,
- create and adapt set of lows concerning e-Commerce, contracts and electronic transactions,
- adopt and implement intellectual property legislation on copyrights, patents, software,
- create and adapt set of lows concerning electronic communications and media.

Information infrastructure

Serbian National Information Infrastructure (NII) (ICT infrastructure of Serbia) will have to be a part of the global information infrastructure (GII). The NII should be open and digital. NII is defined as an open network, a modern technology platform for all applications and services. The **openness** is a necessary condition for an open and fair market. The **openness toward the inside** means the competition in building and maintaining networks. The **openness toward the outside** concerns the use of the network treating equally all the service providers and providing easy and equal access to the network for all users.

It is expected that, when implemented, NII would bring Serbia the a lot of benefits, like:

- Most of the reasons for government regulation will disappear as true competition drives the market.
- The market for telecommunications services and equipment will liberalize without big expenses.
- Easily transformable, such an NII could follow any business, organizational or cultural transformation.
- An open, flexible and low-cost information network would contribute to opening the society and to its democratization.

Strategic priority in the domain of **information infrastructure** is:

Develop access to ICT infrastructure, with goals to:
increase private sector-led competition,
establish a regulatory framework,
develop universal access.

E-Government

The reform and modernization of public administration based on wide use of ICT is one of the key elements of the transition of Serbia into a modern information society. E-Government concept enhance the quality, efficiency, transparency, accountability and effectiveness of the government. Speeding up administrative procedures and reducing business operation costs creates a better business ambient for economic development. The possibility for all citizens to electronically access public services, participate in decision-making processes and oversee government activities improves democratization and government-citizen relationship.

The implementation of the e-Government should be done gradually progressing through three levels of development: only online information available, communication/interaction enabled and transactions/integrated services implemented. During the process of implementation there will be necessary to respect the following basic principles: access for all, prevention of digital divide among different social layers, security and privacy protection, open system based on ICT solution from different providers which are interoperable, coherence and functional unity and interoperability among its heterogeneous parts achieved through standardization and coordination of development, autonomy in development according to agreed e-Government standards and national development plans, flexible and modern ICT solutions, reliance on national ICT sector and academic/research community.

Strategic priorities in the e-Government domain are:

Plan and organize e-Government development, which means to:
establish institutional framework for e-Government,
create detailed e-Government development plan,
develop e-Government standard.

Create an environment for e-Government development, with specific goals to:
develop relevant e-Government legal framework,
build ICT infrastructure for e-Government,
build security infrastructure,
introduce e-Payment methods,
build human capacities,
promote e-Government in media.

Develop of e-Government services, with goals to:
create pilot project of integrated e-Government services,
reengineer and standardize administrative procedures,
develop data services and infrastructure components,
develop G2C, G2B and G2G interactive services.

E-Education

Strategic priorities in the domain of e-Education are:

Make citizens equal members of information society, which means to:
educate citizens for basic ICT skills according to national computer literacy standards compatible with ECDL,
introduce post-education and long-life learning concepts.

Build educational system adapted to the needs of information society, with goals to:
adapt of educational curricula to the needs of the information society,
build human capacities for teaching,
provide ICT resources for modern education.

Foster research and development, that includes to:
promote innovations and technological development using instruments such as transfer technology centres, incubators, scientific parks, innovative centres etc,
foster collaboration with research institutions from developed countries and participation in EU and international research projects,
entrust major national development initiatives, such as e-Government, to the national companies and academic and research institutions.

Provide access to information about national cultural and historical heritage, with objectives to:
digitalize paper based content and create interactive multimedia products related to cultural and historical heritage,
provide ICT resources and cheap and fast access to the Internet for cultural institutions.

E-Health

Strategic priorities in the e-Health domain are:

Develop health information system, with goals to:

- develop national clinical data standard,
- identify practical strategies and solutions for ensuring the secure and private transmission of medical information,
- define needs and expectations of consumers from an interconnected health information system.

E-Business and e-Banking

Through the adoption of e-Business practices Serbia can reach new economic opportunities like economic growth and social development, business efficiency and productivity, decreasing the cost of doing business and enabling domestic companies re-integration to European and world market.

Strategic priorities in the domain of e-Business and e-Banking are:

Create an environment for e-Business, with special goals to:

- set up coordinating committee responsible for e-Business within a government level body for information society,
- prepare a strategy for the creation of an e-Business enabling framework,
- create enabling digital infrastructure for e-Business,
- foster deregulation and stronger competition in telecommunication sector,
- create and implement relevant laws for e-Business practice,
- boost consumer confidence in e-Commerce in partnership with consumer groups and industry.

Facilitate business processes and accept international standards, with specific objectives to:

- reengineer business procedures,
- harmonize national electronic basic trade and transport documents with international standards,
- introduce the Single Window approach to foreign trade.

Support the enterprise sector for e-Business implementation, with main objectives to:

- stimulate companies, especially small and medium enterprises to introduce modern e-Business practices,
- create the stimulating tax environment for e-Commerce,
- build awareness of benefits of wide use if ICT in business processes,
- train managers and executives in areas of management and ICT,
- create guidelines and mechanisms for private-public partnership in e-Business development,
- create web portal about e-Business operators in Serbia,
- include information on Serbian companies on international online directories,
- include Serbian companies in international organizations and business forums.

Development of ICT business sector

In economic development of Serbia, within development of national ICT business sector, special role belongs to the software industry. The need for Serbian software development strategy is obvious. Software capacity is a key to the knowledge economy. The term “software capacity” is defined as the total amount of software that an organization or country can build and maintain. It could be the vehicle for implementing key elements of a knowledge economy: transparent government, a supportive business environment with low transaction costs, enhanced learning environments and effective social programs.

The main prerequisites for software industry developing are: developed telecommunication infrastructure, domestic market for software, adequate human resources, inducing innovation and creating a supportive habitat, stimulating new business creation and finance, supporting software exports and mobilizing the expatriate community.

Strategic priorities in the domain of development of ICT business sector are:

Develop software development strategy, that means to:

- review strategic information systems status,
- review domestic software companies experience and results,
- review literature on world’s software needs,
- develop the organizational framework for strategy development,
- create software development strategy and promote results.

Monitoring and evaluation

Strategic priorities in the domain of monitoring and evaluation processes are:

Ensure the relevance of National Information Society Development Strategy within regional and European context, that includes to:

- participate actively in Stability Pact eSEE Initiative,
- participate actively in regional projects, like bSEE,
- participate actively in international information society development initiatives and plans such as the *e*Europe programme, UN/CEFACT, UNCTAD etc.

Monitor information society development in Serbia (benchmark process), with main objectives to:

- include benchmark indicators in national statistics in line with European accepted indicators,
- monitor and evaluate the information society development in Serbia,
- monitor and examine the process of implementation of the Strategy itself, objectives and outputs.

5. MODEL FOR MONITORING AND EVALUATION OF INFORMATION SOCIETY

Monitoring and evaluation process of development an information society in Serbia is very important for understanding the position of Serbia in the global information society. It is necessary to create a common methodology for this complex job which will include EU standards and in the same time the specific options that answers the needs of Serbia, regarding its current level of development and its possibilities to invest in future development [9, 10]. The main steps in designing that model are:

- Analysis and sistematization of the main world accesses to the problem of monitoring and evaluation of information society.
- Identification and classification of the main elements of the complex process of monitoring and evaluation (decomposition of that process).
- Defining a set of indicators for a quantitative presentation of choosen characteristics of information society (i.e. benchmarking indicators), which have to be compatibile to EU standards and adapted to Serbian specific requests.
- Defining transformations of benchmarking indicators which will result in an agregated indicator of information society status.
- On the above bases, designing a general model for monitoring and evaluation an information society, which will serve as a foundation for a constant and complete monitoring and evaluation process.

6. CONCLUSION

For successful development of information society in Serbia, it is necessary to have national consensus about main directions and strategic priorities. This consensus was confirmed at the end of year 2006. by adopting the most important document for building of modern information society (*National Strategy for Development an Information Society)*. During the complex process of transition toward an information society, it is important to achieve political commitment, leadership and strategic thinking, human resources, funding, acceptation the changes and participation of citizens, businesses and academic/research institutions.

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ICT and Rural Development in India

Deepthi Shanker
Humanities and Social Sciences
Indian Institute of Technology
Guwahati-781039, India

ABSTRACT

The spread of Information and Communication Technologies (ICT) is often stated as the harbinger of a new information revolution and thus an engine of a new economy. The attributes of these new technologies now increasingly dominate the explanations of contemporary change and development. Dissemination, propagation and accessibility of these technologies are viewed to be integral to a country's development strategy. Efforts and projects are under way to bring ICTs to rural areas because of the belief in the transformative potential. The role of ICTs in poverty alleviation and rural development seem to be largely touted in the academia as well as in the policy decisions. The paper in progress is an attempt to debate and explore the application of ICT in the Indian situation. Implementation and functioning of the some of the e-governance policies and projects at the grass root levels in rural India are dealt. The paper seeks to explore the theories, practice and the praxis of the ICTs and its application. It elaborates upon the way they have become a powerful mode of symbolic representation of empowerment.

Key Words: ICT, Rural Development, Application, Empowerment, India.

INTRODUCTION

The 1980s and 1990s have witnessed serious discussions, deliberations and anticipation concerning new Information and Communication Technologies (ICT). It is neither a matter of radical technical innovations such as the Internet/ World Wide Web and its potential prospects, nor is it merely a widespread application of ICT devices and its services. What is involved is nothing less than a major shift in the way we think about the nature of such new technological development and their implications for the social, economic and cultural order. The recent interest in ICT and its perceived 'impact' in economic, social and cultural domains have been reflected across the whole spectrum of the media and public communication. Ideas and images such as 'information superhighways', 'cyberspace', 'information society', 'the networked society' which were largely confined to the realm of science and fiction writing are now employed frequently to describe the changes associated with new communication technologies.

REVIEW OF LITERATURE

There has been a surge of academic writings with a special focus on the role and impact of new ICT and information structures. The striking feature of these writings tends to focus on the technical characteristics of the new devices or systems. Researchers with technical background such as computer science or computer applications have emphasized upon the radical social and cultural impact of new ICTs. However, they are marked by a weak theoretical and historical understanding of the complex interactions between technological change and society. Such contributions reproduce the kind of marketing and promotional hype advanced by very specific industrial interests and technocratic elite based in the high-tech sector. Thus as we enter the new millennium, there is a need to analyze the concept of information technology and assess its presumed social and economic benefits in the process of development. The technical attributes of the new ICTs increasingly dominate explanations of contemporary change and development. Many sociologists see technology as an impetus for the most fundamental social trends and transformations. Indeed, understanding the role of ICTs in the economy and society is now central to social theory. While there are a variety of social theories that proclaim the radical transformation of the society all contain, at their core, claims about technological change and its social impact.

Daniel Bell, one of the most influential writers on the 'postindustrial society' argues that the significance of theoretical knowledge in its changing relation to technology, and the codification of theory as the basis for innovation (Bell, 1973:35). Although much of Bell's reference is on the western countries, such changing trends are visible in the developing countries too. In his 'three axial model', modern society is divided into three parts and each is ruled by a different axial principle. First, there is the social structure**,** which comprises the economy, technology and the occupational or stratification system (Bell, 1973: X-XI, 12-13). He says that in modern western society, the predominant axial principle of the social structure is *economizing* – a way of allocating resources according to principles of least cost, substitutability, optimization and maximization. The second is to do with polity and the axial principle here, according to him, is *participation*. The third is 'culture' which refers to the realm of expressive symbolism and meanings. The axial principle of culture is the *desire for the fulfillment and enhancement of self*. Thus

Bell's model of emerging information society suggests a change in the social structure, the consequences of which will vary in societies with different political and cultural configurations.

Jean- Francois Lyotard and Jean Baudrillard also have made specific analysis of the changing role of information, mass media and communication technologies and their implications. According to Lyotard, 'the status of knowledge' is altered as societies enter what is known as the 'post-industrialist age' and culture enter what is known as 'postmodern age' (Lyotard, 1984:3). He dates this transformation from the end of the 1950s, but like Bell he states that the pace differs according to country and sector. He is of the view that computerization may open up a situation of truly 'perfect information'. Unlike Lyotard or Bell, Baudrillard focuses attention on mass communication processes related to the sphere of consumption and everyday life. He stresses especially on the characteristics and role of new communication technologies, the expanding media, cultural and heritage industries, the proliferation and circulation of signs associated with consumer goods and their impact in transforming the experience of the late twentieth century.

Jean Baudrillard's works focus on the symbolic and he has made an overriding emphasis that everything experienced in the economic, social and cultural realms is a matter of signification. The contemporary capitalism has transcended any connections with the material dimensions of production and consumption processes and is now primarily a system of circulating signs, codes and consumer identity formations. With the ceaseless circulation of signification, signs have lost all connection with any external signified or referent; reality begins and ends with the signs conveyed via commodities and the mass media. He talks of the society of the spectacle and simulation where signs are increasingly pervasive, empty and meaningless but also devoid of any connection to a 'reality' beyond themselves or possibilities for authentic communication. His idea of postmodern society has no distinction between the authentic and the inauthentic, true or false. The real and unreal reality have collapsed and it is the world where 'the real is abolished' and events have 'become lost in the void of information' (Baudrillard, 1998:7)

On the other hand, Manual Castells (1996) argues that revolution in information technology is creating a global economy, the product of an interaction between the rise in information networks and the process of capitalist restructuring. In the 'information mode of development', labour and capital, the central variables of the industrial society, are replaced by information and knowledge. In the resulting 'Network Society', the compression of space and time made possible by the new communication technology alters the speed and scope of decisions. Organizations can decentralize and disperse, with high-level decision making remaining in 'world cities' while lower-level operations, linked to the centre by communication networks, can take place virtually anywhere. Information is the key ingredient of social organization and flow of messages and images between networks constitute the basic thread of social structure (1996:477).

There are some contemporary theories that are technology-centered and these theories can be defined as third-wave models or transformative theories. The striking feature of these theories is a heavy reliance on the assumption that ICT is the key 'driver' of a fundamental transformation of the core economic structures and social relations, which have characterized the capitalist industrial societies for the past two centuries. They suggest that ICT is forging a radically new mode of production, one, which transforms the key social and economic relations of industrial capitalism. Besides a primary emphasis on the ICT factor, some of these analyses also refer to the transformative impact of the expanding economic role of information and /or of the emergence and diffusion of digital communication networks (Kelly, 1998).

The third-wave theorists emphasize that the new technologies are bringing about a number of fundamental changes in the overall socioeconomic and political fabric of the advanced capitalist economies. The main theme is that the world industrial system is undergoing a process of restructuring leading to a fundamentally new economic and social system. Such ideas were shared by a number of theorists, but Toffler was certainly the most influential exponent to analyze the nature and significance of new ICT in the 1980s. The third wave theorists view the historical significance and meaning of new ICTs and they are of the opinion that these technologies are of the same order and significance as the agricultural revolution and the industrial revolution that first developed in Britain in the late eighteenth century. Each of these three technological waves brought massive transformations to existing forms of social, economic, political and family life. According to the third–wave theorists, we are fundamentally moving from a mass production, mass consumption economy to an essentially 'de-massified' economy. With the growth of Internet, the notions of de-massificiation, radical segmentation and individualization have been applied to information and media services (Negroponte, 1995; Kelly, 1998). This has led to greater decentralization raising the level of social and individual diversity in the third-wave society. Hence an analysis of the third wave society promises the end of mass media and centralized data banks in favour of a diversity of ad-hoc networks and de-massified specialized small-audience, small circulation media (Gates, 1996; Negroponte, 1995).

Another feature of the third-wave analysis is that the economic and industrial changes are global in scale affecting most if not all countries. The nation states are losing much of their previous sovereignty, and national boundaries and identities are becoming less salient. In the era of globalization the expansion of Internet and other new ICT-based networks are viewed as 'boundless frontiers', which are intrinsically global in scope and in terms of their potential applications in all the sectors of the economies. As such they are deemed to be major drivers of further intensified globalization of economic, social and cultural relations and are bringing about 'the death of distance' (Cairncross, 1997; Negroponte, 1995; Kelly, 1998). An important change according to third wave theorists is the demise or erosion of traditional social identities, cleavages and conflicts – such as those of class, caste, gender, and race. Toffler predicts a large shift towards home-based work and a big shift in typical male and female roles (1983: 123-37).

At the other extreme, the 'social shaping' approaches reject the idea that technological change is an autonomous process causing social change. The social shaping models suggest that every moment or stage of the technological innovation process is largely shaped by social factors. Technological innovations are seen to 'embody social arrangement' and must always be viewed as part of larger social processes'. The idea is that technology is socially shaped, rather than an autonomously developing force in the society. According to Raymond Williams, virtually all technical study and experiment are undertaken within already existing social relations and cultural forms. In addition he argued that a technical innovation has comparatively little social significance. It is only when it is selected for investment towards production, and when it moves from being a technical invention to what can properly be called an available technology, 'that the general significance begins' (1983: 130). Williams stressed that these processes of technology selection, investment and development are clearly of a social and economic kind and must have a prior location within existing social and economic relations. Within a specific social order, new communication or other technologies do not simply emerge, rather they are designed for particular uses and the particular patterns of their application and use will be strongly shaped by the existing social and cultural contexts (Williams, 1983).

The developing countries have always been emulating the developed countries in various ways. These theories can be applied to the Indian situation carefully to explain the emerging realities of the technology driven society and could then be related with the developed countries. The three waves as explained by Toffler are major changes in the civilization. The first wave came with the development of agriculture, the second with industry. Today we are in the midst of the third, which is based on information and is bringing about the transformation of countries across the globe. The presence of the 'third wave model' has led to the trisection of world power. "Agrarian nations are on the bottom, smokestack countries in between, and knowledge-based economies on top" (Toffler 1980). In India one can see all the 'three waves' coexist and collide.

ICT AND DEVELOPMENT

Development can be defined as a "widely participatory process of directed social change in a society, intended to bring about both social and material advancement (including greater equality, freedom, and other valued qualities) for the majority of the people through their gaining greater control over their environment"(Singhal and Everett, 1989). Development is also a process, which enables the full realization of the potential of human beings, and the ultimate objective of development is the fulfillment of the human potential. Thus development can be understood at two levels, that is, at the level of individual development and the level of societal development in general. Both are interconnected and seek to improve the quality of life among the people. While discussing the role of Information and Communication Technology in development, communication plays a vital role. Development Communication is the concept often used to refer to the benefits of communication to further development. Some of the key elements in development paradigm are the following as suggested by Singhal and Rogers in the late 1980's:

- Greater equality in the distribution of development investments, information, and the consequent socio-economic benefits, by focusing development activities on the weaker sections of society.
- Popular participation, knowledge sharing, and empowerment to facilitate self-development efforts by individuals, groups and communities.
- Self-reliance and independence in development, emphasizing the potential of local resources.
- Integration of traditional and modern communication systems.

ICT IN RURAL INDIA

Most of the developing countries for a long time believed that 'telecom' in itself was a great luxury. But with other infrastructure hitting their lives, they are opening themselves to a whole new range of experiences. They are on the roads of realization that information revolution can transform their lives. Recent experiences with experiments like Gramdoot in Rajasthan, Bhoomi in Karnataka, 2Mbp universal connectivity in Andhra Pradesh, Gyandoot in Madhya Pradesh and e-Choupal across the country suggest that ICT has been quite useful for the rural masses and has met some of their immediate interest and enhanced the quality of rural life (Ghosh, 2004). Several cases articulate the benefits derived from the rural communities out of ICT technologies.

Internet and Villages

The Swaminanthan Research Foundation in some of the villages in Pondicherry is known for promoting the use of information technology and communications through a number of internet centers for getting information across to farmers and fishermen, and from them to urban centers. Dr. Swaminanthan, a top ranking agricultural scientist and administrator, and a winner of Magsaysay award for his accomplishment has been advocating a community-based approach to farm problems**.** He has trained local villagers in areas around Pondicherry to monitor information needed for farmers, fisherman, cattle growers and artisans and helped improve their lives. His foundation based in Chennai, has helped open *internet kiosks*, wherein a local person trained by the Foundation helps villagers to gain information on a variety of their needs. In addition, these kiosks also feeds the farmers information on local weather conditions, prices of various agricultural commodities in nearby markets, on healthcare and several other areas. The entire project is largely run by the people themselves. It is said that information from the computers in rural areas, where people live in thatched mud huts, has saved the life of a milking cow, prevented an old woman from becoming blind and routinely warned fisherman of stormy whether that can claim lives.

Gyandoot and its Services

Gyandoot is an experiment conducted in one of the backward districts, Dhar in the state of Madhya Pradesh. The project aimed at setting up the intranet system that connects rural cyber kiosks throughout Dhar district, which has a heavy tribal population and very low literacy. The experiment involved an arrival of a computer and the availability of information on demand to the people. So Gyandoot provides government-related and other information to the public and enables them to get government forms and other papers they need from kiosks for a small fee. This experiment was awarded a Swedish award for community leadership. The project, however, is not an extenuation of the government, but is run as an independent institution by the local registered society called Gyandoot Samiti. The government input comes through the Dhar District Rural Development Agency, which has provided office space for the network server and project team, free of charge. The aim of Gyandoot is to use a district-based intranet to increase facilities available to the public regarding government policies and procedures, training and education, and commerce. The real benefit of the programme has been the increased awareness of what information technology could give the people and the ease with which this is accessed. The villagers finds that need not have to bow before the officers for such information, which he has right to know, and that right can be exercised by asking the computer operator to give him the information. This improves the feeling of empowerment amongst the people and thereby it waters the grassroots of democracy.

Gramdoot and its Services

While Gyandoot focused on the use of information technology in the backward districts, Gramdoot is a more compact and well-conceived project regarding the use of computers in the district areas. The project was conceived and executed by a young fiber optics company, Akash Optic Fibre Ltd. Through its subsidiary Akash broadband, the project seeks to bypass the high cost of rural telephony by making connectivity available for a number of different services thereby spreading the costs and making these services affordable to the targeted rural communities. The project was implemented in one of the districts in Jaipur, and with sufficient backing so that it could spread to whole of Rajasthan. The range of services offered by Gramdoot includes e-governance, email, e-commerce, matrimonial services, market rates, expert advice, internet, cable, web conferencing, telemedicine and entertainment. Services like copies of certificates and land record are charged a small sum of Rs 20, while cable TV is provided at Rs 105 per month. The menu is prepared in consultation with the intended beneficiaries, so that there is a sense of participation on the part of rural communities. Some of the services are unique such as a web conference with a villager in another village, which costs only Rs 5 for a three –minute interaction. The use of optical fiber ensures that the quality of services is high and that multiple services could be provided. The Gramdoot project has all the efficiencies traditionally brought in by advanced corporate management thus making it more cost effective. It is designed to bridge the digital divide between rural India and the rest of the world by providing e-governance and rural convergence.

Computer and Land Records

Land record is the most vital document in any Indian farmer's life. It is the basis of the entire revenue administration, the area where the government pinches the farmer. For instance, buying and selling or pledging of land to get loans and several other interactions in the village depends upon the production of an authenticated land record document from the village officer who looks after the official matters. He is a powerful man who can make or break the lives of farmers in India. He can play around with the lives of farmer as he has control over the small piece of paper, which documents the details of the land, which is actually the lifeline for most farmers. The government is aware that it is quite difficult for the poor and illiterate farmer to protect his land record against land lords and powerful local leaders. An attempt is now being made to computerize all the land records and give computer outputs for these records a legal status. In Karnataka it is popularly known as '*Bhoomi Project*', which has won international awards like the recognition from the Commonwealth Association for Public Administration and Management and the Stockholm Challenge Award. The project in simple terms digitized some two million-land records in 27 districts. In practice this was a mammoth effort of transferring to the computer the handwritten records, many of them decades or even centuries old and in local languages. The government implemented the scheme taluk by taluk so that each farmer has switched from handwritten records to computerized ones. Gradually, the handwritten ones were declared as illegal from the date of implementation in each taluk. The most important outcome of the project so far as the farmer is concerned is that now he could walk into a kiosk and ask for a copy of his record for as low as charge of Rs 15 per copy within 30 minutes of applying, which is a record in e-governance in the country where delays in responding to such applications is the rule. More than five million farmers have already availed the Bhoomi service from various kiosks. Computerized records make farmers free from harassment by the government officials, middlemen, village level leaders, etc and farmers now have direct access to all information about their property which was earlier not possible.

ICT AND THE DIGITAL DIVIDE

'Digital divide' is the gap in technology (computing and communications) usage and access. This manifests itself in many different ways: between the big company and the smaller companies, between the people in the developed and developing countries and also between the urban and rural populations. The divide is brought about by differences in education, language and income levels. The education divide limits the usage of computing. Language in countries like India is another barrier because most software is still only in English. The perceived market is too small to make investments in creating software for the mass market in different languages, because companies are not sure if they will recoup their investments. Income levels are a huge obstacle as most technology is still dominated in dollars, which makes adoption beyond the scope of most individuals and enterprises, for whom earnings are in local currencies with unfavorable exchange rates against the dollar. The result then is the division of the world into two - one which has access to computers, communications and the internet, and the other, which does not have access to the above. Thus, there are sets of adversaries too in the package offered by the ICT. Besides giving rise to the 'Digital Economy' (or the knowledge economy), these technologies have also given rises to the 'Digital Divide,' further penetrating the already divided world of 'haves' and 'have-nots'. Some of the fundamental queries, which need to be addressed are the following:

1. Is Digital/knowledge economy stopping at big towns and semi-urban towns?
2. To what extent it is affecting the rural and semi-rural areas?
3. Is computer education in rural areas adequate? How to spread computer in rural areas?

These questions are important because for instance in Belandur Gram Panchayat, only Belandur village could enjoy the benefits of Information and Communication technologies. The other villages which also come under Belandur Gram Panchayat like Devara Bisanahalli, Kariyammana Agrahara, Haralur, Ambalipura largely remained unexplored and unaffected by the new technologies. Digital knowledge and economy is not necessarily getting into the interiors of deep rural areas. The impact of ICT is often felt only in the peripheral rural economy and society and that becomes a parameter for indicating the development of the region. For instance, Belandur's success seems to exaggerate the development of the entire Belandur Gram Panchayat. It goes unnoticed that the other villages in the Belandur gram Panchayat are relatively backward and have not been able to enjoy the benefits of the ICT revolution. Hence, the apprehensions about the hype and reality about these new technologies remain.

The computer education in rural areas is not quite adequate. The residents of other four villages besides Belandur in the Belandur gram panchayat were totally ignorant about the computer and its applications. The current computer educational approach to spread computer literacy is showing some positive results only in the semi-rural areas, as there is some degree of awareness about computer technology among the residents. But a more intense approach is necessary to train those villagers who are completely disconnected with the city and township. Knowledge about computer and other technologies needs to be mediated through proper pedagogy, which connects the illiterate rural masses living in the interiors of rural India.

BRIDGING THE DIGITAL DIVIDE

Digital Divide is one of the burgeoning problems encountered due to the uneven flow and dissemination of information and communication technologies both at inter and intra- societal whether it is regional or national level. What are the ways of overcoming the global digital divide? Jeffery (2003) throws light on the low-cost computing, open source versus proprietary forms of computer software, low cost internet access via community wireless local area networks and how these could bridge the digital divide at a global level. Many developing countries have tried and applied these strategies, and have been relatively successful in this regard. It could prove helpful to the policy makers and the organizations to ameliorate the global digital divide before bridging the digital divide within the region. It reflects the combined effort from both the developed and the developing countries in overcoming the global digital divide.

The Indian model of providing sustainable internet access for the rural poor needs to be widely discussed and debated. The 'Grameen Telecom Project' in Bangladesh and n-Logue kiosk model in India have shown some positive results. But the targets in terms of number and accessibility are far behind the anticipated proportions. James (2003) suggests some policy changes to bridge the digital divide and also ways of overcoming the divide by means of a new web based registry of information other than the World Wide Web. This proposal focuses on the supply side and is a welcome measure. It has a tremendous potential to bridge the digital divide provided it percolates at various levels. There should also be a promotion of universal access to ICTs rather than individual ownership of ICTs. Such an idea is novel and will be a success because of cheaper availability and appropriateness, but it requires a paradigm shift to designing new technologies in some cases, or innovations in the existing technologies. Diffusion of Information and Communication Technologies is crucial in bridging the digital divide especially in the developing countries where the consequences are a threat to those whom, for one reason or the other are not participants in electronically mediated networks. To conclude it can be said that ICT policies if properly used and implemented will definitely be an instrument of reducing the divide rather than widening it sooner or later.

CONCLUSIONS

Information Technology is not simply another technology or another medium. It is a major change agent and has an explosive impact on the mass character. It initiates questions in people's mind and shall gradually increase their inquisitiveness with regard to their surroundings and situations around them. Further ICT envisages offering new opportunities for self-employment and entrepreneurship to a large number of people who are otherwise not able to participate in economic activities in a major way. It also needs to be understood that the most visible impact of IT on the life of a common man shall be felt if one is not required to visit a government office for day-to-day work and instead have all such interactions with government and its agencies through the internet.

A great lesson one has to learn from the application of ICT to public policies like poverty alleviation is that it cannot be an isolated move unrelated to the other economic policies. For the poor to fully benefit from the Information Revolution, there must be simultaneous efforts to get the conditions right for national economic growth, for stimulating complementary technological innovation, for rolling out infrastructure, for building appropriate ICT industries, and for utilizing ICTs in many sectors of the economy. It is not enough if there are pro-growth policies and institutions in place for the ICT revolution to be translated into economic growth. It is also important to assure that the poor share the benefits through progress. India's experience in the application of ICT underlines that a holistic approach is necessary to make it a success. An overall national commitment to ICT, with multiple leadership at various levels favouring ICT makes information technology profoundly affecting the lives of the people both in urban as well as rural areas for a better tomorrow.

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The National Interest of Cyprus' Membership in the European Union and the Further Prospects that Arise Concerning the Cyprus' Problem

Antigoni Ioannidou
International Relations, Middlesex University
Enfield, London, EN3 4SA, United Kingdom

ABSTRACT

"We believed in starting with limited achievements, establishing a de facto solidarity from which a federation would gradually emerge. I have never believed that one fine day Europe would be created by some great political mutation." (Jean Monet 1978)

The above quotation by Jean Monet in 1978 emphasizes the gradual development of the European idea from spectral integration as it started in 1951, to political union through the European Monetary Union (EMU) by 1999. The road of the development of this European idea has been uneven and erratic. Nationalism, economic recession, piecemeal enlargement and the growing importance of the Council of Ministers within the European Community's (EC) decision-making system, have at various times impeded EC decision-making and the process of European integration.[1] An integral constituent of these counteracts of European integration is the constraint imposed by the national interests of each member-state of the European Union (EU). National interests and national governments have undoubtedly played a crucial role in determining the degree and the pace of European integration, especially with regard to 'history making"[2] decisions such as the initial establishment of the European Communities, negotiations of the Single European Act (SEA) in 1986, the Maastricht Treaty of the European Union (TEU) in 1992, and the completion of the EMU in 1999.

It is often the case that the regional and international environment similarly influences the domestic politics of a country. It is on the later case that this study will focus. In particular, the study will examine the event to which the process of European Union has influenced the national interest of Cyprus' membership.

The study, seeks to establish whether the Cyprus' national interest of its membership in the European Union is about the Cyprus issue or about any other interests of the country. The purposes of the study are: Was the main target of Cyprus membership in the European Union the Cyprus problem? Which was the first and main reason of Cyprus' joining in the European Union? Greek Cypriots and as a result the Government of Cyprus, and the Turkish Cypriots, and their leaders, have the same aspirations for the future of Cyprus in the European Union? What does the European Union expect from Cyprus and vise versa? By forming these questions the study will draw many important conclusions.

The national interest of Cyprus being a member state of the E.U. will be tried to be presented based on writers' opinion, literature review and research, and interviews.

METHODOLOGY

For the purpose of this research after considering the aims, reviewing the current state of knowledge and reviewing how much access will be given to various resources there was a need that a choice between the various methods of undertaking this research.

The information for this study was gathered in three ways: (i) by a preparatory literature search, (ii) records from the Press and Information Office of Cyprus and finally, (iii) and questionnaires distributed to persons of Cyprus political life.

.Apart from distributing the questionnaires, an informal and very helpful interview took place with the vise president of the Democratic Rally (DISY) and former deputy of the parliament Mrs. Kaiti Cliride, and with the former foreign minister and now deputy in the Euro parliament Mr Ioannis Kasoulides. This was attempted in order to get a general idea of what generally prompted Cyprus to deposit application for membership in the European Union, and also about the Cyprus Problem before and after the accession. Although there was formal interviews, also a structured interview with the person in charge for Cyprus Problem from AKEL Mr Tomazos Tselepis, and the President of the Democratic Rally (DISY) Mr. Nicos Anastasiades, also from the former President of the Republic of Cyprus Mr. George Vassileiou (1988-1993), who was the president who deposit the application in the European Community, and from the former president of the republic of Cyprus Mr. Glafkos Clerides (1993-2003), Mr. Alecos Markides former general public prosecutor, finally from a Turkish Cypriot leader Mr. Mustafa Akinci, president of the Turkish Cypriot political party "Peace and Democracy".

CYPRUS AND THE EUROPEAN UNION BEFORE THE ACCESSION

The beginning of the relations between Cyprus and the European Economic Community began in 1971.

On 11 May 1978, Cyprus and the European Economic Community also entered into two new protocols: a special supplementary protocol which settled some additional agricultural issues in line with the Mediterranean policy of the community and another laying down certain provisions relating to the trade in agricultural products. A new transitional protocol was again signed on 7 February 1980 extending even further the initial stage of the Agreement.

Political and social practices prevailing in Cyprus, as well as Cypriot civilization, historical traditions and values are in concordance with European culture and frame of thought.

Arguments in favor of applying for accession to the EEC gained much public support in the years since 1988. That particular year the foreign minister of Greece Mr. Theodoros Pagkalos, send a letter to the foreign minister of Cyprus Mr. George Iacovou, explain him reason that Cyprus should applied for membership in the European Community[3]. That fact between other reasons prompted the government of Cyprus to submit the application in 1990.

Public sentiment was so unanimous that when the Parliament of Cyprus had a resolution on the floor urging for a petition, three political parties (out of four) voted overwhelmingly in favor.

Indeed, on July 4, 1990, the Foreign Minister of Cyprus, Mr. George Iacovou, on behalf of the Government of the Republic of Cyprus, delivered a letter to the President of the EEC Council of Minister whereby the Republic of Cyprus submitted its official application for membership.

At the beginning of the negotiations Cyprus faced problems with the "Treaty of Guarantee" in the constitution of Cyprus in 1960, which said that the country can't unified with any other country. But that point it was exceeded, and the application was accepted[4], and Greece accomplished to convince the other member states that the applications examined together, and not one by one. The same made by Germany for Poland.

On March 1995 formal negotiations on membership of Cyprus into the EU began. The E.U General Affairs Council re affirmed the suitability of Cyprus for accession.

In December of 1999 at the Helsinki Economic Council the heads of the governments of the member states formally announced a solution to the political problems of Cyprus was not a precondition for Cyprus joining the EU. In their formal announcement, the heads of state stated:

"*The European Council underlines that a political settlement will facilitate the accession of Cyprus to the European Union. If no settlement has been reached by the completion of accession negotiations, the Council's decision on accession will be made without the above being a precondition. In this the Council will take into account all relevant factors"*.

By December 2002, Cyprus was the first of the Candidate countries to complete accession negotiations according to the agreed road map. The sustained efforts for the timely completion of the accession negotiations culminated in the unprecedented and historic milestone decision, reached at the Copenhagen European Council in December 2003, to admit Cyprus, together with nine other countries, as a new member state of the European Union.

The Accession Treaty was signed in Athens on 16 April 2003. Cyprus ratified the Treaty in July 2003. That Treaty came into effect on 1 May 2004. One of the protocols on Cyprus that was annexed to the Treaty provides for the suspension of the application of the acquis in the northern Turkish occupied part of the island, to be lifted in the event of a solution. It also states that the E.U is ready to "accommodate the terms of a settlement in line with the principles on which the EU is founded" and expresses the desire that the accession of Cyprus should benefit all Cypriots.

National interest has undoubtedly played a crucial role of states for foreign policy and political movements. «National interest is the interest of a state, usually as defined by its government. Use by politicians in seeking support for a particular course of action, especially in foreign policy, or use as a tool for analyzing foreign policy particularly by political realist. The national interest is merely what the politician says the national interest is[5]». Usually the kinds of national interest are economic reasons, political reasons, security and military reasons.

The main reason that Cyprus prompted to this progress, of the application in the European Community for been a full member was the political problem and the security of the island[6].

It must be stated that the whole political spectrum of Cyprus saw the accession course as a vision to belong to the wider European family where the rule of law and respect of human rights prevail, and as a way of securing the island against any further military advances of Turkey and as a lever of solving the long lasting division of the island by putting pressure on Turkey[7].

Therefore, a pre-accession strategy was formulated to prepare Cyprus for its accession to the EU, which included the establishment of a structured dialogue between the two sides. This dialogue, which also included a political dialogue on all levels, was particularly useful in helping Cyprus to harmonize its legislation, policies and practices with the European acquis and prepare itself for a smooth transition for membership. Cyprus was also able to participate fully in certain Community Programmes, including Leonardo da Vinci, Socrates and Youth for Europe.

On 12 March 1998, the President of the Republic of Cyprus presented an invitation to the Turkish Cypriots to appoint representatives as full members of the negotiating team for the accession of Cyprus to the EU. The Turkish Cypriot leadership rejected this invitation, which was fully endorsed and welcomed by all the EU member-states.

In Nice, on 8 December 2000, the European Council welcomed and expressed its strong support to the efforts of the United Nations Secretary-General to achieve an overall settlement of the Cyprus problem, which would be consistent with the UN Security Council Resolutions, thus positively concluding the process initiated in December 1999. Finally, it appealed to all the parties concerned to contribute to the efforts made to this effect.

In Goteborg, in June 2001, the desired time frame for the first accessions was clearly set out by the European Council, in order to enable the EU to define the progress made in the negotiations and to mark out the finishing line for those applicants, including Cyprus, that were adequately prepared.

Cyprus, along with the other nine acceding countries - Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia - were become a full EU Member State on 1 May 2004. Until then Cyprus was participated as an active observer in the work and the institutions of the European Union[8].

In March 1998, the former President of the Republic of Cyprus, Mr. George Vassiliou, was appointed Chief Negotiator for the Negotiations for the Accession of Cyprus to the EU and Coordinator of the Harmonization process. The first stage of the accession negotiations, which was initiated with Cyprus on 3 April 1998, involved the analytical examination of the Acquis Communautaire, a process known as the Acquis screening. This process was designed to determine the areas where the necessary changes in Cypriot law need to take place in order to harmonize it with EU legislation. The acquis screening phase of the negotiations was concluded in 2000, covering the new *acquis* up to 1 January 2000.

Since then, the screening process took place in the framework of the accession negotiations. Since the opening of the accession negotiations, substantial discussions on the individual chapters of the *acquis* started on 10 November 1998.

Cyprus' political priorities were essentially altered after the submission of its applications in 1990. After the collapsing of the Soviet block "…the European Union has developed into a new center of power towards which most outside states on the continent the socializing" (R. Varnen, 363, 1995). This had a serious effect on Cyprus political parties and especially the Communist party AKEL. Under conditions of international bipolarity many internal choices were made according to the convergence towards the models provided by the tow superpowers. This goes to tandem with Simon Hix's (1999) argument that ideological, social and economic predispositions influence parties' position for or against the EU.

The four major parties (AKEL, DISY, DIKO, and EDEK) have configured their choices and position towards European Integration under the pressures of the bipolarity system of cold war and the resulting cleavages of class and nationalism. Whether sited left or right on the ideology axes accordingly were their position articulated[9]. This was the case until 1990. In effect even parties with a negative stance against E.U in the past may be realizing that there is no realistic alternative to being pro-EU. Up to date though there is still a significant difference in parties' position towards the EU but on a different level now.

Since 1990, the date that Cyprus submits its application, AKEL was against the accession in the European Union for ideologist reasons. From 1995 and after AKEL has been changed placed, through Congress decisions, and it was for the idea that Cyprus should pursue accession to the European Union, because as AKEL said, European Union may help to solve the political problem of the island[10].

AKEL is now an affiliate member of the Confederal Group of the European United Left/Nordic Green Left and was elect members for the Euro-parliament Mr. Adamos Adamou and Mr. Kyriacos Triantafyllides.

DISY's position towards the European Union was strongly in favor ever since the party came to existence in 1976. EU membership represented an ideological and political target for the party. DISY saw the accession of Cyprus in the European Union a confirmation of its visionary policy. DISY is today affiliate with the Group of the European People's Party and European Democrats. Since the last Euro-elections in April 2004, from DISY were elected Mr. Giannakis Kasoulides and Mr Panagiotis Demetriou, as participants in the Euro-parliament.

Like DISY and DIKO was strongly in favor of EU membership both for ideological and political reasons too.

DIKO has been facing an identity crisis since the collapse of the Soviet block, which resulted, to the inability of affiliating to any party family in the European Parliament. The party became an affiliate member of the Group of European Liberal, Democrat and Reform Party and in the last Euro-elections from DIKO was elected Mr. Marios Matsakis.

EDEK is strongly influenced by the Greek socialist Party PASOK and almost follows its strategic choices. One of them was the EU membership as a security mechanism strategic against any Turkish advancement. EDEK is also the party that exploits more than any other, its European bonds with other Socialist Parties.

The accession of Greece to the European Community in 1981 led to a more active community policy towards the Cyprus problem with the aim of intensifying the efforts for reaching a negotiated solution within the framework of the United Nations.

On November 16, 1983 the ten member states of the European Community issued a common statement strongly rejecting the declaration purporting to establish a "Turkish Republic of Northern Cyprus", in disregard of successive resolutions of the United Nations.

Likewise, when in June 1985 the regime in the occupied part of Cyprus proceeded with organising so-called "presidential elections", the Ten issued a statement (10 June

1985) reiterating, "they do not recognise the "Turkish Republic of Northern Cyprus" and therefore would not recognize any so-called "constitutional" development in “Northern Cyprus".

The European Council, at its meeting held in Dublin on 25 – 26 June 1990, following the discussion of the Cyprus problem adopted the following declaration: "The European Council discussed the Cyprus question in the light of the impasse in the intercommunal dialogue.

The European Council deeply concerned at the situation, fully reaffirms its previous declarations and its support for the unity, independence, sovereignty and territorial integrity of Cyprus in accordance with the relevant UN resolutions. Reiterating that the Cyprus problem affects E.C. - Turkey relations, and bearing in mind the importance of those relations, it stresses the need for the prompt elimination of the obstacles that are preventing the pursuit of effective intercommunal talks aimed at finding a just and viable solution to the question of Cyprus on the basis of the mission of good offices of the Secretary General, as it was recently reaffirmed by resolution 649/90 of the Security Council".

As a consequence of the application by the Republic of Cyprus for membership to the European Community (4 July 1990), the interest of the Community regarding the Cyprus problem was substantially increased.

The EU observer followed the talks, which were once more led to a failure by the Turkish Cypriot leader Mr. Rauf Denktas. The Secretary General, reporting to the Security Council on the talks stated "The Security Council finds itself faced with an already familiar scenario: the absence of agreement due essentially to a lack of political will on the Turkish Cypriot side"[11].

Reaffirming its decisions taken at Copenhagen regarding Cyprus' accession to the EU, the Brussels European Council (March 2003) also touched upon the developments in Cyprus and expressed regret that the efforts of the UN Secretary General to find a comprehensive settlement of the Cyprus problem have not produced any results. In its conclusions, the Council expressed strong support for the continuation of the Secretary General's good offices mission and of negotiations on the basis of his proposals and urged all parties concerned, and in particular the Turkish Cypriot leadership, to reconsider its position and continue the efforts towards a just, viable and functional settlement.

On April 16, 2003 the Republic of Cyprus signed in Athens, along with nine other acceding countries, the Treaty of Accession to the European Union. President Papadopoulos, in a statement he delivered during the signing ceremony, expressed "regret that the artificial walls of division and the line of separation that was imposed by force prevent our Turkish Cypriot compatriots from proceeding with us, within the framework of a reunited Cyprus, on the way to Europe". While reiterating his "firm commitment to exert every effort to achieve a peaceful, workable and viable solution to the Cyprus problem, which will reunite the people and the country" he expurgated that accession does not mean, "That we shall give up our sincere efforts to resolve the problem. On the contrary, we now feel that it is all the more imperative to multiply our efforts to achieve a workable solution that will allow the implementation of the acquis communitarian throughout the territory of the Republic of Cyprus, and will reverse the tragic division of our country in a united Europe".

From the first of May 2004, Cyprus is one out of 10 new members in the European Union, and can count on E.U for many problems; one of those is the Cyprus Problem.

Over the years, the United Nations has made repeated demands for Turkey to withdraw its droops.

On November 1st 1974, the UN General Assembly unanimously adopted resolution 3212 calling for the respect of the sovereignty, independence, territorial integrity and nonalignment of the Republic of Cyprus. Resolution after resolution has been passed since 1974[12].

The latest effort for the solution of the Cyprus problem was initiated following the United Nations Security Council Resolution 1250 (1999), which requested the United Nations Secretary-General to convene negotiations according to United Nations resolutions.

Within the framework of this initiative, the President of the Republic of Cyprus, Mr. Glafcos Clerides, in his capacity as the leader of the Greek Cypriot Community, and the Turkish Cypriot leader, Mr. Rauf Denktash, took part in five rounds of proximity talks as follows: New York, 3-14 December 1999, Geneva, 31 January-12 February 2000, Geneva, 5-12 July 2000, 24 July-4 August 2000, New York, 12-20 September 2000, Geneva, 1-10 November 2000.

On November 11, 2002, the UN Secretary-General conveyed to the two sides a detailed plan for a comprehensive settlement of the Cyprus problem, asking the two leaders to give an initial response to the plan within a week. On 18 November 2002, President Clerides handed the reply of the Greek Cypriot side to Mr. Alvaro De Soto, expressing his readiness to start negotiations without any delay on the basis of the document that was before the two sides. The Turkish Cypriot side, replied belatedly on November 27, 2002 indicating it wished to negotiate the plan of the Secretary General while stating that certain of its provisions constituted a source of grave concern and should therefore be taken up and clarified.

Also on 13 December 2002, the European Council at Copenhagen decided, that Cyprus together with nine other candidate countries would accede to the European Union on 1 May 2004. On the same day, the Spokesman of the UN Secretary-General Mr. Fred Eckhard, stated, "*An opportunity remains, particularly until 28 February, to resolve this problem and achieve a comprehensive settlement, which would allow a reunited Cyprus to accede to the European Union".*

On April 7, 2003, the U.N. Secretary-General's report on his mission of good offices in Cyprus was officially released. The report objectively demonstrated the negative attitude of the Turkish Cypriot leader throughout the three-year negotiating process since 1999 and the constructive approach adopted by the Greek Cypriot side.

The first decision that concerned Cyprus it was just before the submission of the application. At 26th of June 1990, European Union rejected Turkey's application and the European Council state that the Cyprus problem influences the relations between European Union and Turkey[13].

All institutional organs of the Union (European Council, Council of Ministers, European Commission, European Parliament) focused their attention on the Cyprus problem with the aim of promoting a just and viable solution within the frame of the UN on the basis of the relevant United Nations Resolutions. Prominent among these, was the European Parliament, endowed with the legitimacy conferred to it through the direct election of its Members by the citizens of the Member States.

A significant development occurred at the Helsinki European Council in December 1999it was the most important decision that it was taken from the E.U concerned Cyprus. The article 9*(a) The European Council welcomes the launch of the talks aiming at a comprehensive settlement of the Cyprus problem on 3 December in New York and expresses its strong support for the UN Secretary-General's efforts to bring the process to a successful conclusion.(b) The European Council underlines that a political settlement will facilitate the accession of Cyprus to the European Union. If no settlement has been reached by the completion of accession negotiations, the Council's decision on accession will be made without the above being a precondition. In this the Council will take account of all relevant factors."* That decision on one hand meant that the European Union disconnect Cyprus problem from Cyprus accession course. But on the other hand, European Union it will search the reason that the problem it will be still unsolved and then if it wasn't Cyprus fault then Cyprus will continue its accession course ("…the Council will take account of all relevant factors…").

Finally, it was the decision of the European Council that take place at Copenhagen (December 2002) that the negotiations actually ended and Cyprus, with other 9 countries it was a part of the large enlargement and it was typical a member in the European Union[14].

CYPRUS AND THE EUROPEAN UNION AFTER THE ACCESSION

Since 1990, which the country applies for accession in the European Union, the first and major reason was the political problem and the increase of safety of the island[15], despite the economic, social and other reasons.

The national interest for Cyprus' membership in the European Union is springs from the willing for safety in the wider political scene. Turkey's expansive disposals about Cyprus couldn't exist from the time that Cyprus is a member in the European Union, and Turkey starts accession negotiations[16]. Also the island it will be a part of a wider "family" of states, and of the problems and many decision will taking place in Brussels in the longer-term. Moreover, economic benefits will have effect in Cypriot environment and Cyprus may constitute the link between Europe, Middle East, Asia and Africa. In addition, Europe could constitute a large market for Cyprus products.

As it concerns the political interest, the European Union will shape in a confederation and maybe in long-term a federation like USA type. Because of that any countries will be parts of that federation it will benefit better that United Nations. United Nations some times characterized by weaknesses and that are, mainly, because of its composition. Various interests prevent the effectiveness, for example Cyprus accomplished to obtain many resolutions about Cyprus but none of them under the chapter 7. But as a part of the European Union its different the point is how is this develop for now on.

The government of Cyprus believes that the country's accession will act as a catalyst towards a solution to the political problem of Cyprus, a belief which is largely shared by the EU. It also believes Cyprus' membership of the European Union will ensure this security, human rights and prosperity of all Cypriots – Greek and Turks alike[17].

After the accession, same with before the accession, European Union has taken a firm position in support of a solution that respects the sovereignty, independence, territorial integrity and unity of the country, n accordance with the relevant UN resolutions and the high level agreements between the Greek and Turkish Cypriot communities.

In addition, after the referendum, in Luxemburg, the E.U council, noting the results on a settlement plan to the Cyprus problem, expressed its strong regret that the accession to the EU of a united Cyprus would not be possible on 1 May, as well as its determination to ensure that the people of Cyprus would soon achieved their shared destiny as citizens of a united Cyprus in the European Union.

Also after the accession there was the "Green Line Regulation", on the regime of article 2 of the protocol 10[18], who said that "*The European Council has repeatedly underlined its strong preference for accession by a reunited Cyprus…pending a settlement, the application of the acquis upon accession has therefore been suspended pursuant to article 1(1) of Protocol no.10 in the areas of the Republic of Cyprus in which the Government of The Republic of Cyprus doesn't exercise effective control.."* The protocol 10 is about Cyprus Problem as the majority of the European protocols that concern member states, is a medium solution is a decision that it is in favor of the both sites of the island.

The Turkish Cypriots saw in the EU a way of escaping from the isolation imposed to them after the Turkish invasion in 1974 and thus increasing their living standards, reduce unemployment and enjoy all the benefits of being a European citizen[19]. The huge influence of the EU and Cyprus' accession course on the possibility of reuniting the island and finding ways of communicating with the Turkish Cypriots was also stressed by all political leaders of the Greek Cypriot parties during the discussions in the Parliament for the approval of the country's budget for 2003[20].

The EU has also promoted the bicommunal cooperation and exercised pressures for the solution of the problem so that a unified country enters the community despite the fact that at the end of the day that didn't happen[21]. Not only political pressures were exercised through the political decisions of the Union regarding the courses of both Cyprus and Turkey to the Community[22].

BENEFITS OF THE MEMBERSHIP

Since the accession on 1 May 2004, Cyprus has undergone significant economic landscape. Tariffs and quantitative restrictions have been eliminated for all manufactured goods and agricultural products originating in Cyprus and other EU countries[23].

Access of Cypriot goods and services to a huge single market consisting at present of the 15 most economically advanced countries in Europe, with a population of over 370 million, a gross national product of $7,269,116 m, and imports of $1,644,806 million. (1992 data source IBRD Atlas).

The geographic position of the country, routes linking Europe to Middle East and Asia. Cyprus aspires to become the region's economic and financial operations centre, a major communications and transport hub.

The political advantages from the E.U membership are extremely important for both the two main communities of the island and for the State itself. The main benefits being Improvement of relations between the Greek and Turkish communities of Cyprus by following the example of, and participating in the mechanisms developed by, the European Union. Cyprus will benefit from the experience gained in Europe in building bridges between peoples and communities, as well as from participation in the European integration mechanisms.

The Turkish Cypriots are benefit as single persons from Cyprus membership in the EU[24]. Social conditions will be brought up to European levels, free education and chances to work in any European Country for young people who has Cypriot identity card and a more liberal and acceptable form of democracy exercised.

CONCLUSION

In conclusion, and after a long research about Cyprus accession course and membership in the European Union, finally this study is come to finish.

Cyprus' accession course to the European Union was influenced and predetermined to a large extend by the need to promote a solution to the Cyprus problem. Despite the economic and social benefits expected (although there were voices pointing to the opposite direction[25]) by the people of Cyprus the need to terminate the division of the island was the guiding principle behind the application. The confirmation of this way of thinking came when the support to EU membership became apparent and intense in the Turkish Cypriot community creating a factor of coherence over the need to solve the problem and join the EU. EU representatives emphasized that EU membership could potentially allow the Turkish Cypriot part of Cyprus to improve economically.

In December of 1999 the "Helsinki Decision ", formally announced that a solution to the political problems of Cyprus was not a precondition for Cyprus joining the EU but a solution before the accession it was preferred.

After that, in Copenhagen 2002, the European Council decides that Cyprus will be part of the enlargement, besides the continuing division of the island. That was because of the decision that it wasn't Cyprus fault that the devision continues.

Both sides benefited from the EU membership but since the aqui communitaire is not valid on the occupied north, the most benefits resulted for the south part and the legal Government.
Now on Cyprus is a full member in the European Union. The benefits and national interest of the country are many. But the Mainer is the political problem of the island who hopes that the European Union helps to find a fair, viable and objective solution in the base of the resolution of the United Nations.

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From eGovernment to eSociety
- Challenges and Opportunities

Soren Duus Ostergaard
Senior eGovernment Advisor, MA Econ
Government Industry Solutions Leader
IBM North, East, Central Europe & Middle East
Nymollevej 91, 2800 Lyngby

ABSTRACT:

i2010 (Europe's new eGovernment objectives as accepted in 2006) is only a few years ahead. Will this help Europe to become one of the most competitive regions in the World – or do we need an even more radical approach? We all agree with Vivian Reding, that in Manchester UK in November 2005 declared that the strong link between national competitiveness and the quality and adaptability of public administration will be paramount to sustaining the social model Europeans have chosen and which the new member states are eagerly thriving to implement. This paper will try to set up some signposts and ideas for the approach to eGovernment that may lead to a faster, more thorough and hopefully more beneficial implementation of true 'eGovernment' while keeping the objective clearly ahead: Always have the citizens of Europe in the focus and the center of the changes. Let us always question changes that do not build on the strong belief that citizens come first, that social inclusion, respect for the individual and a truly connected society are among the fundamental values for our new Europe.

This is the time for radical change – but how do we come about this in Europe, rich on traditions, overwhelming in legislative details and increasingly short on skills and with a threa-tening demographic development ahead of most of the countries?

Keywords: eGovernment, eSociety, SOA, eHealth. Emergency Management. Case management, change management, i2010

1. WHAT ARE THE CHALLENGES FOR E-GOVERNMENT TODAY?

If you ask public decision makers in Europe this question, you will most likely get a combination of the following answers:

- Break down 'silos' and traditional ways of running the Public Sector – 'modernization'
- Lack of skills – pressure on education, 'life long learning'
- Increased pressure on Public Service – social services, health care services
- Continuous budget pressure – dramatically need to increase efficiency
- Social/technological divide – between member states/in each member state

And consider what I will call the maturity paradox: Even if the new EU-member states currently are 2-5 years behind 'old' Europe in terms of online services, internet penetration, etc., the solutions are MORE up-to-date, the growth rate is extremely higher and the mobility take-up, including take-up of mobile services in some cases ahead of the rest of Europe. And just because a member state has had an on-line service in place for 5 years, does not mean that it can easily be put into a total services context, let alone be left as a 100% self service solution.

In other words: The real challenge for the old member states is lack of agility in the current portfolio of solutions. We will look into ways to break up the old systems, 'silos' and how to re-vitalize the portfolio.

Lack of Skills, and particularly IT-skills, is rapidly becoming more and more evident in all countries. Combined with the gap between salary levels in the public and private sector, it is becoming even more difficult for the public IT-service organizations to fill the ranks. This leads to several actions: Outsourcing to India, China, import of skilled IT workers from overseas, a pressure on the educational system to increase take up of IT-students – but maybe other parts of the solution, that has not been so widely accepted, could be to set up shared service centers at a national or even at an international level, reducing duplication of effort and increase productivity of the IT staff. A minor, but not uninteresting aspect could be new ways of working, new tools for developing applications, portals, work flows and integration between systems.

2. CASES OF RADICAL CHANGES – SCENARIOS & WILD IDEAS – EUROPE 2010:

If we really want to meet these challenges, we have to think in new ways of working, new paradigms for public service and new settings and legislative approach. Let us try to think the unthinkable – and then identify how this might be done by applied ICT in an intelligent way:

2.1. Reduce Number of Authorities, Municipalities, Police Districts by 40-50%

Most of the European countries have organized themselves in Cities, Regions, Counties, 'Länder' and in a number of specialized ministries and semi-public institutions for, say, pensions, social insurance, public utilizes, railroads, roads etc.

Now, imagine a situation where 50% of the employees of all these organizations and institutions will go on pension next year. What will you do? Do you still think that having a local administrative center would be more important than having a 'service arm', that could provide public service to the needing? Why maintain old city-symbols, city halls, old boundaries between peers living close by and needing same skills, same services?

One scenarios for Europe's future would be to reduce the number of 'layers' between Government and the citizen, and to expand the numbers of citizen pr. Service unit without reducing quality, speed of service, responsibility nor citizen's political influence.

There is no doubt than in any country this would produce turmoil in the short term but in a prepared and managed transition it would be doable in most countries within the timeframe of i2010.

We will later look at ICT means, tools and strategies in dramatic changes like this!

2.2. Add Capacity of Health Care Sector by at least 33% without Budget Increase

Hospital standards, standards of primary care and definitely also payment schemes for the health care varies a lot between European countries. But a common problem is the lack of skilled doctors. In some countries the lack of doctors or GP's are really marked. Nurses are becoming scarce. And yet demand is ever increasing. How could we ever dream of inventing a 'radical shift' that could solve this, maybe the most severe problem of all?

A radical approach would be to look at who is taking up the beds at hospitals, taking up a huge and increasing proportion of public health care spending and then trying to look at completely new ways of reducing this. We know that more than 80% of all persons over 65 suffers from at least one chronic disease – COLD, Asthma, Diabetes, Hypertension, Chronic Heart Disease, depression, Arthritis.. Now, imagine a situation where we would turn the treatment upside down for all these types of patients, set up a completely new administrative and supporting system where at least 50% of these patients suddenly became self-reliant – able to live with their disease, monitor the disease and be able to survive with far fewer days in hospitals than before.

This will require, but is equally part of the scenario, that nurses are educated, trained and maybe monitored to take up special tasks, until now being performed by doctors, and also that (municipal) social service workers are educated, trained similarly to take up some of the nurses' traditionally more standardized work - at the same time leaving the patients to increase quality of an extended life.

2.3. Reduce Administrative Manpower for Case Management in Local and Central Government by at least 50%

When our trusted employees go on pension, the public administration suffers a great loss. With them goes the so-called tacit knowledge of the 19'th century, the finger touch of when to interfere, when to say no, when to investigate and dig a little further into an application.

Sadly as it may seem, this may the one big chance to make a revolution in public administration.

The good old tradition of public employees calls upon a mistrust and a sense of investigation skills every time a request, an application or a form is forwarded for a comment, for acceptance or the opposite. If we try to calculate how many applications, requests, queries etc. are being handled by public authorities and map the calendar time used and the manpower applied to looking into the data, comparing with existing databases, rejecting, explaining, correcting, communicating with peer authorities … then the idea of cutting this down to a minimum is quite obvious.

So the scenario is a future way of doing business where a 'customer' – citizen, company, exporter, importer etc. – selects the topic for which he or she is applying, finds the right way of entering UNIQUE information – and then leaves the processing, checking against regulations, filling in blanks from various existing databases etc. and finally producing an answer – not just a 'yes' or 'no', but an informatively rich answer, where reasons, laws, suggested actions are produced and displayed (in a secure way). This is not only a higher level of service, it is also a far less manpower consuming way of doing it.

Well, it is at this point STILL a scenario!

2.4. Establish a Pan-European co-operative Emergency Management System with full Transparency

Global warming means more extreme weather conditions. For Europe it means occasional, severe flooding caused by our great rivers, it means occasional wildfires in the central and southern European countries, and it means increased risk of severe storms in the Nordic countries. Plus, of course, the ever ongoing threat of pollution from oil vessels, leaking pipelines etc. And we should not at this point forget the threat of international terrorism.

To a decision maker that already is fully informed about the current status of each nation's emergency preparedness, it may seem more as a dream than for an ordinary citizen, that may believe the World is already at this point, but try to imagine this scenario:

Well, imagine a flooding of the river Danube, starting off in Germany and rapidly spreading through the landscape. Imagine a situation where the meteorological institutes in each country are working together with pre-warnings, where the German military, civil defense, local government municipal emergency squads are on the alert and linked to a management system that can help the managers decide where to leave out additional water and where to build dikes in coordination with neighbor countries, so you do not pass the buck to the next country downstream, but are able to establish a truly genuine pan European virtual control center for the benefit of all the citizens that would otherwise be left to fighting against the water.

So the last scenario is one where you are able dynamically, across language barriers, across differrent organizations and across even different IT-systems to set up an emergency control system that will enable communication with rescuing forces, fire brigades, ambulances, public utilities, civil defense, civil administration and ma6ybe also defense forces – across boundaries and languages.

3. WHERE ARE THE ICT TOOLS WE NEED FOR TRULY DISRUPTIVE TRANSFORMATIONS?

Well, these scenarios are but 4 out of a whole range of equally radical ideas that could be investigated or pursued. Each of this, if implemented, would surpass the ambitions of i2010 and would not only help making Europe more competitive but also make it a better and safer place to live. But the next question obviously is: Can it be done? Do we have any idea, tools or methods to make these scenarios come true? And this is where the final part of my presentation will take you.

I intend to cover some of the key themes for each scenario and illustrate by real-life cases where feasibility has been tested.

3. 1 - Tools for developing Change Competencies – learn as You go

Our scenario no. 1 described a drastic reduction in the number of authorities, maybe even skipping some of the traditional layers in a hierarchical, old-fashioned traditional administrative division of labor. This means that mayors will loose their chairs, managers will be relocated and a lot of civil servants will have to do something they haven't been doing before. This alone would, one believes, create a massive resistance and the word 'impossible' would probably be used.

Nonetheless an exercise of these dimensions is taking place right now in Denmark. With 5.5 million inhabitants Denmark used to have 271 local municipalities, some 55 police districts, 12 counties running hospitals, high schools, environment protection, road- and transportation services.

From January 1. this year the number of municipalities has shrunk to 98, police districts to 12, all counties have disappeared. 5 new regions have been established with the sole task of running hospitals under much more strict central control. Tax authorities have been centralized to government level, and other county tasks distributed to local government. City planning, economical development.

This change could definitely not have happened at any earlier date. If the level of sophistication and penetration of ICT into every part of the mission critical public services had not been at the level it is now, it would have taken another 10 years to accomplish in stead of the 2 calendar years in which the change actually happened. But we also learned a lot about training and education of civil servants and managers at all levels during the transition; The importance of effective tools and metho-dologies to help the participants describe and discuss business models, ICT requirements and not least needed redesign of public services.

In my presentation we will see one of the many cases where ICT planning methodologies helped the fusion of 2 municipalities into one new, efficient administrative unit. The most important lesson learned was how it was possible to increase the level of insight and understanding between the administrative staff and the IT staff and to ensure top management buy-in and understanding that without a well-functioning ICT infrastructure nothing would have succeeded.

3.2 - Enterprise Architecture - what is it?
The fundamental understanding of the design of a coherent and effective public administrative system is to apply the technique of Enterprise Architecture. This is a way of describing complex administrative systems and business processes, helping to pin point weak points or bottlenecks and to define 'to be' situations based on fundamental principles. The transition process from 'as is' and to 'to be' can then be described in a common language and each tasks can be prioritized in a way that is meaningful to all stakeholders.
The methodology is quickly spreading, originally used as a financial control mechanism in OMB, US department of Finance as a prerequisite for obtaining funding for IT projects, but now being used in several of the advanced countries around the World as a tool for transformation.
The presentation will give a snapshot overview of the differences between US, Canadian, Danish and other approaches to Enterprise Architecture.

3.3 - Health Care Reform – is it feasible?
Scenario number 2 points towards a complete re-thinking of the health sector. In stead of focused on healing sick people, that have become hospitalized, the objective will be to keep people out of hospitals, move the focus to preventive health care, healthy living and to increase the quality of life for the many suffering from chronic diseases. Because of the adverse demographic trend we will see a rapid growth in the number of elderly people, so it is simply the only way to avoid a collapse of our health sector as we know it

Keeping people out of hospitals means putting up systems to motivate people to live a healthier life, systems to identify diseases much earlier before they become incurable, and systems that can retain and rehabilitate patients that of some reason has to go to a specialist treatment at a hospital. We have worked with several projects under the headline of 'Telemedicine' that have aimed at making proof of concepts and to demonstrate that by deploying an intelligent use of ICT people could be monitored or even monitor themselves while living in their own homes and manage their diseases with little help from outside. A number of standardized interfaces to measuring equipment have been defined and developed with the result that by now we have a vast set of blood pressure, sugar content measurement tools and instruments for pulse, respiration, heart beats, pill dispensers, temperature, weight, gyroscopes for tracking 3D-movements, intelligent plasters to put on the skin in a non-intrusive way – and all these instruments and tools can be monitored, feed back given to the patient or citizen, confirming that everything is under control or suggesting slight changes in behavior, medical compliance – or maybe suggested exercises. In case of predefined or dynamically in-ferred abnormal deviations, alarms can be sent immediately to skilled and trained staff and to relatives or neighbors.

During my presentation I will describe 2 concrete projects and give an idea to how a benefit-cost analysis model can be constructed that will demonstrate to decision makers that investing in such systems can actually help drive down costs for the public sector while at the same time improve quality of life.

3.4 From Case Management to Citizen Managed Workflows
In scenario 3 we discussed the hypothesis that we might be able to save up to 50% of traditional case management work in the administrative parts of public administration. The evidence behind this hypothesis is actually based on a number of piece-by-piece projects that have been carried out over the last few years, some of which funded by EU, others established and pushed as a result of a strong political desire to change things dramatically.
As mentioned one of the reasons case management and administrative work takes up so much manpower is the traditional way of having a very strong division between the citizens (or compa-nies) and the public sector. The applicant fills in a form, answers a lot of questions defined by law and tradition and in this way laying out the framework for decision whether the applicant could be granted what he/she wants. What happens is that first all information in the form will be checked against existing databases. If the data does not belong to the agency in question, the request is being sent to the 'owner' agency to control the data keyed in by the applicant. Also some informal 'hearing' rules may be used to create a further check of the quality of data. When all this checking is over, decisions can be made. Yes or no. That much – or maybe less can be granted. Including advice on how and where you can complain of you do not agree.

During the early phases of the digital signature we tested the potential administrative savings in parts of the Danish social security system. One of the recurring and relatively heavy administrative tasks is reimbursement of salary payment due to illness of employees. After a certain number of days, an employer can apply for an (insurance-like) refund of a part of the employees salary.
The traditional, complex form had all the characteristics mentioned here.

But when you change the view point to modern eGovernment, it is obvious that almost all of the needed information to decide on the matter already was in some or other database within the public sector. As long as the employer and the employee were clearly identified by their digital signature, almost all information could be obtained automatically: income/salary information from tax department, address and family information from the personal registry, and so on. By introducing the concept of intelligent forms we demonstrated savings capabilities and a reduction in calendar time of more than 50%. In my presentation I will mention a few typical ICT-tools used with similar experiences.

The most IT-mature country in the World is amazingly enough Iceland. With only 450.000 inhabitants they normally never show up in intrnational comparisons. I intend to show the most advanced Citizen Self-Service Case Management System that has been developed here and is now being implemented internationally.

3.5 - Cross Border emergency Management 'on the fly'
Our final scenario dealth with the increased need for international coordination between different organizations in case of emergencies. Some countries have already implemented Tetranet as a means to have a secure and trusted set of frequencies that can be used to communicate in case of a crisis. The problem with Tetranet is that the bandwidth is so small that in practice it can only be used for voice communications. And this is not practical in multi-national emergency situations, even if you can talk on the secured frequencies. You need to exchange pictures, map, videos – share information on situation development, assets – fire engines, vehicles, ambulances, hospitals. You need to share and agree upon a control structure while having the first responders informed and up to date. Some countries have started to establish guidelines fo0r communication with neighboring countries, agreeing on special terms, 'meta data'. But we are far from a 'semantic web'.

The real challenge is also that you may never predict with whom you may want to communicate. You should be able to establish meta-directories of all parties involved and dynamically to map the progress of the situation in much the same way as the military act in it's concept of NCO - Network Centric Operations.
Based on experiences going back to '9-11' a set of building blocks for handling complex situations have been developed and tested in more than 18 major cases, one of which was actually the Football Championship in Munich in 2006, where the so-called RapidResponse solution was put to a test by the German police, fire brigades, ambulances and civil defense around the greater Munich area to be prepared for emergencies including terrorist attacks.
My presentation will give a short summary of major elements in a solution like this, describe the ICT architecture and some ideas of where this may be implemented.

4. CONCLUSIONS & RECOMMENDATIONS

Extracting the recommendation from the 4 scenarios we can point at a number of critical success factors and ideas for future development moving from eGovernment to a higher level of ICT which for now we will label eSociety:

- Describe key public services by an accepted standard for Enterprise Architecture
- Have all new legislation tested by a business modeler system – simulated, stress tested and tested for logic flaws.
- Use Open Standard as a mandatory requirement for ex change and for access to public databases across agencies and silos.
- Think in work flows and define the solutions from outside in
- Concentrate on building on a well defined integration model – an enterprise service bus as a prerequisite for a service -oriented public architecture.
- Let the Public sector act as a driver – but in a Public/ Private partnership when defining standards and open interfaces
- Be open for your neighbours experiences – and be open for sharing your own experiences – and not only the suc cesses!

Useful Links:

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[3] About mobile/**pervasive healthcare:**
http://www.zurich.ibm.com/pcc/index.html
[4] **Intelcities project** on case management and modernization:
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About the Author:

Soren Duus Ostergaard has worked with IBM since 1970 in a number of management positions, during the last 10 years as a senior eGovernment advisor for Europe, Middle East & Africa. He is responsible for identifying and implementing ICT solutions for Government and Health Care.
He is a member of the Danish Technology Council, an independent organization advising Government and Parliament on technology issues and opportunities. He has participated as a partner or subcontractor in a number of EU projects since 1988, has been an evaluator and external expert for EU in a number of matters from Multimedia to Security. He is an external censor for the Danish IT University in Copenhagen for eBusiness, Enterprisee Architecture etc
He has recently been appointed as a member of the IT Council for Greenland and as a chairman of Alexan dra Institute/University of Aarhus Research centre for Security.

Contact: sdo@dk.ibm.com

Virtual Reality 3D Models for Urban Planning and Communication

Rosa Peral
Virtual Reality Division
EUVE (European Virtual Enginnering)
Vitoria-Gasteiz, Spain
rperal@euve.org
and
Diego Sagasti
Virtual Reality Division
EUVE (European Virtual Enginnering)
Vitoria-Gasteiz, Spain
dsagasti@euve.org
and
Sara Sillaurren
Virtual Reality Division
EUVE (European Virtual Enginnering)
Vitoria-Gasteiz, Spain
sillaurrens@euve.org

ABSTRACT

The Interactive Virtual 3D model is a very useful and more necessary tool in the stages of design, creation, study, acceptance and diffusion of a city-planning project. Its undeniable power, ease of use, portability, flexibility and utility makes it a completely integrated tool in the process of project development. It is also a perfect mean for the decision making for urbanism projects. Its multimedia nature makes an ideal way to show and to distribute the city-planning project to the public in general.

Keywords: urban simulation, real-time simulation, urban planning, virtual environment, public participation, urban design

1. INTRODUCTION

In order to obtain the viability, development and final execution of a new city-planning project the collaboration and agreement of stakeholders is necessary. The institutions, urban planners and users should reach a consensus to develop a city-planning project that will affect to all of them [1].

Nowadays, planning projects have to be divulged and made "visible" not only to government officials, engineers and administrators, but also to city-dwellers [3].

In this way, the goal of developing a 3D interactive model is to verify beforehand a variety of interventions or modifications for a particular area [3]. A virtual model allows us to observe, simulate and analyze the design project, as well as its behavior, in a much better way than a physical model.

2. BACKGROUND

Castilleja de Guzman is possibly the village with smaller superficial extension in Seville province (280 inhabitants registered in 1990). Its urban structure in those years corresponds more with a small mountain village that one territorially inserted in the greater urban sprawl of Andalusia and little far away from its capital, Seville.

It is from 1990 on, when the modification of the urban nucleus configuration begins, with the expansion process towards the north and the south already finalized. Interventions have been recently executed to the North and the South, which has supposed the creation of a second population center, separated from the main one by a highway and a non urban area.

In 1995 this plan development supposed numerous city-planning and administrative conflicts since the municipal corporation made possible and allowed to increase the sector density by reaching a maximum capacity of 800 houses.

This partial plan was designed with very rigid plots and outside from the topographic context generating a repetitive and suffocating disposition of leaned and staggered houses, with excessive height, terribly integrated in the natural landscape that surrounds them.

The institutional confrontation generated came to the standstill of the urbanization and construction process, annulling the municipal agreements, and leaving without legal cover the executed constructions and works to date

3. 3D INTEGRATED APPROACH

Objective Definition

In 2001 Galia company begins the collaboration with the new Municipal Corporation with the objective of equipping the municipality with a General Approach which allows the city-planning development in an ordered and balanced form, avoiding unwished environmental impacts and impelling solutions having sustainability as final goal. It is here where the work developed by EUVE technological center acquires special importance

Solution Search

Having into account that any urbanistic intervention was going to provoke confronted opinions and the local administration (as the autonomic one) would have been convinced of the kindness of the agreed proposal and that, inevitably, would arise some local group trying to provoke a crisis in the proposed solution, defending some interests that can be considered legitimate but that would bring face to face with the urbanizing process. It was analyzed the necessity to have a powerful tool which would serve to illustrate and to explain the project kindness and harmfulness [4].

Study, dissemination and project agreement

In the same way, the tool developed by EUVE technological center would have to serve in helping in the project study and design in all its stages, for the dissemination and easy understanding by users and institutions of its goodness, and for the project final acceptance by all the groups [5].

4. SOLUTION: 3D INTERACTIVE MODEL

With this objective, EUVE has developed an application of Virtual reality (whose content was agreed) by means of 3D visualization of urbanistic interventions and with voice over and explanatory texts, allows to observe the project final result in its environment (Figure 1)

Figure 1: View of the 3D model of Castilleja

3D Interactive model general features

The Virtual reality, in our case, is a technology of interactive visualization in real time, which offers the possibility of visualizing, interacting and manipulating information in a 3D real time environment [6].

The 3D Interactive Model allows to construct a new virtual world, similar to the real one, in which can be experimented the same sensations as in reality. This allows us to know beforehand the features of any architectonic project in which a single stone has still not been put yet [7].

The application will get:

- The same vision of a person walking on the streets not constructed yet,
- Knowing what is seen from the window of a future house or
- Looking from a bird's-eye view the layout of any non-existing village (Figure 2)

We can observe a detailed wall material of a specific building or the type of lamppost of a particular street, or seeing simultaneously a whole state from thousands meter height...

Figure 2: View from a bird's eye

Some of the 3D Interactive Model features are:

- Possibility of changing materials, textures, objects placement, or 3D object model and in that way see what is better
- To see the city-planning model at day or night
- How sun shade looks like in any day of the year
- Possibility of including dynamic elements, as the real circulation of vehicles, sources with water flowing, birds flying...

Imagination is the limit.

We can add multimedia information (text, image or video) to certain elements of the observed scene, which allows us to lead to a greater understanding of the visualized architectonic elements. For example, in the case of a building, besides observing it, it would be of interest to see images, videos, audio, ...

Another type of inmersive feature is the reality sensation or immersion capacity, where the existence of different elements can make the experience more or less real. It is different to see it in a computer screen, that in a CAVE, surrounded by screens, with glasses that allow the end user to see the scene in Stereo (to perceive three dimensions). The sound also can be in 3D, coming from the place from where it is created.

Special features of Castilleja Virtual Model

The Castilleja Interactive Virtual Model allows to visualize from any point of view the project general result and the specific interventions being made, to obtain data on all the new elements, to measure true altitudes of any element in the project (Figure 3), to visualize the location from Seville and to observe this city from Castilleja to know the final visibility ...

Figure 3: Feature of measuring true altitudes

This application allows cars automatic routes tracking, bicycles by the bike-route, flights on Seville through emblematic architectonic elements as the Giralda, the Torre del Oro, V Centennial bridge, ...

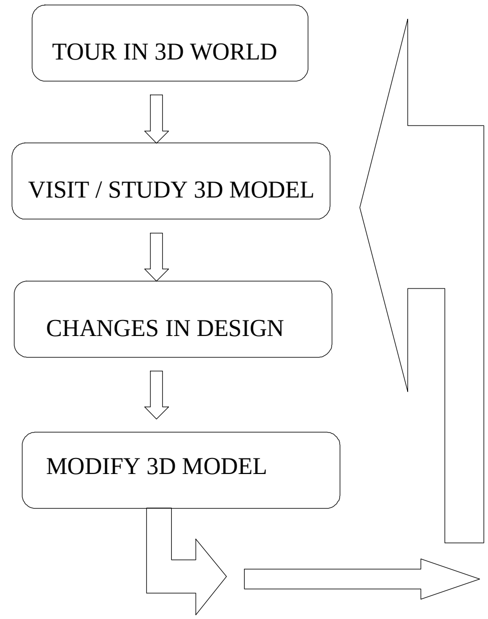
The application can also work in an interactive way, in which the user can choose what wants to see and where to move, to request information of which is saw or choose a tour by the zone. It has pre-fixed routes allowing to visit certain zones. Also it can work in an automatic way, in which different explanations are listened about what is being visualized, and it is showed a detailed vision of each urbanistic intervention.

5. RESULTS

A 3D interactive model allow us to observe, simulate and analyze the design project, as well as its behavior, in a much better way than physical models.

Furthermore, it allows the correct evaluation of outcomes and effects before a real interventions effectively occurs.

The main process for developing this interactive tools can be captured in the next graphic design:



We can conclude the 3D interactive model is a useful tool both in the study, dissemination and project agreement stages.

Study stage

The 3D Interactive model is a very powerful tool at the project study stage and the decision making. The ability to observe the project as a whole simultaneously to appreciate the individual elements with the level of wished detail, makes this application a much more powerful tool that a simple physical model. In the creation process of this particular 3D model, many changes and strategies were decided thanks to the visualization and the development of the 3D model. Although an architect or designer are used to interpret planes and have a vision of the project in their head, the observation of the virtual 3D model, can make them appreciate elements which are not obtained through the CAD planes. The result is a global, easy and intuitive vision, with much more new different points of view to work with. It is similar to observe a graph instead of reading an arid report.

For this case in particular, the 3D model was used in the project presentation to the Municipal Corporation. The plan was showed, according to the municipal interests. This presentation served to decide changes in the height of some buildings because they covered the vision from others. In order to be able to make this study, the interaction with the 3D model and the possibility of location anywhere is basic to contemplate the views. This study had been much more complicated and nothing intuitive if they had only worked with planes. The case that could easily occur is the buildings being constructed, without nobody realized about the problem until it were too late.

Dissemination stage

As element of information dissemination, the Virtual 3D model allows us, from making a multitudinous presentation in a giant screen to distributing the application on CD or by Internet, so that each user can operate with it in his own house with a simple personal computer.

The user takes an active role being able to interact with the 3D model, observing the interest points he prefers or he can be a passive subject and leave the application to show him the information by means of automatic flights and prefixed explanations.

A presentation was made with the 3D Interactive model of Castilleja, so that all the town inhabitants, could have knowledge about the project. After this presentation and during a month, the application was on the public disposal.

Project agreement stage

When showing the comprehensive project, the Virtual 3D model allows either to ordinary people or to the one in charge of the decision making, power to know in quite an approximate way how will the project look like and thus to obtain their final approval. After the presentation, the citizens had much more clear the urbanism work was being undertaken in the town of Castilleja de Guzmán. This fact is of basic importance for the citizen to accept the project as theirs and it is possible to arrive at a consensus between the institutions/authorities and the citizenship.

6. FUTURE WORK

The different possibilities the 3D models offers are countless. It is possible to get the 3D model evolving with the project and incorporating more detailed models of the new city-planning interventions in the project. Different models from urban furniture can be studied (lampposts, wastebaskets, banks, ...) and their impact with the rest of elements. A single click allows the possibility of changing all the lampposts of Castilleja, tiled of the sidewalks or even the location of different buildings.

7. CONCLUSIONS

It should be stressed that public institutions have been usually reluctant to the use of Virtual Reality as a relevant way of communication with citizens. In this way, this project is another evidence of a change in that trend, leveraging the budget with the efforts to involve all the social agents affected by an urbanistic change.

The originality of our approach comes from its high usability and cost-effectiveness.

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E-Government: Trends and Sophistication at the Local Level of Government

Tony E. Wohlers
History and Government, Cameron University
Lawton, Oklahoma 73505, United States

ABSTRACT

Innovations in information communication technologies have contributed to new forms of interaction between governments and citizens in the United States and other industrialized democracies. The adoption of these technologies at different levels of government has contributed to the emergence of electronic-government or e-government designed to communicate information, deliver services, and offer additional avenues designed to interact with and participate in government. Based on a detailed content analysis of government websites in conjunction with descriptive and multiple regression approaches, this study assesses and explains the level of e-government sophistication at the local level of government across different States in the United States. The study argues that local e-government sophistication increases for municipalities governed by professional managers, endowed with more organizational resources, characterized by higher socioeconomic levels, increasing population size, and located in the west. While the findings support the hypothesis, the descriptive analysis also illustrates that local governments have not fully embraced the potentials of e-government.

Keywords: e-government, assessing e-government sophistication, e-democracy, municipalities.

INTRODUCTION

Over the past two decades, innovations in information communication technologies have contributed to new forms of interaction between governments and citizens in the United States and other industrialized democracies. The adoption of these technologies at different levels of government has contributed to the emergence of electronic-government or e-government designed to communicate information, deliver services, and offer additional avenues designed to interact with and participation in government. An increasing body of research examines the breadth of e-government at the international and national levels, while a systematic analysis of e-government at the local level and across different population sizes remains scant. In an attempt to fill this gap, this study focuses on e-government at the local level of government.

Based on a detailed content analysis of government websites in conjunction with descriptive and multiple regression approaches, this study assesses and explains the level of e-government sophistication at the local level of government. The focus rests on small to relatively large municipalities located in the western, southern, and eastern regions of the United States. The study argues that e-government sophistication increases for municipalities governed by professional managers, endowed with more organizational resources, characterized by higher socioeconomic levels, increasing population, and located in the west. Following a brief review of the literature about current trends in e-government, this study defines the relevant concepts and introduces the methodological framework. The third part of the study analyzes the contents of local websites and the level of local e-government sophistication across a random sample of municipalities.

LITERATURE REVIEW

With the aim to encourage the use of the internet as a interactive tool of information retrieval, communication, transaction, and public outreach, many industrialized countries have embraced e-government [1; 6; 9; 19; 24; 29; 32]. The idea of e-government in the United States was born with the imagination of "interactive multi-access computer communities" by the late 1960s. Decades later, the idea of e-government crystallized with the release of the 1997 *Access America: Reengineering through Technology* [34]. For some, e-government can increase government efficiency and transparency and improve citizen-government interactions. However, technical, organizational, and cultural barriers continue to undermine the development e-government (29; 34; 35; 39; 43].

Optimistic forecasts in the 1980s predicted the emergence of an automated city hall to become a reality in the near future. Others took a more realistic point of view arguing that "new information technologies show about a 10-year lag period between introduction in local government and acceptance and routinization in a significant population of local government" [16, p. 25]. Within the last ten years, the use of the new information technologies at the local level has jumped from an estimated nine percent in 1995 to about ninety percent by the early 21st century [11]. Large governments units, especially those with city or metro status, governed by the professionally-driven council-manager form of government, and located in the west, adopted e-government earlier and to a greater extent than their counterparts [11; 21].

From a traditional bureaucratic paradigm, local government websites are mostly informative and limited to providing a range of basic one-way services rather than transactional services [30; 10; 11; 13; 14; 15; 30]. Responding to the information need of specific groups within the community, city e-government has evolved beyond this information-oriented stage. From both an e-government paradigm and a user-oriented portal design, local governments are in the process of centralizing their citizen-oriented e-communication channels. Residents can communicate with a *centrally managed service request system*, learn about community events and employment opportunities, acquire city governing body agendas and minutes [3; 10].

An increasing percentage of the cities offer online services, including the payment of utility bills, parking tickets, building permits, and taxes, submission for city job applications, and application for permits, license renewal, and property registration. Particularly, the professional influence of city managers on local governance "[strengthens] communication with the community" and seems to be conducive to the development and expansion of e-government at the local level [36, p. 161]. Accordingly, a series of cities, mostly guided by professional managers, have attained high levels of e-government sophistication [3; 21]. Despite these accomplishments, much more growth is possible, but especially the lack of a technology infrastructure, staff, financial resources, and expertise hamper further growth [11; 22].

Over the past few years, it has become increasingly possible to retrieve information about the local government and complete various governmental transactions online. On the surface, these ongoing efforts sound simple but, as claimed and illustrated by research, they can profoundly shape government-citizen relationships. The provision of government online services "will likely have a positive effect on levels of citizen trust and confidence in their governments" [26, p. 230]. Research by Caroline Tolbert and Karen Mosenberger [37] confirm this claim illustrating that the use of local government websites creates greater trust in local government.

Given this positive influence, greater accomplishments through information and communication technologies are possible. E-government can nourish a interactive and participatory democracy or e-democracy. At this stage, government websites are much more than high-speed highways flanked by billboards and a series of service stops along the way. E-democracy provides an opportunity to "extend public space [promoting] consultation and dialogue between citizens and their governments [18, p. 274].

Advocates of e-democracy generally stress e-democracy as an extension of governance [7; 17]. For them, the internet can be used to "enhance our democratic processes and provide increased opportunities for individuals and communities to interact with government for the government to seek input from the community [31, p 11]. Despite recent efforts by governments to encourage participation in online governance, only a few have attained a meaningful level of e-democracy (Riley and Riley 2003). Nevertheless, research points to promising advances made by local governments in the area of e-democracy. The City of St. Paul, Minnesota offers an email notification and personalization option, the Village of Hastings, New York provides a online input system, and Vienna, Austria hosts online public issue forums [7].

Studying websites in the hundred largest U.S. metropolitan statistical areas, James Scott [33] finds that most cities allow citizens to interact with elected officials and to utilize a variety of online services. This research also shows that while some cities try, only a few facilitate participatory democracy through online public dialogue and consultation [11; 33]. Several obstacles remain regarding e-democracy. They include the lack of information technology expertise to reduce errors and tampering with the system, the limited access of the poor to e-government, and the uneven telecommunication infrastructure across the country [2; 23; 38].

METHODOLOGY

As discussed by Ignace Snellen [35], e-government at the informative level provides basic information about government operations and services. Beyond this basic level, government can seek higher levels of e-government by allowing citizens to interact and communicate with government, conduct online transactions with government, and gain access to other aligned websites of public and even private nature [35]. E-government is defined as the "transformation process of the Public Administration as a whole and of its interaction with people; this process, through information and communication technologies (ICTs), aims at optimizing the provision of services, at increasing participation by citizens and enterprises…" [29, p. 24).

Typically, the implementation and assessment of e-government has relied on a sequential approach [5; 8; 21; 29; 33; 40; 42]. Accordingly, this study relies on a three-level approach to assess local e-government sophistication. It concerns the ability of local government websites to communicate information, offer a range of online services, and facilitate interaction with the government and the community. The billboards level emphasizes the display of information used by city residents to evaluate the performance of government and the elected officials. The service-delivery level allows multiple constituents, including city residents, businesses, visitors, to gain tangible benefits from the use of online services. The interactive democracy level offers a range of interactive features that facilitate encourage the interactive communication with and involvement in both the government and community.

Professional management, available organizational resources, and demographic characteristics influence the level of local e-government sophistication. In addition, this study argues that socioeconomic attainment is another influential variable. The respective indicators for the independent variables are: 1) the presence of professional managers; 2) the number of administrative full-time employees; 3) the population and regional location of municipalities; and 4) the percentage of both, residents with a college or professional degree and families living below the poverty line. The study argues that e-government sophistication increases for municipalities guided by professional managers, endowed with more organizational resources, characterized by higher socioeconomic levels, increasing population, and located in the western region of the United States.

To test the hypothesis, this study conducted a detailed content analysis of municipal websites between November 1, 2006 and January 15, 2007 to construct an additive index for the respective e-government sophistication levels. Descriptive and multiple regression approaches were used to analyze the data. Based on different population categories to include small, medium-sized and large municipalities, this study drew a disproportionate stratified sample of about 200 incorporated towns and cities in the States of Washington (WA), Wyoming (WY), Oklahoma (OK), Arkansas (AR), and Maine (MA). The United States 2005 census data, the Oklahoma Almanac (2005) and data collected by the respective municipal state associations served as the principal data sources to determine the municipalities' size, governing structure, organizational resources, and socioeconomic characteristics. To verify information and to close gaps in the data, numerous municipalities were contacted by email and telephone.

FINDINGS

Interesting patterns emerge regarding the presence and sophistication of e-government across the different population categories in terms of billboards, service delivery, and interactive democracy. As expected, the online presence of local governments increases as a function of a growing population. For the selected population categories, the presence of e-government for municipalities between 100 to 1,000 residents is about 13.0 percent. This relatively low, but visible, internet presence almost triples to about 36.0 percent for municipalities with a population between 1,001 and 2,000. From this point on, online presence increases further to about 80.0 percent for municipalities between 2,001 and 10,000 residents and eventually stabilizes at a fully comprehensive online presence for municipalities larger than 30,000 (see Figure 1).

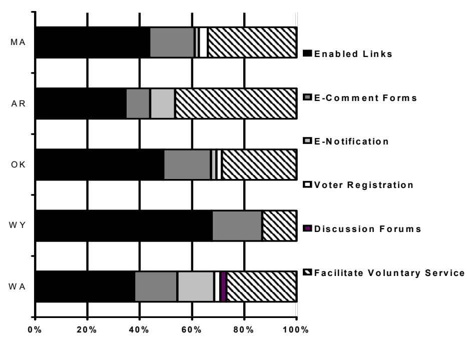

Figure 1: Online Presence by Population Category (in percent)

The descriptive analysis regarding e-government sophistication across the selected population categories illustrates similar patterns. As indicated by the respective billboards, service delivery, and interactive democracy mean scores in Figure 2, small municipalities with a population between 100 and 2,000 residents are generally characterized by low e-government sophistication. They only provide a few essential information nuggets about government via the internet and rarely expand into the more sophisticated service delivery and interactive democracy areas. A visible expansion into the service delivery and interactive democracy levels occurs for municipalities with a population of more than 2,000.

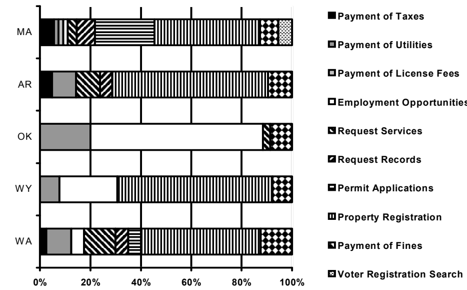

Figure 2: Local E-Government Sophistication by Population Category (mean scores)

Interesting patterns also emerge regarding the presence and sophistication of e-government across the municipalities in the selected States. Moving from the eastern to the western regions of the United States, localities in Maine and especially those in Wyoming and Washington have a much stronger website presence at the local level in comparison to their southern cousins. With an overall website presence at 71.7 percent, localities in Maine closely trail their counterparts in Washington (80.0 percent) and Wyoming (76.9 percent). In contrast, the online presence of municipalities in the States of Arkansas and Oklahoma drops to 54.2 percent and 53.2 percent, respectively (see Figure 3).

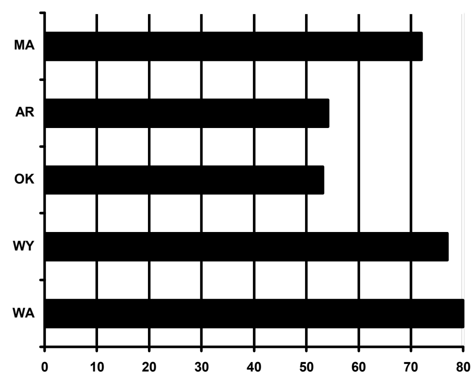

Figure 3: Online Presence by State (in percent)

Similar patterns emerge regarding e-government sophistication. Municipalities located in the east and west exhibit considerably higher levels of e-government sophistication than their counterparts in the south. Accordingly, the respective mean scores regarding billboards, service delivery, and interactive democracy for municipalities are 8.3, 2.2, and 2.7 for Maine, 10.0, 2.7, and 3.0 for Washington, and 9.0, 2.0, and 2.2 for Wyoming. The respective e-government sophistication mean scores in the south are much lower at 4.1, 0.9, and 1.0 for Arkansas municipalities and 5.4, 1.2, and 1.6 for the sampled municipalities in Oklahoma. In addition, the data reveals that the billboards level is by far the most developed area at the local level compared to the more sophisticated service delivery and the interactive democracy levels (see Figure 4).

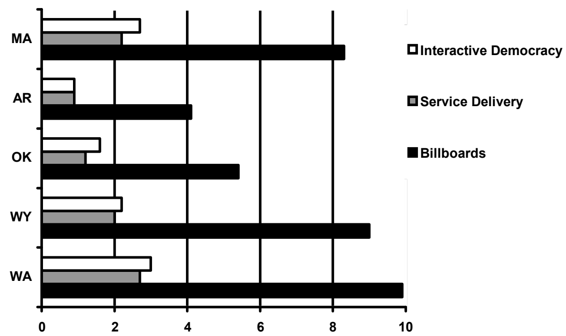

Figure 4: Local E-Government Sophistication by State (mean scores)

The prevalence of the specific content items associated with the billboards, delivery, and the interactive democracy levels are a reflection of the previous trends. In contrast to municipalities in the south, those in the east and west offer a broader array of information, ranging from the current government structures to information about the missions of and services provided by city hall. Particularly, the most prevalent information provided via the internet include news and notices, regulations and ordinances, council minutes, council agendas, and email contacts of the elected officials. Background information about the elected officials and commission agendas are the least common municipal online information features (see Figure 5).

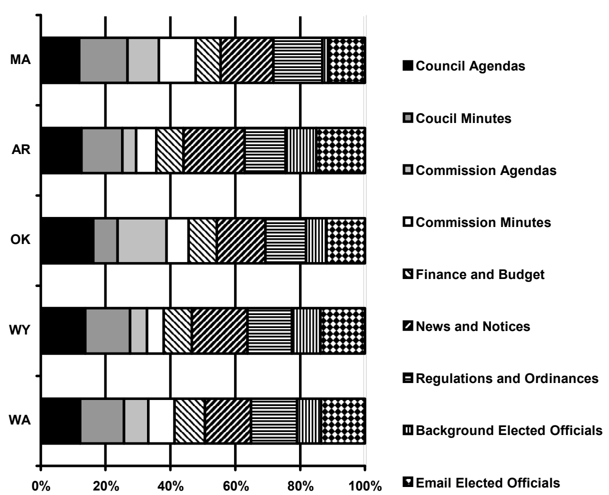

Figure 5: Billboards Contents by State (in percent)

The service delivery and interactive democracy levels are the least developed e-government areas. Accordingly, only a few specific services and interactive democracy tools are offered online on a consistent basis. Nevertheless, trends are visible. The most consistent service delivery items across municipalities include the payment of utility bills and fines, while the possibility of registering property through the internet is a common online feature for municipalities located in the east and west. In contrast, only a fraction of municipalities allows residents to apply for permits and search voter registration databases (see Figure 6).

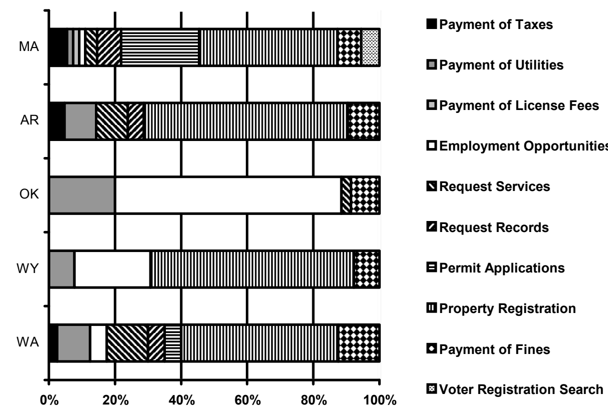

Figure 6: Service Delivery Contents by State (in percent)

Communities are also in the early stages of nourishing interactive democracy. Through enabled links, numerous municipalities, particularly in the east and west, allow residents to learn about and get involved in civic organizations, such as churches, youth organizations, and other volunteer organizations. Other common interactive democracy online features are the availability of online comment forms to ascertain input from residents and the explicit encouragement by city halls to volunteer for services on government and civic organization committees or boards (see Figure 7).

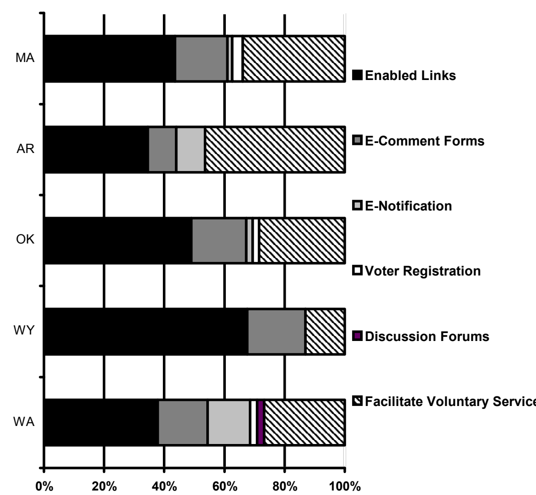

Figure 7: Interactive Democracy Contents by State (in percent)

In addition to the population and location of municipalities, the specific administrative perspective provided by professional managers makes a difference in each State. Municipalities guided by professional managers tend to have a stronger online presence than those without. In fact, municipalities with professional managers in Oklahoma and Arkansas are able to more than double their online presence. With the exception of a few municipalities in Oklahoma and Maine, municipalities with a professional manager in the States of Washington, Wyoming, and Arkansas have a fully comprehensive website presence (see Figure 8).

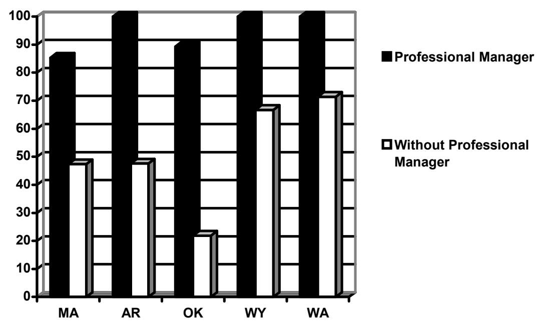

Figure 8: Online Presence by Professional Management (in percent)

As expected, the degree of local e-government sophistication in each state varies considerably with the presence or lack of professional managers. Accordingly, Table 1 indicates that the use of the internet by local governments as a means to provide information, services, and opportunities to interact with the government strengthens for those communities with professional managers. Depending on the specific level of e-government sophistication, this is again most obvious for communities in Oklahoma and Arkansas. The presence of professional managers in these states coincides with a four to twenty-three fold increase in the respective mean scores for billboards, service delivery, and interactive democracy.

		Local E-Government Sophistication		
State	Professional Management	Billboards	Service Delivery	Interactive Democracy
MA	With	10.6	3.0	3.6
	Without	4.0	0.7	1.0
AR	With	12.6	3.6	2.6
	Without	2.9	0.4	0.6
OK	With	10.0	2.3	2.9
	Without	1.2	0.1	0.4
WY	With	12.5	3.0	3.5
	Without	7.3	1.5	1.5
WA	With	14.8	3.5	4.6
	Without	7.7	2.2	2.1

Table 1: Local E-Government Sophistication by Professional Management (mean scores)

The multiple regression analysis presented in Table 2 confirms most of the previous trends. The models estimating the influence of professional management, organizational resources, socioeconomic characteristics, population, and location on the level of local e-government sophistication in terms of billboards, service delivery, and interactive democracy yield influential and statistically significant coefficients. As suggested by the research literature, professional management and educational attainment are consistently influential and significant across the models. The remaining determinants of local e-government sophistication mostly behave as expected but are not consistently significant. Overall, the respective R squares adjusted suggest that the combined influence of the independent variables explain 45-51 percent of the variation in the dependent variables.

Particularly, municipalities located in the west tend to perform better in terms of e-government sophistication compared to those located in the south. In contrast to southern municipalities, there is a consistent positive relationship between municipalities in the west and their level of e-government sophistication. Furthermore, there is a consistent but negative relationship between families below poverty line and local e-government sophistication. However, as with municipalities located in the west, this variable is only significant in relation to the billboards model. To some extent, these patterns are also visible regarding the influence of population, which, interestingly, has an exclusive significant positive and negative influence on the billboards and service delivery levels, respectively. The most important variables contributing consistently and positively to local e-government sophistication at p = <0.006 are the educational attainment of residents and especially the presence of professional managers.

	Billboards	Service Delivery	Interactive Democracy
Professional Management	.420 (.754)***	.307 (.308)***	.346 (.312)***
Fulltime Employees	-.454 (.002)**	.811 (.001)***	.011 (.000)
College/Professional Degree	.199 (.075)***	.172 (.031)***	.220 (.031)***
Families below Poverty Line	-.129 (.060)**	-.069 (.025)	-.070 (.025)
Population	.686 (.000)***	-.347 (.000)*	.331 (.001)
Region (West)	.167 (1.027)**	.090 (.419)	.057 (.425)
Region (South)	-.054 (.913)	-.053 (.373)	-.095 (.377)
Constant	3.689 (1.149)**	.608 (.469)	.805 (.475)*
R Square	.526	.499	.467
Adjusted R Square	.508	.480	.447
F	28.715***	25.771***	22.669***
N	204	204	204

* p = < 0.1 ** p = < 0.06 *** p = < 0.006
Note: The numbers are the standardized least squares regression coefficients, with the standard error in parentheses. The number of asterisks indicates the level of statistical significance. Tolerance statistics show that there is no multicollinearity in the models.

Table 2: Determinants of E-Government Sophistication

CONCLUSION

The findings show that many local websites associated with professional management, higher socioeconomic status, and located in the west embrace e-government and attain relatively high levels of e-government sophistication. These municipalities, in contrast to those that lack professional managers, are characterized by lower socioeconomic levels, and are located in the south, do particularly well in terms of providing a wide array of government related information. Beyond this information-driven billboards stage, local e-government performance regarding online service delivery and interactive democracy declines substantially and across the board. A relative small proportion of municipalities provide online services or facilitate a meaningful involvement of residents in government and in the community, as defined by the service delivery and the interactive democracy levels. Nevertheless, across these higher levels of e-government sophistication, municipalities characterized by stronger socioeconomic attainment and especially those with professional managers continue to outperform their counterparts.

As demonstrated by other scholars, the findings clearly suggest that local governments have widely embraced the internet as a tool to inform their residents. With respect to providing online services and enhancing democratic engagement through the new information communication technologies, local governments across the United States are still in the early stages of implementation. As such, despite the advances made in information communication technologies in recent decades, local governments in the United States have not fully acknowledged and realized the more advanced and probably more challenging stages of e-government. Given the rapid advancements in information communication technologies, this research encourages other scholars to discuss the policy implications of online service delivery and e-democracy and to expand the comparison of e-government sophistication to municipalities in this and other industrialized democracies.

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Social Aspects of ICT
A 21st Century Perspective

Prof. (Ret.) **PhD Amos Avny**
Omnidev International Consultants, Israel
amosav@smile.net.il

Abstract

ICT is a powerful instrument, which is a leading phenomenon in the changing 21st century affected by the technological advancement, globalization, and democratization processes. Although ICT combines three common elements as Information, Communication and Technology, every one of them receives new meaning in the 21st Century. As a product of human ingenuity they change as people change and they represent they cultural and social changes of the time. Thus, it is wrong to see ICT as a proper technological product and to disregard its cultural background. As a combination of cultural and technological factors, ICT has many forms and, therefore, also several social aspects, which are also affected by indigenous values and traditional customs

Key Words: Information, Communication, Technology, ICT socio-economic environment, Man-machine Relations, Explosion and Excess of information, Shallowness of knowledge.

Introduction

Information and Communication Technology (ICT) is today a popular buz word developed from another term, **Information Technology (IT).** Although many use the term ICT, but still, its meaning is not clear because it contains expressions from science, technology and social sciences, education, media and other public and business activities. Since ICT contains so many expressions it has also a different meaning in different places. History teaches us that a given phenomenon has different meaning to various people. Even what seems to one as hard facts, could be interpreted by others as an illusion (see for example the Raushoumon case). Another problem that emerges within today's complex environment is the availability of many forms of communication and information delivering methods. In this regard it can be said that the Post-modern communication reality takes us back in time to the pre-language ancient era, when people communicated without words by using shouts and cries, horns and Tam-Tam drums. Due to the availability of vast variety of linking forms the written word lost much of its crucial position. Television and other audio-visual devices deepened the comprehension that a real picture and an authentic presentation impress and have a greater effect than a written description. In politics and in social relations, in education and training, in art and sport, in all similar areas the audio-visual means prevail and are in their way to dominant communication.

This type of change pushes us to reexamine the meaning of ICT in the 21st Century. The paper starts with exploring the three components of ICT, Information, Communication and Technology and on this basis illustrates the ICT within its social environment. I further discuss the complexity of today's social environment in another article: "Future Challenges for the Judiciary" Avny (2006).

Information

Information is defined by Webster (1987) as: "**the communication of news, knowledge etc., a fact or facts told or communicated, data fed to a machine**". The dictionary does not relate to the form of the information or the data, and how it is delivered and is conveyed. It is fair to assume that Webster refers mostly to the traditional written or wordy information because these were the dominant ways of expression in the 20th Century.

The importance of dispersing credible facts and the desire to provide reliable information to the people was recognized by the American founding fathers who included in the Constitution a special clause, where The Congress is required: "To establish Post Office and Post Roads" (The Constitution, Article I, Section 8 (7), for informing educated citizens about what is going in government.. This fact indicates that statesmen and scientists in America like their colleagues in France and UK were aware of the importance of providing meaningful information to their fellow citizens.

Basically, information must have some meaning meaningless messages mostly are valueless. A group of characters, or a single tune usually, has no meaning and therefore cannot be seen as information. However, when they are incorporated within a written or a vocal sentence they become information. Sometimes it is impossible to collect meaningful information from a vague or a changing environment. In such cases every piece of data is recorded and only after a cumbersome process of processing and crosschecking the massage is understood.

In the past, most information was **written information,** which covered a wide range of expressions, messages and descriptions in the forms of written texts, papers and pamphlets that were delivered by hand or by mail. This was the case with scientific and academic information being delivered to relatively small groups of scholars, and this was also the case with other types of information being dispersed to the general public. Later on, this written information was broadcasted by the Radio or dispersed by the Telegraph. Common wisdom teaches that written words are more credible than insinuations, hints or other rumors and stories. Writers, journalists and informers, who produce the information usually take their duty much more serious when they have to present written texts. This language-based environment has changed in the last quarter of the 20^{th} Century, when the Television became one of the most important source and mean of information. In the 21^{st} Century other Audio-visual electronic devices become very popular, the scope of information expands dramatically and more people became consumers of information. The extended demand, beside the scientific and academic fields, forces the provision of large amounts of versatile data, vocal, visual, audio and other electronic forms. In this way information becomes a commodity, a mass product, which is provided to the general public in many forms, other than the traditional wordy forms. The information sources and providers have changed also due to the technological changes. The influence of serious writers and reporters also has diminished since everyone with a camera or a recorder, intentionally or unintentionally, can provide news. Although shortening the time needed for providing information assists in making it more relevant and updated, but, on the other hand, it also opened it to be more biased and less credible. Editors know quite well how to maneuver and manipulate photographed materials in accordance with their needs or with their audience's preferences. Although one picture impresses more than thousand words, nobody knows how and where this picture was taken.

I name the process of changing the information's nature as the **Democratization of Information,** which represents the transformation information, has passed during the past two hundred years.

Sorting information by its nature and form enables to understand better and have a more comprehensive picture of its content. Below information is categorized by type and form, quantity and quality, frequency and volume, sources and means of delivery.

The Type category includes all kinds of written and printed data, audio signals and visual pictures, musical tunes, and sometimes also wordless gestures and behavior. **The Form** category describes how the information is delivered, directly or indirectly, coded, or decoded by words, notes, graphic signs, or numbers. **Quantity** refers to the amount of data provided while **Quality** tries assessing its value. **Frequency** describes the rate of delivery information and **Volume** tells about its level of operation. Source reveals where the information is coming from while **Means of delivery** indicates how it is conveyed and distributed.

The analysis above indicates the failure of seeing information as a single flow of words, notes, signals etc. It would be more accurate to perceive **information as a multi-facet, omni-dimensional flow of notes and tones, signals, and records.** Very rarely one would find a homogenous, unequivocal, and explicit kind of information. Thus, when referring to information one should be concrete and specific in his or her claim.

Finally, I want to emphasize two points that characterizes general (not scientific) information in the 21^{st} Century: (**1**) **Quantity, (2) Credibility** or **Rating-oriented** information.

1). Quantity. As said, the technological development results with creating big amounts of Information, which is known as **Explosion of Information.** Very sophisticated devices, like cameras and other audio-visual instruments, originally developed for space exploration, were later used for collecting and processing information. Optical, Digital, and Wide band channels, the Internet and networks enable today conveying information and spread it all over the globe. As a result, big quantities of information are available at present for the public at real time.

This abundance of information challenges the 20^{th} century conventional perception that teaches that **more information yields better decisions.** Management theory teaches that right decisions can be made only after data is collected and processed and appropriate options are sorted out. Than, decision makers can review the options and select the most suitable one. This approach to decision-making, very common in the past, is not relevant any more.

At present, two other concerns occupy decision-makers' mind: **How to choose and select the suitable information from the big quantities of data available,** and **How properly to combine intuition and feelings with data when decisions are made?** President Clinton, (2004, p52) refers to this point when he wrote about an argument with his staff about aid policy to Russia and Yeltsin: "**I went with my gut instincts and placed a bet."** I would say it simply; sometimes it makes sense to ignore most information and relay mostly on one's intuition. Understanding that **quantity replaces today quality** could hint toward how to act vis-à-vis the large amounts of information.

The Explosion of Information, besides it positive contribution for knowledge acquisition, also has some potential dangers; it can **reduce the strive to learn** and it may promote the **swallowing of knowledge.** Laymen would ask themselves and others, why to invest long time and much money in acquiring knowledge, when so much information is available on the Internet and Google can easily replace every textbook and even a university class? I address this topic and others in another article; "ICT in Academia" (Avny 2006).

2) **Credibility. How the recipient accepts and understands the provided information** is another point of concern. The rating-oriented environment in which most of us live affects drastically the information and media world. This impact is so significant that penetrates also to science, technology and medicine. Since research depends on substantive donations, most scientists and scholars tend to provide information that will point to their future success. In this way private donors and public funds will be attracted to support potential winners. People love winners and the Media helps to find them.

The business world recognizes the importance of this point and promotes the customer's interest as the most critical factor in analyzing the firm's chances for success. This perspective is responsible for the present emergence of many management theories, which teaches how to satisfy customers, making end-users happy, and fulfilling buyers' expectations. Today it is quite obvious that technical information or data related to consumption is judged and assessed by its affect on the buyer. Information that drives and urges customers to act and make adequate decision is perceived as a valuable instrument for every organization. Unfortunately, education enterprises and learning institutions move very slowly on this track. Most of them, as the majority of the educators, tend to stick to their conventional approach, which pays more attention to the teacher's knowledge rather than to the student's understanding ability. An unsaid reason for this behavior could be the concealed belief that "this was the way I, my parents, and other prominent people were successfully brought up in the past, and there is no good reason to change teaching methods now." The fact that the world is changing is not convincing enough for causing those educators to adopt a more advanced teaching approach. For a broader discussion of this topic, see "ICT in Academia, Avny (2006).

The fact that information is provided in **real time**, crucial in sport and entertainment events, also has some deficiencies in building credibility. This situation enables unqualified people, reporters and TV anchors to broadcast their opinions on matters that they know very little about. Unfortunately, the principle of the "right of the people to know" is used here as an excuse for delivering instant information resting on a very shaky support. Human history and present experience teach that written information is more reliable than audio-visual scenes, even if it is not so impressive. Good writers and distinguished reporters also will agree on how much effort they put on every text they send to print, as compared with the easiness of broadcasting instant information.

Communication

Communication is a general term, which refers to all types of connections and links created among human beings. Although it is a very popular and common activity, which seems simple, in reality it is a complicated process. Communication is executed by three basic components: a **Transmitter**, a **Receiver,** and a system of **Channels** or **Links,** which connect between them. When one of these component fails or does not function well the whole operation stop working. The mutual dependence and the complexity of the system demand that the three components will carefully be assembled. If the three components do not fit, the transmitter is too strong or the receiver is too weak, the conveyed information is distorted or curtailed. Balancing and fine-tuning the system is, therefore, crucial for enabling smooth functioning. When, shortage of resources, or low maintenance awareness, prevents the system's preservation the quality of the operation deteriorates.

Frequently, the owners or the operators of the communication system disregard these technical issues. Commonly, information transmitters do not pay enough attention to the receiver's ability to understand or digest the message. Newspapers uses high sophisticated language for describing a simple occurrence, politicians speak eloquently to common people, or professors read from books they authored instead of providing a concrete and simple reply. Most transmitters and many teachers tend to send their messages, or to teach, in their own style and manner, without wondering whether they fits the receivers' mode of understanding.

In the past, the receiver's preferences were neglected since the transmitters were the important ones. They were, mostly, a small group of communication barons, media stars and prominent politicians, representing powerful interests. They lead the nation, they were the smart and the able and they have decided what should be delivered to the general public. A two hundred years struggle, commencing with the French Revolution and the establishing of the American Constitution, came to its end in the 21st century's Post-modern society**.** The business world had, for some years know, recognized the crucial position the customer has in today's reality. This understanding led to many changes in the business organizations. Public bodies and education institutions began to internalize this concept but it is difficult for them to make the required transformation. The information and communication environment also must realize that **the receiver becomes the ultimate objective of the communication networks.** In the era of mass media every part of the system, every promoter, reporter or informer depends on the receiver's opinion. The receiver's ability to consume, digest, and adopt messages is the criteria for assessing the quality of the communication system and the rating of its transmitted or broadcasted message. Consequently, end-user's assessment, or in other words, the rating, forces all the elements to fit to the consumer preferences.

The structure of a communication system and its level of functionality must fit to the type, quantity, and quality of the information it is designated to convey. As mentioned, information today usually is versatile and complex. Signals are coming simultaneously in different modes; they are transmitted from several sources, in different frequencies and changing volume. On the other side, mobile or cell phones demonstrate the popular, simple, and cheap solution for the masses. These phone systems, which expand tremendously during the past two decades, well demonstrate the importance of communication for ordinary people. They want to talk with each other, even if and when they have nothing to say.

The vast dispersion and popular use of Audio-Visual means for providing information, in contrast to the past popularity of the written words expresses quite well the meaning of the communication's revolution. The well-known saying that "one picture says more than thousand words" demonstrates also the power of the new means. Even Universities and education institutions would have no choice, they will have to incorporate some new teaching methods in their learning programs.

Technology

Technology is the driving power of our time. The second half of the 20th century could be characterized as the Scientific and Technological revolution period. This revolution changed almost everything in the fields of computers and communication. Although many technologies were developed for the space exploration and military requirements the inventions overflow and found their way to the civil market. Information and Communication Technology (ICT) is one of the products of this revolution. The digital ICT enables today to transmit, move, and receive tremendous amounts of information in real time. Similarly, it enables to collect, process, and spread big quantities of data in relatively very short time.

The importance of Communication Technology surpasses the trivial human need to get in touch with his/hers friends. This advanced technology, and all the instruments derived from it, fulfills an essential task in many scientific fields. Research of nature and human phenomena produces big quantities of information that must be processed and transferred to the right laboratories Space missions that send back home tones of information regarding all kinds of space occurrences, are only two examples for this demand.

The high level of technological development enables today to fulfill almost every human need, wish, or even caprice. The point is that **many do not know what to ask, or how to use the scientific potential available.** Some think that technology could resolve many social conflicts, while others negate any link between them. The truth is, as always, some were in the middle. A smart use of technical devices and high-tech equipment can assist public agencies to carry out their mission. An appropriate deployment of digital cameras in problematic areas, for example, can assist low enforcement agencies to survey and supervise criminal movements or illegal drug trafficking. Advanced medical technology succeeds in bettering the quality of life and prolonging life expectancy. But, the relations between people and their technological environment were complicated from the early days of human kind. I discuss below only one aspect of this issue.

Man-Machine Interface

Since the beginning of human history **Man-Machine Relations** were an important component in the emergence of civilizations, cultures and nations. One can say that the early struggles between nomad tribes and peasants were struggles on mastering one of the first machines, the primitive plough. Civilizations' history teaches us that human existence have been determined and led by the ability to master the technology of their time. For generations back a big part of technology was used for military purposes, while civil needs came later.

At the 20th century the balance change a little, but still large amounts of money were allocated to defense expenditure. Besides nuclear research and space exploration that were initiated by the military establishment, high-speed computers, sophisticated communication devices, and even the Internet, were originally designed for military uses. I emphasize this point because of its importance for shaping people behaviors. Within the defense world people were demanded and they agreed to fit themselves to the machines' requirements. As a result they were willing to be taught and trained to properly operate the defense equipment and machines. No question that this military technical training prepared, and well equipped them with skills that later were very demanded in civil life afterward.[1]

With the emergence of the affluent society in the "West," and the growing strive to sell more and more advanced equipment and machines manufacturers began understanding the importance of customer's comfort and satisfaction. During the last twenty years many books were written on the issue of how to make products more user-oriented and friendlier with their customers. In the consumption-oriented society of the 21st century customer satisfaction became almost the ultimate goal of every seller.

Unfortunately, the situation is different with regard of a big part of the Personal Computer (**PC**) business. Although the PC, and the Internet became very popular today, still many users are not able to fully use these instruments. **Human Computer Interactions (HCI)** are still a major issue in social life, which well demonstrates the gap between man and machine. HCI represent links between supposed to be an objective numb machines and subjective sensitive human beings. Such links are complex by their nature and are going to be even more complicated when they will become more popular, at the post-modern era. How to talk with machines, how to force them to execute exactly what we want, how to make them sensitive to our human gestures and intentions, and so on, all these are demands that a subjective human being is expecting to get from his/her objective mechanical counter partner. Every professional driver or pilot witness the creation of special relationships between them and their machines. They also know that in some crucial point, when technology is totally exploited, there is no choice but to talk and ask salvation from the engine's spirit. I dare to guess that when Lindberg[1] called his airplane "The Spirit of St. Louis," he believed that if needed, he would be able to be assisted by the engine's spirit on top of his courageous character.

These Human Computer Interrelations, **HCI,** are even more critical in education. Education is and should be, a product and a reflection of tradition, mentality, culture, religion, and ethnical heritage. **I do not believe that there is an objective mode of education, which is good for all people.** Even when studying Mathematics, nevertheless the figures are neutral and objective, the narrative behind them has some meaning. Those who want can always put ideology into any kind of a neutral subject. Therefore, **there is no one type of HCI**. People from different countries will communicate differently with, and by their PCs. Some famous literature or lyric writers still prefer to use a pen for their writing, because, they say, it gives them a better sense of intimacy with their work. Others, professionals or writers of technical texts, type on the keyboard almost automatically without developing any kind of emotional linkage with the text produced. The whole issue becomes

[1] Charles Lindberg was the first person that crossed the Atlantic Ocean by a single engine airplane.

more difficulty when it comes to ordinary people who never experienced working with PC or the Internet.

History teaches that technology and human development do not proceed at the same pace. Whereas, **technology moves very fast**, especially during the last decades, **human habits and social structures change slowly**. As a result, **a gap** is created between the two developments. This gap reflects sometimes education, development, or a generation gap. Similarly to what occurs in other areas, grand parents do not understand their grand children's language. In another article: "Promises, Perils and Prospects of E-Government," I address the potential dangers for society from a non-balanced development of ICT (Avny, 2005).

I also believe that this gap contributes also to the strengthening of some social maladies we face lately all over the globe. People are jealous, frustrated, and angry on their failure to attain and achieve the materialistic prosperity of the "West". Post-modern media pushes people to seek mainly materialistic goals. When they fail to attain those goals, or they do not believe that it is possible, many turn to use of drugs, religious fanaticism, violence, and terror as an escape. This is a kind of "an **anti materialistic escapism**" that basically is an anti social demonstration, which in many cases becomes "**a negative escapism.**"

On the other hand, those who are familiar with the ICT, spending hours and days by the PC, forget sometimes that real people and not machines live around. They are so happy and satisfied within their digital environment that they do not seek, and are not ready to invest in establishing human relationships. This type of social behavior, which could be named "**a digital escapism**," is also one of the characteristics of the 21st century. People try to find in the simple linkage with the machine something that will replace the complexity of human and social relationships.

It seems to me that for bettering social life and improving human interrelationships there is no choice but to face all kinds of escapism and meet the HCI challenges. One of the major vehicles for conducting this struggle is the **education system**, its institutes and universities.

In sum, ICT as a system combines the features of its three elements so that it is difficult to follow their influence separately. As such ICT has a significant impact on many walks of life. The technical ability of providing reliable information, in real time, changes and improves research and development from astronomy to medicine, from physics to social science. ICT opened new avenues for music creation and distribution and puts serious obstacles on the issue of intellectual property rights. ICT contributes significantly to strengthening the globalization expansion by shortening the time of communication and enabling fast delivery of big amounts of data. These capacities have a tremendous impact on human way of thinking, learning and behaving.

My Perspective on ICT

The former UN Secretary-General, Kofi Annan (1997:1) expresses the feelings that: "In many fields future decision-makers will be presented with unprecedented new tools for development. Communication and information technology have enormous potential, especially for developing countries, and in furthering sustainable development." Others see ICT as a vehicle for poverty reduction, especially in Africa (Tcheeko, 2005). Common wisdom argues that ICT "has been found to be one of the most potent tools for promoting equity and access to education, and a great resource in bridging the gap of the digital divide (E. Mckay, 2005). With all the positive qualities given to ICT and great hopes assigned to its global extension I tend to be modest and to lower my expectations from it. I see **ICT as another tool, instrument, or a vehicle designed and organized for improving civilized life on earth, and maybe in the outer space.** As other technical systems, ICT is a product of human ingenuity, it reflects human culture, and mainly it comes to serve people and to make their life better. For demonstrating this view let us compare ICT **with the concept of an** automobile. **As such**, Technology **represents the** engine, Communication **represents the** driver, **and** Information **represents the** load. For hauling a given load from one place to another different combinations can be used. Furthermore, the Engine could be strong or inadequate the driver could be a professional or an amateur one, while the load could be large or small Based on these three basic elements, several combinations could be constructed, all in accordance with the customer's demand. As a human product ICT represents the social, cultural and technological environment of its users and operators.

But, as many distinctions differ world civilizations, it is imperative to learn the cultural background and ethnical heritage in order to understand nations' behavior (Huntington 1996). Almost every nation has its inherited way of building its society, developing its people's competence and adopting new technologies. We have to pay attention to this lesson and not to put all nations in one ICT melting pot.

The disagreement in theEU, on adopting one common language for technical use, demonstrate well the argument on multi-face ICT. Russians do not think like Americans and Chinese differ from Europeans.

Officially recognizing cultural plurality and legitimating dissimilarity are the main points of this argument. In today's pluralistic world, ICT is not exceptional. Every society has its own authentic form of ICT and therefore, there are many forms of ICT. ICT should be constructed and shaped in accordance with the cultural background of every nation, or a group of nations.

Conclusions

The conclusions are presented here in a "bullet" form since I believe that this is a better way to emphasize their meaning and remember their message.

- ICT, as a leading phenomenon of the 21st century, is a **powerful mechanism** for spreading knowledge and developing people.
- ICT operates within a **chaotic and changing environment** of the 21st Century and is subjective to rapid **technical** advancement, **globalization** process and a strong **democratizatio**n move.
- As a system build of Information, Communication, and Technology, ICT well functioning depends on a **proper balancing** and fine-tuning of its components.
- ICT has **many forms** since it combines technology with human and social concerns and represents national and cultural heritage.
- ICT as a powerful source of knowledge could play **a tremendous role in education.**
- ICT, if not properly used, can cause some harms, like an **excess of information** and **shallowness** of **knowledge**, which result with a decreasing wish to learn.

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'Tell Mee': A Political Experiment in Community Practice

Blanca Gordo, Ph.D. [1]
Berkeley Center for Information Society (BCIS) at the International Computer Science Institute (ICSI)
1947 Center Street. Suite 600
Berkeley, CA 94704
b_gordo@hotmail.com

Abstract: *The creation, design and implementation of Tell Mee, an open source web-based data collection system both suggests the development of an interdisciplinary field and works as a case study in designing technology with controls set for conditions that reflect social values. Designed by Blanca Gordo & Richard Carlson, Tell Mee builds the research capacity of a grassroots CBO focused on serving the public health needs of underserved low-income social ethnic groups disproportionately and negatively affected by HIV/AIDS. The challenge and opportunity was constructing an easy to manipulate open source web-based data collection system and application.*

Keywords: Open Source, Low-Income & Low-Literacy Populations, Community Based Organizations (CBO).

Can information and telecommunications technology (ICT) be integrated into the productive functions of a nonprofit social service delivery mechanism? How can this be provided directly to social services for low-income and marginalized populations to further their organizational development within a digital capitalist society?

To compound these questions, under which conditions and social processes can affordable and functional applications be designed to facilitate the community based organizations' (CBO) productive and efficient work processes to attain the development goals of social ethnic groups with low technology production skills and low literacy levels who live in poverty? [2]

These are complex questions because they underline various interconnected factors, some of which are hardly understood, while others remain unrecognized socially and unrelated to scholarship. In implementing experiments it is vital to select information-rich cases with a representative set of organizational factors that reflect the overall sector

It is vital to empirically think about, design and examine any innovative practical experimental case studies. Important here is to control for place-related factors and socio-economic conditions. We need to consider how controls are set for social conditions and other cultural, political, institutional, economic and spatial factors that can hint at other relevant questions.

Some scientists concerned with social issues believe that under a certain set of conditions, technologies can be designed in ways that reflect the social values of inclusion and well being. The question is then: *How can we lay out a blueprint to construct a formal and equitable institutional electronically-based social service delivery system of operations with guidelines built to be open and accessible to the disadvantaged with low literacy levels and little exposure to technology*?

By using *Tell Mee*, a case study grounded in these ideas, I begin by suggesting the development of an interdisciplinary field of study. The focus is on: (1) institutional adjustments through the integration of electronic and information technology-based tools; (2) institutional forms of operation; (3) rules of operation; (4) and, public interaction. The purpose is to inform public policy officials and influential decision makers that design legislation and restructure systematic forms of social service delivery and guideline procedures. There is no standard model, but there are similarities in the ways in which civic agencies are using IT based applications to exchange resources. This changes how institutions share information, enhance communication, and exchange materials that translate into money through network technologies with the public.

The second part of this paper deals with *Tell Mee* as a social experiment. The goal was to build the research capacity of a grassroots CBO focused on serving the public health needs of underserved low-income social ethnic groups disproportionately and negatively affected by HIV/AIDS. The challenge and opportunity became the construction of an easy to manipulate an *open source* web-based data collection system and application.

1. DESIGNING FUNCTIONAL TECHNOLOGY FOR A COMMUNITY BASED ORGANIZATION

CAL-PEP (California Prevention and Education Project) is located in downtown Oakland, California. If anything can be learned about the potential to design technologies that improve

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[1] I want to acknowledge the support of Jerry Feldman at the International Computer Science Institute in my taking direct action in designing technologies that implement social values and reflect the needs of the most disadvantaged in society. He was a helpful reviewer, advising me to think about the need to outline cautionary, privacy, legal and ethical conditions of operation. It was a pleasure to work with Richard Carlson-- always positive, willing to try, and encouraging during difficult and trying times. I am fortunate that Carla Dillard Smith at CAL-PEP let me step outside of comfort zones and accepted my challenges, supporting my ideas and being flexible with my demands. Don Operario's willingness to invest in the capacity building of the organization, made it possible for CAL-PEP to support the construction of *Tell Mee*. Also, Shakema Snow, Michael Benjamin and survey respondents gave useful feedback. I especially want to acknowledge the intellectual support and in-kind access to full use of facilities and resources to design, pilot test, and train CAL-PEP staff on the use of *Tell Mee* at the Berkeley Center for Information Society at ICSI in Berkeley, California. Jerry Feldman and Ellen Fernandez-Sacco gave useful edits on *Tell Mee's* description. I want to give additional thanks to Ellen for her great and generous editing and formatting of this paper.

[2] Here, I make a distinction between a high and low technology production skilled labor force as follows: At the top of the digital economy's high valued labor market scale, are computer scientists, software engineers and computer programmers that design and code applications that generate profit in the market place; certified degrees vary from Ph.D.s to a Bachelors Degree with some substitution for well-experienced talent. At the bottom, are workers who have no experience with productive digitally based technological systems. In between, are low-skilled production workers who can't devise necessary mathematical algorithms to construct calculations for functional technologies and applications. They can, however, utilize basic windows interfaces and functions. These workers tend to have a Bachelors degree, general education and high school diplomas and some workforce training. Academic achievement levels and grades distinguish literacy levels. For the most part, CAL-PEP's core labor force represent low levels of educational attainment and certification; many are considered "para-professionals" because they are experts with practical experience in working with and serving their target population. CAL-PEP does have highly educated people on their staff and counting volunteers and other collaborative associates, they have the support of high-value human capital at PhD level expertise in their work.

the work process of CBOs serving social ethnic people living in crisis, it will be from this well-structured bureaucratic organization within the San Francisco Bay Area near Silicon Valley. This region is one of the wealthiest places in the globe, has a high concentration of high valued human capital and technological innovations. It's also a place with poor living conditions and high illiteracy levels,[3] and unequal public health outcomes seen in the AIDS crisis among African Americans in Alameda County, where a State of Emergency was declared in 1998.[4]

CAL-PEP is recognized as one of the most innovative and influential community based HIV/AIDS prevention projects in the country. Excluded and underserved populations know them for their long lasting and unyielding commitment. They support community development by hiring "peers" from the community it serves. They uphold a tradition of creatively reaching high-risk African American populations for HIV/AIDS. Their constituency includes sexually exploited minors, prostitutes, substance users, ex-offenders, straight men who have sex with men, the homeless and marginally housed, and other economically disadvantaged populations. CAL-PEP's motto is "AIDS is 100% preventable!" Thus, the focus is prevention through culturally and linguistically appropriate HIV/AIDS education and free Rapid HIV testing. Their goal is to "save lives." The strategy is meeting people where they are.

This case, then, is an information rich example of: (1) How to design a functional technology that could be manipulated by a low technology production skilled labor force. It could provide insight about: (2) How to integrate technologies and efficient work processes that are appropriated by CBOs focused on social services. Furthermore, input on: How to develop transparent and design easy to use interfaces by populations with low literacy levels that have never used technology. This project has been selected out of a pool of 300 potential CBOs throughout the U.S. because it meets several important criteria:

(1) *Beneficiaries in extreme poverty*. This organization serves African Americans at high risk for HIV/AIDS infection and transmission and hires urban residents in areas with high unemployment and poverty.
(2) *Uniqueness*. This project uses novel and innovative approaches applicable to other communities.[5]
(3) *Measurable community outcomes*. The organization has delineated community outcomes that are tangible, attainable, and novel.[6]
(4) *Longevity and size*. CAL-PEP has over twenty-three years in operation, and has leveraged ample matching funds. Since its inception, this agency has used multi-media in its work to provide social services.
(5) *Ethnicity of staff*. African American women govern CAL-PEP. Two very strong and charismatic executive directors lead the agency with close ties to each other. The executive director is its founder and an ex-prostitute; the deputy director has a Masters level education. The agency has retained a core of long-term employees that spans over 16 years; they are a close knit "family."
(6) *Public and private support*. CAL-PEP has formal relations with institutions, and a track record of attaining contracts with government agencies, civic institutions, philanthropy, and corporate firms. It has embedded itself into the network of formal community social service providers.[7]
(7) *Risk-takers*. CAL-PEP directors are strategic in action planning and are self-interested risk takers, always looking for opportunities that can advance their organizational efforts, and are willing to negotiate on their client's behalf.

The intent was to develop a project and discover what technologies could improve the work process and social service delivery systems of the CBO. The strategy was to enhance CAL-PEP's ability to accomplish its goals. Direct action and participatory inductive process-oriented research and the use of the qualitative and explanatory case study method were triangulated. These different sources of evidence (archival organizational documents, emails, executive and strategic plans, confidential requests), participation in staff meetings, observational data, and information gathered through informal interviews and work interaction with CAL-PEP staff, participants, and partners.

The goal of this research was to identify opportunities for integrating technology to develop CAL-PEP's community research department. CAL-PEP seeks to develop scientifically solid knowledge and evaluation of their HIV/AIDS intervention programs to meet funding requirements. The objective is to provide information about (1) Specific problems the research department is designed to address; (2) Technical approach that can be used to ameliorate these problems; (3) how technologies can be appropriated by a low technology production skilled labor force organization at the community base.

Direct action and process-oriented research over a period of time gave insight into how the organization works.[8] Theme

[3] Illiteracy is seen in disproportionately low levels of academic achievement and performance. For example, the Oakland Public School, which serves a large percentage of African Americans and Latinos in crisis, with some schools overtaken by the state for incredibly low performance.

[4] The AIDS crisis that CAL-PEP takes on in Oakland is striking. Oakland has the 18th highest reported cumulative AIDS caseload of 107 metropolitan areas listed by the CDC (Oakland EMA, Alameda County Public Health Department, 12/2005). While only 14.9% of Alameda County residents are African American in 2005, from 1990-2004, Oakland's disproportionately high rate of HIV/AIDS affected 59.4% of African Americans.

[5] The design of culturally and linguistically appropriate educational HIV/AIDS service programs and materials for low literacy populations living in crisis is an indicator of a novel and innovative practice.

[6] An indicator is outreach, participation in educational, counseling and research programs, continued participation of clients, and HIV testing.

[7] The literature on organizational development shows that well structured programs need what CAL-PEP has attained: (1) Public funding from government agencies such as the U.S. Center for Disease and Control (CDC), State and Alameda County Office of AIDS, San Francisco and Alameda Public Health Department, University wide Task Force. The agency has political ties and attained support from officials at the local, assembly, state and national levels; (2) Corporate sponsorship from pharmaceuticals like GILEAD. (3) History of collaborating with representatives from community based organizations, churches, and participating in county policy taskforces and planning councils; (4) Close ties with populations living in crisis and on the streets.

[8] To gain understanding of the work process, I persuaded the executive director to hire me as executive administrative and research assistant for a one-year period, from February 2006 to 2007. In these positions, I was expected and able to relate to everyone in the agency and obtain first hand experience of the organization's culture and day-to-day

analysis provides meaningful insights and allows one to build a qualitative model to address a research question about the types of applications and social process by which the CBO can benefit from the productive use of IT.

This paper concludes that the construction and current use of the open source and web based data collection system by CAL-PEP's The Brutha's Project research team, shows that affordable and easy to use functional technologies can be appropriated by low technology production organizations. *Tell Mee* can offer CBOs a competitive edge (in cost reduction and potential development in the sophistication of quality data collection, that could set them apart from other competitors; ultimately optimal utility and function is dependent upon human capacity and input). It also reflects the culture of social innovation embedded in the organization and the possibility for capacity building through the development of open source.

2. BUILDING THE STUDY OF FORMAL ELECTRONICALLY-BASED SOCIAL SERVICE DELIVERY SYSTEMS

Institutions are integrating technology into work processes, redesigning social service delivery systems, and automating material exchange in an attempt to maximize efficiency, reduce transaction costs, and save time. By and large, competitive pressures have driven businesses and public institutions to adopt a wide range of network technology and computer systems to improve productivity, maintain both internal and external communications, manage production, and offer customers new services (Castells, 1996).[9] Thus it is an important question how CBOs can interrelate with institutions through automated operation systems to service their community constituency. As we create an interdisciplinary study of electronically based social service delivery systems, we must account for the community-based mechanism. CBOs provide direct social service. Viewing the CBO as a fundamental part of an institutional process, locates the CBO as a necessary productive mechanism in service delivery. The community mechanism was created to make up for economic externalities and institutional shortfalls. They are financed by public funds because of abiding constitutional guidelines as our democratic society expects there will always be populations that institutions can't, don't want, but, need to serve.

The recognition of the CBO as a function to meet social responsibility principles highlights gaps and deficiencies in our formal meta-institutional and digitally based institutional structures of operation. The CBO's lack of social technical infrastructures and productive knowledge of changing work processes that could connect them to our evolving social system is a net loss to American society, which is already generating inefficiency and increasing transaction costs for the poor. The end result is reinforcement of inefficient and costly two-tier social service delivery systems that fail to resolve old age and ongoing poverty problems. This negatively affects the potential efficient function of the social institutional electronic based system of operation underway. So institutional marginalization continues.[10]

We need a comprehensive discipline of well-structured technology based civic experiments that take account of institutional structures and internal dynamics. We can advance our study by creating social experiments designed to integrate technology for: (1) Maintaining complex governance structures, extending outside of the agency; (2) Enhancing productive work processes; and (3) Reinforcement of beneficial social service delivery systems. Implementing these at the community grassroots level can help identify strategic ways of overcoming obstacles and opportunities for organizational development. In this process, we need to identify the assets and needs. Analyzing organizational rules and culture, working interrelationships, human and technical capacity, (in) formal rules of operation, forms of creating change, etc. are key. Also relevant are the types of rules created that incorporate technological advancements and creation of new institutionalized electronic procedures. The ways in which politicians, legislators, and organizations interpret and reinforce policy by place matters.

One enigma for concerned social scientists and technology innovators is the resistance and obstructions encountered in the process of invention and development of a capacity to solve social problems with technology. There are well-recognized barriers to construct productive innovative technology-based solutions that can be appropriated by low technology production end users at the community level: *Technical capacity*. There are limits in the advancement and embodied human ability of mathematical calculations that advance the innovation of open source code (an undeveloped asset) by interested computer science engineers and programmers. Some organizations are limited by access to high valued human capital and hardware capacity. (2) *Social values*. There are few who can and want to develop technologies that address problems. Some engineers have the capacity, but not the willingness to create inventions without profit. Others have social values but lack the technical capacity to code. (3) *Culture* (beliefs and values). Many resist change or fear a loss of power and control. Some believe technology could create more work and replace rather than enhance human interrelationships. (4) *Politics*. Interest can override utility. (5) *Economic*. The cost & benefit analysis for hardware and maintenance or limited access and inability to afford a high valued skilled labor doesn't equate the organization's funding streams. (6) *Organizational capacity*. Most organizations have limits in human capital and necessary investment in retraining is lacking. (7) *Institutional constraints & rules*. Often, bureaucratic and hierarchical structures are controlling and intervene in the process of invention.

3. *TELL MEE*: OPEN-SOURCE TECHNOLOGY

operation. This allowed me to experience, identify, and analyze the actions and interrelations of the influential members who are actively engaged in the decision-making and direction of the agency. I examined their activity on and off site with a particular focus on how they used (or didn't use) technology to do their work and maintain professional ties across space. Offsite activities included direct service with target population, attending meetings with funding agencies and collaborators, board of directors, and potential partners, also attending professional symposiums and conferences, fundraising events, the planning of formal programs, launching ceremonies at city hall, and formal and informal gatherings with civic and community agencies.

[9] M. Castells. **The Rise of Network Society**. Cambridge, MA: Blackwell. 1996.

[10] For a descriptive analysis of institutional marginalization, read: B. Gordo. "Overcoming Institutional Marginalization." D. Silver and A. Massanari. (Eds.) **Critical Cyberculture Studies**, New York: New York University Press, 2006.

Tell Mee is an open-source technology. This is a web-based data collection application for constructing the infrastructure of touch screen survey interfaces that use natural language. *Tell Mee* is a web based system where the content producer can: Construct automated touch screen interfaces for each survey question and record the reading of each question or instructions in any natural language, (although not the answer), through an attached windows button that presses a speech component. This function facilitates the creation of a natural language, culturally and linguistically appropriate digital surveys required by data collectors when seeking a scientifically approved general sample inclusive of any literacy level.

Features of *Tell Mee* include the automatic storage of input information, and the capacity to transfer data files into a statistical database for analysis that is inclusive of end-users with low-technology production and literacy skills.

Another mechanism that distinguishes this tool from comparable proprietary software in the marketplace is its transparent adaptability—it has easy to understand functions for survey respondents with low literacy levels who may have never used a computer.

Another aspect of this tool is a web-based administrator where the content producer can create an overlay of an automated touch screen survey by clicking buttons to select preferred order, the type of question per interface, and a selection of various standard survey functions (i.e. Multi-part questions with redirections, pre-selected answers and multiple types of standard survey measures that include a range of choices in the type of answer functions (i.e. yes or no, multiple selection answers, keyboard for input of personalized answers etc.) that includes linking questions based upon the response. This editor overlay has an easy to use recording system for questions, not answers.

To maximize efficiency and reduce the high workload of data managers, *Tell Mee* is tied and adaptable to a commonly used statistical SPSS database and can merge with Microsoft's Excel Database. This function reduces the manual input of stored data.

Each interface question has color-coded universal sign language symbols (i.e. use of arrow directional, stop, repeat, next question, return, etc.) for the respondent to navigate questions. Navigation buttons with universal language makes it easy for respondents with low computer and literacy levels to manipulate the survey.

In addition, the system has a tutorial function, which can be constructed through the administrator tool. This component is designed for populations who don't often or never use a computer and want to practice. It teaches respondents awareness of the type of selection functions they may encounter. Through a recording of written visible guidelines, it directs participants to answer survey questions and note universal symbol functions while they practice input with examples of questions and answers. The selection of practice questions and answers cover all the various types of answer functions that can be used in the survey.

4. BUILDING CAL-PEP'S RESEARCH CAPACITY

CAL-PEP has directed and collaborated with social scientists in the design and evaluation of research based intervention programs for over a decade. CAL-PEP's research teams have partnered with leading scholars and researchers in the fields of HIV/AIDS epidemiology and intervention methods. Some of their collaborators are investigators at the CDC, California Aids Prevention Studies at University of California, San Francisco, and the University of California's University Wide Task Force.

Gordo, Benjamin, & Carlson pilot-test Tell Mee at ICSI.[11]

Together they contributed to research design, and collection of data that has been analyzed and used to influence public policy, as well as enhance the dialogue between public health researchers and legislators. CAL-PEP is a valued research partner because of their ability to collect data from hard to reach low income and high-risk African American populations. CAL-PEP wants to solely direct a scientific research agenda, have ownership, and the capacity to control the design, collection and analysis of data. They want to produce independent, CAL-PEP-led studies and publications. Part of this process is upgrading and manipulating their data collection system.

5. EXPOSURE SUPPORTS INNOVATION

CAL-PEP was first introduced to computer assisted self-interviewing (ACASI) through a subcontract with the CDC Epidemiology Research Unit's Equal Access Project. The three-city study examining the willingness of African Americans to participate in preventative HIV vaccines used ACASI to collect data. The CDC through a private QDS program that costs thousands of dollars constructed the touch screen digitally based survey with a speech component. While CAL-PEP conducted digitized surveys on laptops in Oakland's shelters, onsite, and other venues, it was unable to manipulate the tool to abstract data and produce content. Through Equal Access the agency noted the benefits of digital based surveys, internal limitations and challenges in manipulating software, and need for simple computerized forms of surveys that account for the low literacy of their constituency.

Tell Mee is now being used by CAL-PEP's The Brutha's Project Research Team to collect data from hard to reach African American men who are at high risk for HIV/AIDS. More specifically heterosexually identified men who have sex with men (Het-MSM). Their target is generally secretive about their behavior and has low literacy levels. The Brutha's survey

[11] Pictures by Madelaine Plauche.

is self-administered and asks very confidential personal information and beliefs about sexual risk behaviors and drug use, etc. The partners of this men's health initiative are: CAL-PEP, Center for AIDS Prevention Studies at UCSF, and Oxford University and funded by the University of California, Universitywide Task Force AIDS Research Programs. The research team became open to the potential of creating a digital survey for a cross sectional study of their designed intervention program targeting AA Het-MSM at high risk for HIV. This population is hard to reach and survey. The idea came that ACASI may facilitate the result of a more reliable valid answer because respondents would input private answers by themselves in a confidential secured number coded computer system that doesn't identify them by name.

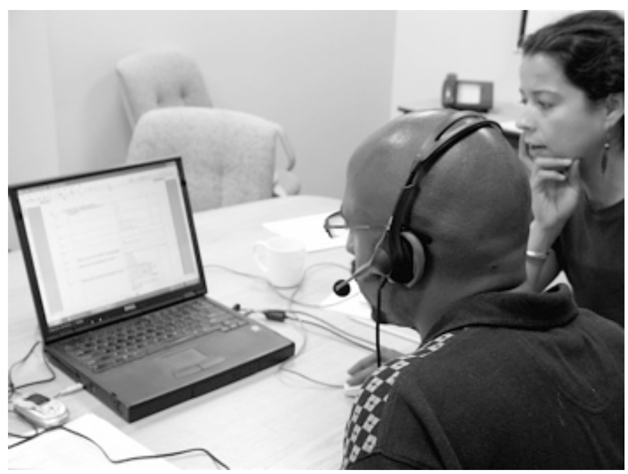
6. THE STRATEGIC WORK PROCESS

Blanca Gordo, Ph.D., from the Berkeley Center for Information Society (BCIS) at the International Computer Science Institute (ICSI) in Berkeley, CA, and as a part of The Brutha's Project research team, and Richard Carlson, independent computer science engineer and programmer, proposed to create a digital survey for CAL-PEP. Gordo suggested matching her organizational analysis with Carlson's computer science engineering expertise to construct an easy to use technology tool to create digital surveys that a low technology production skilled labor force can easily manipulate. A transparent tool would facilitate any necessary content changes that would reduce CAL-PEP's outsourcing costs. Also, give them the desired ability to install and transfer files unto a database system for their own analysis. Basing her analysis on the human interaction of low literacy populations, who never used a computer, in Oakland's homeless shelters, as they took the Equal Access ACASI survey, she advocated for the development of easy to navigate interfaces with universal sign language and a speech component that would record natural language. This would meet CAL-PEP's demand for culturally linguistic appropriate material. Carlson was recruited because of his unique interest and capacity to build open source software, experience working with low- income, literacy and computer skilled populations in India, and personal commitment to the development of technologies for the benefit of society that could address long standing poverty problems. He was willing to work beyond a paid contract for coding. His desire to transfer a skill set to the agency is a necessary key to build capacity and organizational development. Organizational development through integration of ICT is the prime experiment.

Two of the project's co-principal investigators, Carla Dillard Smith, Deputy and Research Director of CAL-PEP, and Don Operario, Professor at Oxford University, were willing to take a risk. Gordo had established some trust by designing a graphical structure for CAL-PEP's public marketing and other educational materials for the project. Her affiliation with BCIS and her personal connection with Carlson became an advantage over price from a competitor. Carlson's physical proximity became an advantage over an out-of-state private vendor that CAL-PEP didn't know or could see. According to Operario, proximity could facilitate any unforeseen problems and potential changes.

BCIS at ICSI provided Gordo and Carlson with in-kind intellectual support and feedback plus full use of facilities and resources necessary for design and piloting of technology, including training of end-users. Dillard Smith adopted the potential for innovation and integration of technology unto CAL-PEP's data collection system. Operario gave seed funding to pay for some of Carlson's time who was willing to be paid below the market rate. Some of Gordo's time, also below market rate, was financed by CAL-PEP. Gordo directed the production and conceptualized the tool and its application to suit CAL-PEP's long-term interest. In the design, she took account of traditional constraints such as cost, human capital limitations and institutional capacity, internal constraints (time schedules, political pressures, timeline restrictions and deadlines, literacy levels of target population, a culture of technological distrust, etc.) to create an easy to use and efficient data collection system with reduced operational costs. Carlson contributed his mathematical and coding abilities to create functions that override social problems. The value for Gordo and Carlson is the opportunity to prove that affordable and functional open source applications can be created, appropriated, and directed by low technology production end-users.

CAL-PEP also invested in the time used by staff to pilot *Tell Mee* and train their data manager and voice recorder in the use of the tool. Michael Benjamin, men's health counselor for The Brutha's Project, first piloted *Tell Mee.* He was trained to input and record content. Shakema Snow, CAL-PEP's data manager, was trained to construct and edit digital surveys. Gordo's close observations of end-users' interaction with *Tell Mee* alerted her to potential errors, missed and needed functional adjustments to be developed, and gave insight about ways to reduce physical strain, and how to adjust technology to human habits that speed construction of digitized surveys, etc. This analysis and suggestions were fed back to Carlson who improved the interface façade, adjusted its necessary functions and programmed the easy to use data collection system. An indicator of sought facility for co-designers came when Benjamin said, "It's so easy to use, a baby could do it."



Gordo observes Benjamin's interaction with Tell Mee as he transfers survey content at ICSI.

7. OVERCOMING BARRIERS TO INNOVATION

The greatest challenges to designing a functional technology are social. CAL-PEP is fast paced, expects immediate visible results, and is responsive to those funding it. There was conflict in Gordo's insistence on creating long-term solutions through the creation of a tool and the immediate short-term demand of having a digital survey to meet funding deadlines. The creation of new technologies has a predetermined experimental time component (that includes trial and error, identification and fixing of bugs, feedback information given use, etc.) and work process that may not be in line with external political forces and internal pressures of the directorate and their funding agents. Although CAL-PEP recognized that *Tell Mee* is a gateway to collecting scientifically reliable data, the immediate interest of the agency was to collect and meet numbers by a set deadline. Ultimately, they exist to provide service. There was tension when the directorate expected immediate results (a digital survey) rather than fruitful technologies. Through the process of development, CAL-PEP faced economic hardship due to downturns in state HIV/AIDS funding, negatively impacting their pull of funds.[12] Thus, the directorate didn't have time or want to hear about the intricacies of technology design and development. It was then difficult to translate the vision and work process. This barrier was overcome through tangible visible results. The end product proved useful when it generated economies of scale as survey content changed and the data manager could make changes.

A challenge in the appropriation of *Tell Mee* is the learning curve. The tool facilitates but still creates work and new skill demands without adequate allocated time. When there was more pressing work responsibility than time and capacity, end users resented knowing how to manipulate a tool that created more and different work tasks without adjusting schedules or replacement of job duties. Recording became boring after repetitive need for concentrated and skilled recording of precise survey language and clear-pitched voice sounds of objectivity. The challenge for the project director was identifying and assigning the irreplaceable role of each partner. She identified their expertise and work roles in manipulating the productive functions of *Tell Mee.* The outlining of tangible benefits, in the reduction of operational costs (by eliminating licensing fees and incurred costs for changes that could have been outsourced without in-house skill) was pointed out. A strategy to maintaining necessary buy-in and defending time invested on the project and outside the agency was to continuously incite and maintain interest and support of end users until tangible results could be delivered to the directorate. Navigating internal dynamics and responses to political pressures was overcome by the incremental buy in of end users, empowered by their ability to create digital surveys, and ability to input content. It required teaching by doing, direct involvement of end users in the development of the final product, and crediting each user's added value when directing what each player could and needed to do.

It was a thin and difficult road to travel during training sessions. The agency is constantly facing crisis and it has a limited amount of time to hear detailed accounts. Much needed to be processed in a short period of time; this skill had to be transferred. The strategy for transferring skills was *teaching by doing*. Constantly attempting to avoid, but not always being able to override the condescending perception of "outsider" scientists and professionals wanting to "help" social ethnic groups was challenging.

[12] During the Bush Administration, public funds for HIV/AIDS prevention and services have fallen rapidly. Many of the funds supporting prevention, direct service, research, and education have been redirected to the War on Terrorism and Homeland Security, which had an enormously negative effect on social service providers, especially at the community level where many projects have shut down. For example, since the inception of the Bush Administration, the Ryan CARE Act funding has remained virtually static with less than 2 million dollars in funding increases from 2001-2005.

8. CONCLUSION

CAL-PEP's use of *Tell Mee* is still new and evolving. We are still learning about the benefits derived from the development and appropriation of open source technologies by end-users with low- production skills and literacy levels. Perhaps with the passage of time and increase in pilot experiments we can construct a database measuring social uses of *Tell Mee*. Assuming wide range use of the tool, we could examine an array of factors that could build a comprehensive interdisciplinary empirical answer to how technologies can facilitate the work process and refine the social service delivery mechanism by building the social technical capacity of nonprofit direct service providers.

In our study, it would be relevant to collect data and examine economic relationships between nonprofit employers and employees in the context of enforced evolving labor expectations and derived benefits of (non) compliance in the use of electronically based social systems of operation. We can also look at the difference in use, according to governance structures (hierarchical and bureaucratic vs. horizontal organizations) to examine innovation, productivity, and efficiency in meeting set goals through socio-technical systems. Another important distinction in use can be the type of work processes and operational procedures employed. Ultimately, the utility of the tool is determined by human input, which is determined by the organization's actions. We could design high functioning technologies but to maximize optimal utility, organizational rules have to adjust to new work processes and demands. Even more, designers must relate cautionary, privacy, legal and ethical guidelines of operation. For instance, Tell Mee is a web- based application and can be used via the Internet. If an end user is collecting sensitive confidential data, they must be aware of limits in security safeguards and potential legal risks determined by use. If collecting personal confidential information it is best to keep the survey localized on a computer. How nonprofits can and do facilitate efficient access to upgraded electronically based social service delivery systems is relevant to policy.

To conclude, there are opportunities to innovate and uncover pathways that connect and improve access to resources by those who provide quality and direct service to meet the development demands of needy and low income social ethnic populations. One negative effect of CBOs not having social technical infrastructures that connect to formal meta-institutional systems of public and private funding is a constraint in the potential pool of agents that can compete for public funds. Competition then becomes about who can apply rather than by the potential benefit of any social effort that can yield a return on investment and cause positive social change among the most needy, in ways that meet guidelines for social responsibility.

The negative effect for nonprofits is a lack of access to public funds vis-à-vis their inability to interface (attain information, communicate, and exchange formal documents and materials) with institutions to obtain public funds that help them with the social service needs of the populations they serve. Through this mechanism, CBOs continue to struggle to meet the needs of the underserved and a two-tier system is reinforced. The deprived then can be locked unto a life of crisis.

How to Measure the Impact of RFID on Today's Society

Oliver HEDGEPETH, Ph.D.
Logistics Department, University of Alaska Anchorage
Anchorage, Alaska 99508 USA

Morgan HENRIE, Ph.D., PMP
Alaska Center for Supply Chain Integration
University of Alaska Anchorage
Anchorage, Alaska 99508 USA

ABSTRACT

The newest step in the evolution of the computer involves the perceived wave of RFID technology moving through business in the U.S., Asia, and Europe. An economic question many trade articles entice the reader with is, what is the real cost and impact of using such RFID technology? There is no simple answer to this question. However, history of the last forty years indicates that there will be an "unknown unknown" type of impact on the social fabric of decision-making and an impact on society. This paper explores the complexity factors of the assumptions surrounding the uncontrolled growth of this next phase of the computer evolution. It also explores the knowledge tensions that are arising from the interaction of different cultures toward expanded data, information, and knowledge sources. A business war game, based on Assumption-based Planning, is described that analyzed user's perception of RFID compared to other communications technologies. The results will highlight a hypothesis that graduate students can pursue to measure pace and common denominators of the acceptance of RFID technology.

Keywords: RFID, Metrics, Unknown Unknowns, Data, Assumption-based Planning, Knowledge Tension, Culture

1. INTRODUCTION

When you compare Radio Frequency Identification (RFID) technology to barcodes, or radio, TV, the Internet, or the mobile phone, which of these technologies helped change society most, which helped change decision making in business? Is this technology revolutionary, or just another step in routine technology development? Are we witnessing some aspect of Moore's estimate of a continuous increase in complexity of computer components [1] with a similar increased rate of technology adoption by society? Some industry experts think the "comparison between RFID and the Internet, as an equally revolutionary tool is a bit extreme [2]". However, when you examine the history of computer component growth since the 1950s, there is evidence that related communications technologies, like television, telephone, mobile phone, portable computers, wireless connections with portable computer, smoke detectors, etc. do impact society, do impact business decision making [3].

As of 2007, it is estimated that organizations data collection will grow "as much as 40 – 60%" [4]. How this explosion of data growth will impact business and society, and how to make sense of this growth, where organization are part of the Web of Things [4] is the focus of this research paper.

2. METRICS FOR RFID

The adoption rate of passive and active RFID tags and technology is exceeding expectations [2]. However, collecting data and information and using it are different functions and may require different metrics [2] [3]. Reported areas of impact of RFID technology in manufacturing are in the three metrics of inventory visibility, labor efficiency, and tracking and genealogy [2] [3].

Recent articles suggest that supply chains will require and provide greater visibility for the customer as well as the supplier [2].However, being able to precisely locate inventory and tracking it along some global information system is a "relatively recent development" [3] [4]. Location of items to gain improved visibility can depend on how location is expressed [4]. Different countries have different cultural and semantic definitions that go beyond the technology of geographic location of an item [2] [4] [5]. Further complicating inventory visibility depends on the decision maker's choice of interface with new and legacy information management systems, which are as different as the many acronyms, such as EDI, WMS, TMS, GDS, ERP, etc. [4].

The metric of labor efficiency is discussed by many as being impacted significantly by the use of RFID technology compared to the use of barcodes [2] [3]. In a recent interview, by the authors, with a major grocery store chain, the manager of the central distribution center indicated that labor saving was the top metric in their decision to use RFID. Inventory visibility was initially thought to be the most important metric for management of this grocery distribution center. Nevertheless, with the combined use of RFID, barcodes, and voice recognition, operational data collection pointed toward a shift in decision-making by management. The voice recognition system decreased the tracking time compared to previous manual operating standards that had a significant number of human errors. The voice recognition system, called Martha, was a headset that allowed a worker to pick and place the requested grocery items being called (by real-time, Internet-based point of sales data) for from stores that were hundreds of miles away.

The human factor element with the voice recognition system changed the dynamic from the previous manual process of reading a written pick order form to being told by Martha where to drive the fork life and what bin to approach and how many items to pick. The labor savings was being reported as the metric that management was more interested in, not the inventory visibility.

This distribution center sends approximately 70 LTL trucks per week with items picked and packed at the center. Pallets of goods picked are placed on wooden pallets, and shirk wrapped for transport. Each box of goods on the pallet has an RFID tag and a barcode. Each truck is equipped with a RFID tag as well. There are several RFID readers placed along strategic points on the highway between the distribution center and the grocer stores. The use of RFID for the trucks is to alert the grocery store one hour before the incoming truck arrives. This process with RFID on the trucks frees the labor force at the grocery store to be used more efficiently. There was no data on whether or not fewer dock workers were being employed as a result of RFID technology at the grocery store or the distribution center.

The metric of inventory visibility became a minor importance when the pallets were loaded into the receiving area of the grocery stores. The only errors reported by the grocery store manager were for missing items that were not scanned automatically by the RFID antennas when the forklift driver moved a pallet from the back of the truck into the loading dock area. In all cases of such error reports, the error was a box of goods where the RF signal was being blocked by metal foil or water. The error rate for missed items shrank to zero percent.

The authors were told that labor savings, not inventory visibility as the key metric to manage.

However, while labor efficiency increased, the cost or return on investment (ROI) remains unknown. This is after three years of operations with RFID integrated with the voice recognition and barcode system.

The metric of tracking and genealogy still seems elusive. Being able to track the birth to consumption of a product throughout a complex supply chain is still years away [3]. The Department of Defense and Wal-Mart started in January 2005 with a forced collaboration mandate to use passive RFID (pRFID) on all pallets and special high value items from suppliers [3]. This forced collaboration is still being developed by these suppliers, with various levels of reports on success [3]. One of the issues reported with this metric is that many organizations and decision makers are "overwhelmed by the volume of information available on RFID technology and don't know where to start [2].Schuster reports that one of the result of this explosive growth in data is the equally explosive growth in data storage devices [4]. Decision makers are now being faced with current computer systems that cannot handle the increased volume of data coming from the integration of RFID technology inside the current information technology structure. Add to this the growing awareness by decision makers that the data collected is both structured and un-structured [4].

Metrics then is the linkage between a business strategy to use or not to use RFID technology and its operations [3].The metric most commonly read about for RFID is an information technology metric [3]. As such, the decision maker is forced to consider either a functional or operational metric. The functional metric is more traditional, that of cost and expense, based on basic accounting principles, usually shown as an income statement or balance sheet [3]. The operational metric is more in line with the operational aspects of the organization, such as manufacturing goods, providing a transportation service [3]. For comparison, barcode is measured by the seller's needs; RFID code data is measured by the computer needs. Or, so we thought beginning with the mandate in January 2005. But, what is data, especially in an RFID-driven organization?

3. DATA DEFINITION; METRICS

What happens when you collect data and it does not show the pattern you wanted in you forecast, prediction, or projection? Or, it does not meet the expectations of your theory? In the scientific world, from the research lab to the operations research office on major airlines, seeking customer feedback on service, this activity can be described as "fitting of square plugs (observations) into round holes (theories) [6]." When your observations create a database that does not support your pre-drawn conclusions or hypothesis or problem statement or expectations, "the standard conventional assumption is that there must be something wrong with the plug (observation), not with the hole (theory) [6]." That is, often the data collection method is seen as at fault, but not the theory of what the data pattern was suppose to show. Now, this is not the case for everyone who collects data.

One issue for data not meeting an expectation could be the data collected is less precise – less accurate or includes missing data or noise [3] [6]. More precise data and consequently, information, may lead to a more accurate modeling of supply and demand chains, leading to reduced slack time and delays in manufacturing, improved transportation of goods, reduced waste, and more accurate flows of information, dollars, and data [6]. But, all of this attention to data needs first a clear definition of what data is. By defining data and all its relationships with other environmental factors and variables can we begin to better understand how to manage and interpret data.

What is that term data? We all think we know what it means. We all can collect data by interviewing people to obtain their opinion about cell phone use in restaurants, or how many cups of coffee they drink each day. These data can be added and divided and an average of 1.56 cups of coffee per day can become the some final answer, or that 33.56% of the people interviewed do not mind the use of cell phones in restaurants.

Alternatively, we can count how many people come into a retail store between the hours of 8 and 9 a.m. on Mondays, during the month of December in the year 2008 compared to that same data collected in 1998. Data then seems something simple to collect, to stack neatly into piles and to use to make predictions of future behavior of people.

Data can be aggregated from many samples into just one number, such as an average. We can take the average number of cups of coffee consumed for the cities of populations of less than 30,000 people in Virginia, North Carolina, and Tennessee. We can then take these averages and average them again and obtain a new number of 1.65 cups of coffee that people drink each day. The problem with data like these is that it is so easy to collect, or so many people think.

In the mid-1960s, the computer was considered to be "barely out of its infancy [6].The focus of computer trends was in four areas. One was computer power, using a metric of circuit speed, memory size and the number of operations that the computer could perform. It was considered that these performance metrics would continue into the indefinite future to increase "one order of magnitude every five years [6]".

The second metric for computer progress in information technology was the cost of computing power, which again was considered to drop by one order of magnitude every five years [6]. It was an assumption that "improved cost performance over time is an inherent characteristic of young technologies [7]".

The third trend noted was the physical limitations in size or minimizing the physical size of all parts that comprise a computer [6]. Interestingly, that this size trend did not extend to what we have in the year 2007 as very small computer systems.

The fourth trend was that the computer was still seen as a device for military and scientific use. However, it was being recognized in the 1960s that direct user access was making it more commonplace, and a necessity [6].Still in the 1960s, computer were large, bulky, and you needed to be a computer programmer or mathematician or scientist to operate one.

All these trends focused on the use of computers as tools of information technology as part of the growing industrial sector, with predominant use inside an organizations activities more than between organizations. The use of the computer in the home, or for use in a retail store, such as today's Wal-Mart or Target or Safeway, was considered as insignificant. Additionally, the movement of data or information between organizations by "information brokerages" was considered as an occasionally reported activity. And, as you may have surmised, the use of computers was primarily for the large business enterprises, not small business, not in the home, and not for the individual [6].

Forty-five thousand slot machines at twenty-eight of Harrah's Entertainment casinos create over 100 million separate pieces of data each day [8]. Each year, the number of data items collected by businesses such as Harrah's or Wal-Mart grows by over 50% [8]. For retailers or wholesalers, data is collected on each item or unit, which could be one gallon of Matanuska Maid Dairy milk, or one case containing 100 Epson T044120 ink cartridges, or one shrink-wrapped pallet of these cases, and the location of that T044120 case on the pick shelf and on the replenishment shelf inside a Safeway distribution center. The question for decision makers, the managers, the data category analyst, the operations researcher, the logistics manager, is what to do with all that data? "How do we measure the impact of "these massive floods of data? [3]?"

4. ORGANIZATIONAL STRUCTURE

Today's RFID-driven organization, such as the grocery distribution center visited by the authors, and trying to refine the correct metric to use point toward another evolving issue; that is how today's automatic replenishment programs will be influenced by RFID [9]. Since the 1980s, the authors have been involved in analyzing how the instant communications of the mobile phone, later Internet, and cell phones would impact military and business organizations. The consensus seemed simple; such communications would flatten the traditional hierarchy of organizations. Our experience in living through this period proved that the classic struggle between centralized versus decentralized organizational structures was not as easily changed as the experts thought. Since the 1990s, that argument has changed, but not for debate, but as an almost overnight consequence of the ubiquitous cell phone and the Internet. Sabath examined in 2001 the possibility of structure once again being impacted by communications technology [9]. Current research seems to indicate that the use of RFID technology, along with the Internet, and the cell phone business tools, will accentuate the decentralization of business operations [9]. The example the authors witnessed in the grocery distribution center seems to support that assertion; that the rate of decisions is increased. The metrical unit of time, measured in hours or days, is now measured in seconds. We witnessed in the distribution center how grocery items were now being measured by inches, not in feet along the three dimensional space of the warehouse. Sabath says that decision makers who make extensive use of information technology 'tend to adopt decentralized organizational practices [9]". It seems that with the use of RFID technology, the discussion of whether to have a centralized or decentralized organizational structure is less important; the knowledge tension created in this discussion in the past seems to be a non-issue today [3] [5] [9]. Still, these are but a few indicators of how decision making is changing with the adoption of RFID.

5. RFID IMPACTS ON SOCIETY

The authors conducted a business transitional wargame to evaluate the issues of metrics, data, and organizational structure from using RFID [3]. This wargame is a tool based on RAND's; Assumption-based Planning concept [3] [10]. This wargame was played with 11 graduate students over a period of weeks. During this time, they identified and analyzed the impact of RFID on society compared to other technologies, address such issues as the impact of data collection, what metrics to use, and different organizational structures.

As for metrics, the consensus was that the traditional metrics used for RFID technology did not match those of other technology such as TV, cell phones, Internet, etc. The labor cost in an organization appears to remain dominate, as the grocery distribution center analysis uncovered. Whereas RFID experts were looking toward shrinkage or inventory visibility, the student's conclusion was that these were now playing a minor, not major role, in measuring RFID ROI.

On a scale of 1 to 10, with 10 being the most significant impact, and 1 being no impact, the average wargame results compared to RFID are shown in Exhibit 1.

Technology	Impact (1 to 10)
RFID (passive)	2
TV	8
Telephone	9
Cell phone	9
Internet	9
Portable computer	6
Barcodes	9

Exhibit 1 – Comparison of RFID to other technology

The population of this analysis were student who were in an age range of 22 to 28, except one who was older. It is interesting to note that from detailed analysis and discussion, the impact of RFID was seen as extremely low, compared to the other technologies.

The story of RFID technology impact on society and business cannot be forecasted with accuracy [3]. However, from the above review, we can develop the following problem statement and support hypothesis to help get closer to understanding this impact:

- Problem Statement: How is the organization structure of decentralized versus centralized management impacted by RFID?
- Hypothesis: The efficiency of decentralized structure is the same as that of centralized when RFID is implemented.

6. CONCLUSIONS

The history of the next forty years of computer development using technology like RFID is full of unknown unknowns. There are complex factors of the assumptions surrounding the uncontrolled growth of this next phase of the computer evolution. There are knowledge tensions that are arising from the interaction of different organizational structures and cultures toward expanded data, information, and knowledge sources. With the use of a business war game, based on Assumption-based Planning, we described that user's perception of RFID compared to other communications technologies shows little support for RFID adoption. The results indicate that the use of RFID have not exceeded expectations. To help focus on this issue, we highlighted a hypothesis that graduate students can pursue to measure pace and common denominators of the acceptance of RFID technology.

When will the transition of RFID move toward an impact of the same level as that of the barcode , or television, the cell phone, our many and variable portable computers? The answer lies in continued questioning; we have some answers; but, more are needed.

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Research Trends & Needs in e-Collaboration

Sathasivam Mathiyalakan
Management Science & Information Systems Department
College of Management, University of Massachusetts Boston
100 Morrissey Blvd, Boston, MA 02125

ABSTRACT

The trend toward greater use and reliance on e-Collaboration is expected to accelerate in the next decade. In this study, we review e-Collaboration and related research streams with a view to identifying research trends and needs. We focus on three major issues namely extension and applicability of prior research streams to e-collaboration and methodological issues, virtual teams, and technology and technology integration across organizations.

Keywords: e-Collaboration, Groups, GSS, Technology, Virtual Teams

1. INTRODUCTION

e-Collaboration is "Collaboration among individuals engaged in a common task using electronic technologies" [13]. Benefits of e-Collaboration include: any place/any time meetings and training/learning, process loss reduction associated with face to face communication ([14], [21]). Other potential benefits include advanced communicational, information, and decisional support, cost reduction, productivity enhancement, increase in profits and customer/business partner support through better planning, lead and delivery time reduction, process integration, and strategic effects.

The trend toward greater use and reliance on e-Collaboration tools is expected to accelerate in the next decade. Several factors contribute toward this acceleration. These include movement toward market orientation in several parts of the world, global production and consumption, increasing technology savynesses of employees, firms, and consumers, decreasing technology usage costs, and the increasing use of the Internet for business and personal use. Institutions such as universities and colleges where e-Learning is gaining prominence also contribute toward trend.

Prior studies with few exceptions have usually focused on examining e-Collaboration within a single organization and thereby avoiding potential cultural issues. Globalization is likely to bring the issue of cultural issues to the forefront.

In this study, we review e-Collaboration and related research streams with a view to identifying research trends and needs. Due to space limitation, we focus on three major issues namely extension of prior research streams (GSS, Groupware, CSCW) to e-collaboration and related methodological issues, virtual teams, and technology and technology integration across organizations. We end by providing some summary remarks.

2. EXTENDING PRIOR RESEARCH STREAMS & METHODOLOGICAL ISSUES

Group Support Systems (GSS) are a subset of Decision Support Systems and address the organizational task related needs of groups in areas such as brainstorming, alternatives generation, alternative organization, prioritization, & evaluation, group memory, and communication through the use of information and communication technologies. The growth and development of GSS and its specialized applications such as GDSS and GDSS provided a foundation for the growth, use, and acceptance of e-Collaboration tools. The roots of GSS go back to early and middle 1980s. During the 1990s, the GSS research stream, i.e. using decision, information, and communication technologies to support the needs of individuals, groups, and organizations was one of the popular topics amongst researchers and as a consequence, more than 200 GSS related publications exist [18].

Initial GSS research focused on comparing face to face groups with that of computer supported groups. Subsequent research dealt with distance and time dispersion issues. It is at this time, that the term Distributed Group Support System (DGSS) was coined to identify distributed groups that use GSS. The late 1990s and early 21st century saw a tremendous increase in the use of computer networks (Internet, Intranet, Extranet etc.). The widespread availability of Internet at many parts of the world has led many GSS developers and researchers to focus on collaboration through the Internet. Although the terms e-Collaboration and virtual teams precede the widespread availability and use of the Internet, the Internet has given new collaboration opportunities and challenges.

Kock and Nosek [12] identify two trends within the field of e-Collaboration research. First is the development of sub communities devoted to the examination of a particular topic. The second is integrating prior research and identifying topics of relevancy for e-Collaboration. It is our argument that findings of GSS research cannot be blindly transferred to e-Collaboration research and there is a need to determine the extent of applicability, relevancy, and boundaries.

Many theoretical frameworks such as TIP and AST amongst others were developed to study GSS. There is a need to examine the applicability and relevance of these theories to the study of e-Collaboration. Measurement is an important area for future research. Current studies tend to use measures developed for GSS research. There is an urgent need for the development of constructs and measures that focus on the e-Collaboration environment. Such measures should be empirical verified.

3. VIRTUAL TEAMS

Virtual teams are "Groups of geographically and /or organizationally dispersed co-workers that are assembled using a combination of telecommunication and information technologies to accomplish an organizational task." [23].

Over the past twenty years, researchers have focused their attention on a number of topics within the GSS research stream. Initial focus was on comparing outcome measures for computer supported and non computer supported groups. Subsequent research has focused on alternative GSS system designs, trust, leadership, conflict management, group history and membership, media richness etc. While initial results suggest mixed findings on GSS usefulness, later results do show that GSS can be valuable tools for collaboration. We identify the following as important issues that need to be re-examined in the e-Collaboration environment: a) System design, appropriate or relevant technology toolbox, and task-technology fit, b) Group structure, and c) Process issues.

System design, appropriate or relevant technology toolbox, and task-technology fit

The technology landmark has changed dramatically, both interms of number of players and the level of technological sophistication within the last two decades since the advent of GSS. Two main findings and their applicability to the e-Collaboration environment emerge from an analysis of GSS literature. First, the GSS technology and system design play an important role in meeting outcomes ([1], [19], [24]).

Previous research also suggests the need for task and the technology fit ([8], [9]). Information richness is the ability of a medium to facilitate shared meaning or convey information ([5]). This suggests that some media have the ability to transmit more cues than others. Daft and Lengel [5] propose that different media could be ranked in terms of feedback, multiple cues, language variety, and personal focus. Prior GSS studies rarely used multimedia capabilities. The interaction with other users was primarily through keyboard typing and where permissible non verbal cues. Some of the later GSS studies did use rudimentary audio conferencing capabilities. Nowadays with bandwidth becoming a non issue and the availability of web based software, e-Collaboration have multimedia capabilities and provide rich media for collaboration. The different e-Collaboration tools available in the marketplace vary interms of capabilities, cost, features etc and it is commonplace for organizations to employ diverse technologies. A group engaged in e-collaboration may use different tools at different collaboration points. Participants may also be engaged in multi tasking during the collaboration process. In this environment, there is a need to examine the applicability and relevance of previous work on task – technology fit.

While IS research is rich with literature of technology adoption and implementation, such studies with emphasis on strategic perspectives are rare. Previous GSS research has generally focused on individual and group level. There is a need to examine technology adoption and implementation from a strategic perspective. Issues of inhibitors, cost – benefit analysis, organizational transformation, formation and use of virtual teams, technology and business process re-configuration, design and integration of inter-organization systems need to be examined at greater depth if e-collaboration is to be a success.

Group Structure

Group structure refers to issues related to group size, status/power structure, group norms, history etc. [17]. Initial interest in groups arose due to the belief that pooling the knowledge and abilities of several individuals is beneficial to organizations. A rationale for using e-Collaboration tools is to minimize process losses. Processes losses occur due to the pressures due to conformity, fear of negative appraisal by superiors, domination by more senior/ranking members of the group (status differences), communication monopolization, ability of only one member to speak at a time (production blocking), lack of information support, fear of ridicule/reprisals for speaking out (evaluation apprehension), information overload [21].

While many factors affect group performance, group size is a key ingredient since it places a limit on the knowledge available to the meeting group [6]. Early research suggest that the optimal group size is five ([10], [20], [11]). Such determination was based on factors such as participant satisfaction and participation opportunities. These studies were based on the concept that as the size of a group increases, meeting outcome measures (net value) increase until a maximum point is reached. Any further increases in group size yield negative net benefits. Many GSS studies ([3], [4], [22]) use groups of five based on this determination. Subsequent work suggest otherwise ([7], [14]).

Anonymity was seen as a desirable issue and GSS tools incorporate the means to ensure participant anonymity. Many e-Collaboration tools promote features for video conferencing or other means for reducing participant anonymity. Therefore these systems could be seen as an extension of face to face meetings with electronic support and where participants may be dispersed both in time and location. We argue that there is a need to examine whether process losses do occur within e-Collaboration environment as the theoretical foundation on which GSS studies were based, i.e. process loss may not be valid.

Process Issues

Prior research findings on GSS are based largely on laboratory studies. Organizational groups may be different from laboratory groups in several dimensions including task type and complexity, nature of groups and duration, nature of incentives. McGrath [16] notes that while researchers have studied groups for over a half a century, there are limitations on inferences that can be made as much of the work focused on the use of groups that met only once. Researchers tend to avoid longitudinal studies due to cost, subject attrition, and career impacts. Longitudinal studies provides permits the investigation of learning, attitudes and changes in attitudes over time, effect of technology on work, use of technology, development of group cohesiveness, conflict resolution, group composition and changes therein.

McGrath [16] further notes that group membership continuity or change are defining aspects of group outcomes. But such investigations in practice are rare. The few studies that have studied groups over time suggest that not all groups are alike and that group developmental patterns differ. Chidambaram et al. [3] find that there were significant differences in developmental patterns between manual (non-GDSS) groups and GDSS groups. Initially, the GDSS groups exhibited lower conflict management ability and cohesiveness than manual groups. But, by the end of the four meetings, this pattern had reversed, suggesting a potential benefit (enhanced conflict resolution skills) for GDSS groups. Dennis et al. [7] find that established groups exhibited different personalities than adhoc groups. The established groups were more likely to express critical comments and uninhibited comments and had a less even distribution of participation. Mathiyalakan [15] investigates group composition change and continuity in groups of three and five. The initial experiments yielded results formally verifying that membership continuity produces better meeting outcomes (increased performance and productivity, and decreased solution time) while membership change produced the exact opposite (decreased performance and productivity, and increased solution time).

Two major findings emerge from above discussion. First, these studies indicate the importance of group dynamics and how it changes over time as over time, GDSS groups may exhibit a different pattern of behavior and task outcomes than manual groups, and group developmental patterns over time may not be the same. Thus, the results of a study taken during the formative stages of a group may not be indicative of its future, suggesting the potential value of longitudinal investigations. Second, if group dynamics change over time and groups become more cohesive with time, then trust building measures especially among business partners are needed to ensure that e-collaboration leads to fruitful and beneficial outcomes for both organizations and its constituents.

4. TECHNOLOGY & TECHNOLOGY INTEGRATION ACROSS ORGANIZATIONS

To achieve these stated benefits, e-Collaboration tools provide modules for E-mail/Automated E-mail/Unified messaging, Instant messaging, Whiteboards, Audio/Video conferencing, Threaded discussion, Blogs, Calendaring and scheduling, Directory services, Document sharing, Knowledge and Data repositories, Databases, Content management, Group/Individual decision making support, Alternative generative and voting, hardware/Software sharing, Project management, and others.

Currently more than 100 vendors serve the e-Collaboration market. Market consolidation is likely to occur impacting the choice of technology availability[1]. The growth of web services is also likely to affect B2B collaboration. Factors such as use of web services within private exchanges, P2P technologies, web services

[1] http://www.appliedglobal.com/content/white_papers/WP_eCollaborationChoices.pdf

network, the movement toward mainstream products due to integration complexity, decline of ERP vendors may contribute to changes in collaboration among business partners [2].

GSS/GDSS technologies of the late 1980s and 1990 is vastly different to today's e-Collaboration technologies. Technology adoption, implementation, and use has been one of the dominant theme of IS research over the past 40 years has been. Even though technology changes over time, it is important to examine past practices and extrapolate guidelines and suggestions for use with the newer technology. The issue then becomes how should the system be designed and how to structure the process and inputs to maximize organizational benefits.

As individuals and suppliers/business partner firms begin using e-Collaboration to reduce costs and increase productivity and profitability, system design, multi language communication capabilities, and participant/team characteristics are likely to play an important role. Another issue that is likely to affect the choice of technology is the changing nature of collaboration. The last few years have seen the shift from same time/same place to any time/any place meetings. Such a change will have a profound impact on technology use and outcomes as not all participants are likely to use the same system for e-collaboration. Thus some participants at a location may use a set of technologies while other who are mobile may be using PDAs, cell phones etc. to communicate and interact with other participants. Thus, while technologies may be integrated, the use of different applications entails thus participants may experience differing outcomes due to the use of differing communication media.

5. SUMMARY REMARKS

The use of e-Collaboration tools for both business and personal use is a defining issue in today's global interconnected networked world. The roots of E-Collaboration goes back to GSS and Computer Supported Cooperative Work (CSCW) or perhaps even further. The purpose of this study was to identify research trends and needs within the area of e-Collaboration. This paper contributes to both the academic research community and practicing managers by bringing to attention the issues and challenges that need to be understood fully. Given the space limitations, we identified three areas that are vital to developing a greater understanding of e-Collaboration. As discussed previously, not all GSS findings are relevant and directly transferable to e-Collaboration. Future research should examine the basic premises and theory behind GSS and assess their relevancy and implication for the e-Collaboration environment.

Today's technology is vastly different and superior to the technology of the late 1980s and 1990 interms of multimedia capabilities, bandwidth, networked environment, multi tasking etc. Earlier theories on task-technology fit may not be relevant and thus the need to examine this issue in an environment rich with technology capability, availability, complexity, and level of sophistication. Issues of inhibitors, cost – benefit analysis, organizational transformation, formation and use of virtual teams, technology and business process re-configuration, design and integration of inter-organization systems need to be examined at greater depth if e-collaboration is to be a success.

Key group structure assumption such as group size and provision of anonymity have been altered and may not be valid within the e-Collaboration environment. Due to outsourcing, off-shoring, and globalization, there has been a tremendous growth in the use of virtual groups. Group dynamics do change over time and groups composition does play an important part in group cohesion. This indicates that trust building measures are needed to overcome lack of familiarity. More longitudinal experimental and case studies are needed to fully understand what works, what does not, and how within the e-Collaboration environment.

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Theory Building Following ICT's Substantial Cognitive Accomplishments

Charles L. Mitchell
Department of Political Science and Public Administration, Grambling State University
Grambling, Lousiana 71245 USA
mitchellc@gram.edu

ABSTRACT

Developments in information and communications technology (ICT) have been occurring at an astounding rate since about 1980. The ICT phenomenon has introduced numerous innovative concepts to the popular imagination. This analysis discusses the cognitive contributions of ICT to other areas of knowledge. The pervasive influence of ICT's, cognitive concepts are discussed as having a significant influence on how people theorize in many areas of social reality.

How contemporary international relations theory is shaped by cognitive ideas derived from ICT is presented as an example. Brooks and Wohlforth's soft balancing theory of reaction to unilateralism is explained as influenced by ICT's confidence in analyzing situations very thoroughly. A contemporary methodology for analysis of ICT is presented. Netlog is analyzed with observations from Netlog users. Cognitive gains from Netlog are seen as making sophisticated changes in interpersonal theory, helping problem solving, and encouraging users to be more effective at personal projection of self.

ICT is concluded to make valuable cognitive contributions. ICT provides significant opportunities to rethink all sorts of problems with more tools for reasoning. ICT succeeds in breaking down impasses to finding answers by encouraging innovation in thought and reasoning. Analyzing ICT in terms of cognitive contributions appears a promising technique for more effective ICT analysis.

Keywords: ICT, theory, qualitative methods, Netlog, cognitive, international relations, soft-balancing, interpersonal

INTRODUCTION

For several decades, information and communications technologies have been becoming more ubiquitous in popular culture. The personal computer was introduced on a widespread basis about 1980. Since that time, computer usage has developed from a small percentage of technologically oriented people to popularity somewhat less than television. Original computer programs accomplished tasks like data management, word processing, and financial management. The ensuing decades have seen the development of Internet and an increase in the entertainment content on the personal computer (PC).

Innovations in communications technologies have paralleled developments in information technologies. Mobile communications are among the most dominant present trends. Everywhere one looks, one sees people with mobile communications devices to their ear. The sophistication and attractiveness of these mobile devices appears to be continually improving. The memory capabilities of mobile devices now exceed the memory of most PC's of 1980. Innovations in the consumer-oriented mobile communications market are continual, and competitive pressures continue to regularly deliver technological developments to consumers.

Pervasive computing is increasingly a reality. The PC continues to improve in sophistication with new useful possibilities being added at all times. The personal computer and the mobile device connect through a wireless network. All the computers one has now interconnect wirelessly. Useful devices that contain computing equipment are increasing in number, and interconnection between all ICT devices is becoming the norm.

After 1980, the PC developed from an educational device for the technologically oriented to a means for almost everyone to acquire basic information and entertainment. The small percentage of people who owned PC's in early the 1980's has by 2007 become a group inclusive of all segments of society.

The unprecedented acceptance of ICT is a remarkable contemporary social phenomenon. The popular consciousness about ICT has undergone some very substantial changes in a very few years. Not to so long ago only the technologically oriented were expected to have comprehension of ICT. By 2007, a high level of computer literacy prevailed throughout the educated strata of people and each year more people are deemed computer literate. Interest in increasing computer literacy is greater each year.

The substantial change in popular ideas about ICT has been accomplished only by conditioning public consciousness about several ICT related ideas. The purpose of this paper is to consider the substantial cognitive accomplishments ICT has produced. The extensive change in ideas and consciousness produced by ICT is possibly best understood in terms of the profound effect ICT has had on theory building. Because of technological innovations, people no longer reason explanations the same as they did. Contemporary explanations for everything are shaped by ICT developments.

ICT'S INFLUENCE ON THEORY BUILDING – THE EXAMPLE OF INTERNATIONAL RELATION'S SOFT BALANCE THEORY

Attempting to appreciate how far reaching the substantial influence of ICT proves to be quickly reminds that ICT is influential in all areas of knowledge. The rational orderliness of the computer has implications for how knowledge is organized in a tremendous number of subject areas. The cognitive contributions of ICT have created unprecedented influence on theory building whatever the subject under consideration.

An objective of theory building is to improve present explanations for phenomena. Successful theory rearranges symbols so as to create reasoning that improves perceptiveness. Competition among theory builders is substantial, and all seek techniques and devices that will reason with their intended audience. Theory building has obligations to use the most effective tools available to reach and reason. ICT's development has occurred in the theory building environment. ICT's success has transferred analytic concepts to problems in other substantive areas. This transfer of concepts has improved ICT's popularity.

What is occurring in theory building is a transformation in cognitive conditions resulting from the unprecedented and pervasive success of ICT. The dazzling rate of technological innovation that ICT has maintained has conditioned the theorist's reasoning processes. The success of the ICT phenomena convinces there is something useful in all this innovation for personal concerns. In a problematic sense, people ask if the logic and rationalism of ICT may contain valuable suggestions for how they resolve issues relevant to their own pursuits

In cognitive terms, one cannot imagine that the ICT field exists together with other academic endeavors without imagining some sort of transfer affect occurring. Cognitive studies have been concerned with how a reasoning person escapes foibles in the thought process. Cognitive psychology has answered how thought patterns discover new and innovative answers to ordinary problems. Breaking out of traditional modes of thought is an aptitude seen as virtuous.

Everyone does not look at problems and see the same answers. Successful analysis of complex problems and issues requires an ability to perceive and explain reality with different emphasis. How the analyst directs the attention to his audience can make all the difference in his success or failure in building new explanation. ICT is invaluable in allowing analysts to choose some variation in reality explanations. The slight changes in technique and perception that ICT offers can cause profound discoveries about a problem. Shifts in cognitive patterns improve comprehension in an environment substantially influenced by ICT's profound developments.

Consider the field of international relations theory as exemplifying how ICT can cognitively revitalize crucial concerns. Among theory builders, international relations theorists have often considered themselves as among the most preeminent. International relations theory explanations tend to have a primacy in reason.

Consider a contemporary international relations theory and evaluate how influential ICT theories and concepts are in shaping international relations ideas. The new concept "soft-balancing" has emerged to explain an increasingly common response to U.S. unilateralism. In the years since the demise of the Soviet Empire, the United States has been described by some as pursuing policies of hegemonic unilateralism. For the last two decades or so, the U.S. has been seen to have no effective countervailing foreign-policy influence, and thus, to approximate being a unilateral power.

How other states react to U.S. unilateralism is the subject of international relations theory developed by Brooks and Wohlforth. According to these theorists, the potentially threatened states develop ententes or limited security understandings with one another. This process Brooks and Wohlforth identify as "soft-balancing" which can take the form of limited arms buildup, ad hoc cooperative exercises, or collaboration in regional or international institutions. Contemporarily, these actions are thought to have the potential to balance unilateral policy action by the U.S. (Brooks and Wohlforth, 2005, p. 512).

The soft-balancing concept is extensively influenced by ICT. The theory is reminiscent of the strengths of artificial intelligence (AI). Computer software developers like to include artificial intelligence in programs they devise. Comparing the product features of commercial computer games, one discovers that all sorts of claims are made about the strength of the artificial intelligence in the game program. The ability of game AI to handle situations is similar to the analysis requirements in the soft-balancing theory.

Computer artificial intelligence makes two significant contributions to soft balancing theory. The soft-balancing concept could be thought of as making use of various semantic trees found in an AI representational system. AI designers are concerned with how well the programs they devise represent the physical and social reality relevant to the AI program.

John F. Sowa explains that knowledge representation is a multidisciplinary subject applying theories and techniques from three other fields. Knowledge representation turns to logic for formal structure in it rules of influence. Ontology defines those realities that can exist in the computer's knowledge domain. Computation allows that a knowledge representation be appreciated as representing the real world instead of being philosophical (Sowa, 2000, pp. xi-xii). Semantic and mathematical techniques in computing distinguish the real world from abstract concepts.

International relations theory of soft balancing requires a very exacting calculation of international power realities. One imagines Sowa's discussion of knowledge representation when one thinks how this is possibly done. Questionably, the soft balancing concept would never have been developed without some of the sophisticated suggestions AI developed to promote more effective knowledge representation.

From a cognitive psychology perspective, AI's knowledge representation has helped encourage new thought patterns about how we perceive the issue of U.S. unilateralism. The cognitive contributions of AI have been to make international relations theorists quick to appreciate some sophisticated possibilities in thoroughly and confidently delineating various possibilities that exist in the international order.

For soft balancing international relations theory to succeed, sophisticated calculations of the effectiveness of international politics moves in parrying unpleasant unilateral policies are required. Probability and Bayesian probability might be useful in devising these representations. Reasonable ideas would be required to explain a how soft balancing would affect each successive step in international relations problem solving. Probability techniques in representational knowledge are excellent theoretically for presenting how states can succeed year after year with soft balancing policies against unilateralism.

Brooks and Wohlforth identify three possible costs of a unilateral policy. First, deciding among unilateral actions of different types has costs. Whether a unilateral action is precedent setting, already highly institutionalized, or associated with the hegemony's actions can be a costly determination. Second, unilateralism is explained to result in reduction in the efficiency gains that occur from institutionalized cooperation. Cooperative systems may be producing nice results that are disrupted when a state decides on unilateralism. Third, unilateralism can be thought to undermine the legitimacy of the state that pursues this policy. Claims that a state's actions are not consistent with accepted norms can compromise a unilateral policy. (Brooks and Wohlforth, 2005, pp. 517-518).

The ambitiousness of Brooks and Wohlforth's soft balancing theory requires concepts from ICT to make the international relations theory plausible. The developments that have occurred in ICT in the last several decades cause theorists like Brooks and Wohlforth to imagine more sophisticated ideas in explaining how physical and social reality happens. Without sophisticated representational knowledge from AI, one has trouble imagining how an international relations theory as complex as soft balancing would ever be deemed credible. International relations theory is indebted to developments in ICT that allow some of the cognitive steps necessary to accept Brooks and Wohlforth's ideas.

Similar cognitive possibilities are opening up thanks to ICT 's contributions to theory building in other areas of knowledge. The concepts and theories that underlie contemporary developments in ICT are promoting changes in cognitive processes. ICT produces a substantial encouragement to theorist to think beyond familiar concepts, to be bolder in explaining the social and physical realities, and to discuss phenomenon with more ability to communicate ideas effectively.

COGNITIVE CONCEPT BUILDING FROM ICT – THE EXAMPLE OF NETLOG

Analyzing a recently introduced ICT idea, Netlog, is a useful exercise in appreciating the cognitive contributions of a reasonably basic ICT idea. Until April 2007, Netlog was known as Facebox. Typical of a plethora of technological developments, Facebox yielded to the legacy environment in ICT and became Netlog. The current Netlog idea is typical of several similar Internet community ideas now popular.

Netlog has several features attractive to users. To begin using Netlog, one points the web browser to netlog.com, and either registers as a new user or logs on as a returning member. Netlog allows members to upload pictures of themselves and videos that they have created. Other members of Netlog can see these personal pictures and videos from members. Search features on Netlog allow members to locate other members with interests and personalities specified in the search criteria. Photos recently uploaded to Netlog are displayed on the systems beginning page. Netlog members can invite other netlog members to become friends online which means the friends' profile pictures are displayed with the member's online profile. Members can create communities of people with their interests. Netlog members who like to blog can do so from their profile page. A guest book is provided for visitors to the member's site who wish to leave some comments about the member's profile. Visitors can write comments about a member's online pictures. Chat between Netlog members is supported.

The Netlog dashboard, as the feature is called, allows the member numerous possibilities in making use of Netlog. Members have the option of changing the personal description in their profile. The profile options describe profession, hobbies, and interests. Members indicate the personal orientation of people they would like to meet. Statistics about the number of other users who have accessed their profile can be viewed. There are settings allowing members to receive alerts when someone sends them a private message, signs their guest book, or posts a comment on one of their photographs. Members can manage how private messages are kept in their in box. Management of the profile's guest book is allowed. Netlog members are given a choice of 50 different skins that change the appearance of their membership profile.

Netlog is a popular idea on Internet for several reasons. Netlog members like to upload photos of themselves and videos they have created to Internet. The possibility of meeting people in virtual reality with similar interests encourages Netlog's substantial following. Netlog offers members a place to hang out on Internet in a friendly environment with possibilities for discovering new people. Netlog members are continually uploading interesting photos and videos that provide substantial entertainment content. Netlog is international and members have excellent opportunities to become familiar with people in cultures distant from their own.

Attaining mastery of the Netlog features and possibilities is challenging. How to meet and become involved with other Netlog members is not readily apparent. Substantial individual difference in the adeptness with Netlog appears to exist among Netlog members. Netlog geeks are possibly able to gain a substantial amount in interactions among similarly inclined Netlog members. An inducement for following Netlog is the imagination of gaining some of the skills that successful Netlog members exhibit. Establishing online communities of like-minded people appears an example of advanced Netlog skills. In an era where computer games have taught to strive to move to the next level, Netlog encourages attempts to gain proficiency skills and become geeks at using this service.

A CONTEMPORARY METHODOLOGY FOR APPECIATING ICT'S COGNITIVE CONTRIBUTIONS

Techniques for evaluating how Netlog reorganizes cognitive consciousness can be devised. The international relations theory example indicates that the orderliness of ICT innovations, specifically AI, have had significant influence on conceptual problems as exemplified by Brooks and Wohlforth's soft-balancing theory. There are methods that can allow ICT researchers to perceive how an ICT innovation, such as Netlog, affects cognitive developments in reasoning. Possibly, users' personal theories about interpersonal relations can be shown to have conceptual development as a result of Netlog.

Analyzing Netlog allows introducing qualitative social science methods to the discussion about ICT. The gains made by qualitative methods in the last few decades have meant social scientists listen to what those directly involved with a phenomenon have to say. Qualitative methods demand that the social scientists not impose their own ideas. Famously, qualitative methods resolve this possible problem by listening to stakeholders or those directly involved with whatever is being researched.

Interpretive techniques are the skills qualitative researchers use to develop effective explanation from stakeholders' responses to in-depth questions. Interpretivist methods are useful social science for devising explanations about the cognitive contributions of an innovation like Netlog. Interpretive methods needs to be included in this discussion because sometimes the successful interpretivist can make substantial contributions to more powerful explanation by effectively reasoning with a few cases.

The Australian sociologist Bronwyn Davies has conducted research that exemplifies difficulties interpretivists have resolved in interpreting qualitative data. Davies' conducted a study about how children acquired gender identification. Her qualitative study included 7 four-and five-year old children. She spent many hours with each child during a one-year period reading and discussing children stories with each child.

From this small group, Davies concluded feminist interpretation of children's stories to be associated with employed mothers and more traditional explanation to be the result of stay at home mothers. The sociologist found that how children from different backgrounds explained stories about a prince, princess, and dragon were substantially different with feminist overtones. (Czarniawska, 2004, pp. 89-90) Her interpretivist methods exemplify the reliability researchers accept in working with small samples.

Talking with those directly involved with an ICT phenomenon similarly allows more effective analysis. In many situations even to the present-day, social science researchers show a surprising reluctance to allow stakeholders to shape the direction their conclusions follow. While qualitative methods have gained acceptance, substantially more discussion of whatever is being studied with stakeholders would valuably improve most social science research.

ICT research and analysis can gain valuably from more use of qualitative techniques. Analysis of ICT can suffer from the researcher imposing his own ideas on what ever is being studied. This problem can be resolved with the use of qualitative methods. Stakeholders can tell the ICT researcher new perspectives on the computer usage situation being analyzed.

LISTENING TO HOW NETLOG USERS DISCUSS THE SYSTEM

Analyzing Netlog is an excellent opportunity to use qualitative methods in an ICT analysis. The interpretivist possibilities for building useful knowledge about Netlog are many. All the interpretivist needs is some connection with those directly involved with the phenomena being studied. Deriving better explanation from listening to stakeholders is the idea that permeates qualitative methods. While some methods authorities encourage substantial in-depth interviews to assure qualitative methods produces knowledge building, the most significant method idea remains that ideas flow from the people directly involved with the phenomena to the social scientist. The idea is to circumvent the social scientist imposing his ideas on the knowledge building process. Listening to stakeholders is the idea ICT researchers need acquire from qualitative methods

In many areas of public policy analysis, social science researchers need be encouraged to use qualitative methods in their evaluations of different situations. The extreme example at present, is disaster assistance. In the aftermath of Hurricanes Katrina and Rita, questions were raised about whether federal and state agencies had read literature about stakeholders and public policy. Establishing that those responsible for disaster assistance, in any instance, consulted the hurricanes' stakeholders is difficult in retrospect. With this recent example in mind, encouraging ICT analysts to consult those directly involved with an ICT subject is deemed sound methodological advice.

Theory is an inclusive term, and when one discusses Netlog the researcher is working to know what affect ICT is having on how users theorize about interpersonal relationships. The researcher needs accept the qualitativist's position about talking with those directly involved with the phenomenon. How do Netlog users explain the cognitive influence the system causes? Social science wants to know if Netlog users make comments valuable in constructing explanation of how Netlog affects cognitive processes. Can interpretivists devise new understanding of Netlog's significance from Netlog user comments?

Original research about Netlog's cognitive influence approached about 150 Netlog users asking about cognitive issues and Netlog. This research assumed the intepretivist social scientists correct in aggregating stakeholder comments into better explanation. Theoretically, even a limited study would yield data valuable in devising useful knowledge about Netlog. The perspective developed here endorses interpretive techniques..

Netlog users were asked some open ended questions about whether Netlog contributed to improved thinking about all sorts of issues. Comments were sought on whether Netlog geeks are moving information technology to the next level. Comments were solicited as to whether Netlog was useful in how users thought about social reality. Whether Netlog was useful in problem solving was asked of Netlog users.

Netlog's search feature allowed creating a demographically diverse sample. Netlog private messages allow communicating questions to Netlog users. Consistent with the norms of good qualitative studies, as much extended exchange of messages as could be support was encouraged. This technique approximated ideas about in-depth interviews.

The results of the author's attempt to produce some data useful in explaining Netlog had both positive and not so positive results. Earlier experience with Internet research had shown to expect a low response rate. The response rate to the Netlog study confirmed that response rates to Internet studies are low. Only approximately 10% of messages received replies. Those responses received in some instances allowed a series of follow-up questions. The comments and observations by Netlog users were valuable in improving understanding of the Netlog phenomena. While the response rate was low, reactions received from Netlog users were definitely useful in building knowledge about Netlog.

From the theoretical perspective of this paper, one can follow ideas about cognitive development occur as a result of ICT, in this case Netlog. Somewhat the same phenomena presented in the international relations theory example can be found in comments of Netlog users. Netlog users encourage a belief that ICT is teaching cognitive development in interpersonal situations. With several decades of unprecedented success, ICT has effectively brought cognitive concepts to interpersonal realities. Netlog users are developing new personal theories about interpersonal relations.

The response rate itself instructs that Netlog users tend to be privacy oriented and prefer to react selectively to those individuals who approach them online. ICT has done a substantial amount to encourage that people cautiously accept those with whom they would like to connect. The ICT reality accomplishing this cognitive development is the network phenomena.

Computer mediated communications involve networks, and the first principle of information technology networks is that the larger the network the quicker and more exact the connection between buyer and seller supported. IT networks teach that the objective of network connections is buyer finding the precise seller. When this principle of networks is followed with Netlog users, one learns that Netlog users have become conditioned to be very selective about what they accept online. Because of the selectivity Netlog users imagine in networking, an attempt to study them with messages receives a low response rate in reply messages.

Netlog users discuss "Internet reality" accepting that this can be "quite different for two different people." Some Netlog users regard Internet reality "as real as the outside world." Other persons regard Netlog as "A cyber playground where they can be who they want to be, when they want, where they want." The Netlog experience is discussed very positively. One user explains, "Because of Netlog's simplicity in use it makes it one of the easiest ways to converse communicate with different people anywhere at any time and thereby broadens the attitude of people towards others and a culture. It's a fantastic idea and shouldn't be abused."

These type of comments emphasize the cognitive discovery is occurring on Netlog. People are discovering they can test how they interact with people more readily online. The blur that exists between people as they communicate online and in person appears as profound to Netlog users. The computer-mediated communication is encouraging some experimental connections and allowing a belief to develop that what is on line connection now could become in person social reality tomorrow.

Cognitively speaking, Netlog users report thay are experiencing some ambiguity in how they relate to people that they are getting to know online. The cognitive contributions of this online learning may well carry over into their ordinary social interactions. As a result of online computer mediated communication, people may solve beginning interpersonal relationships by allowing more ambiguity in initial involvements. From the comments made by Netlog users, managing solving personal interaction situations differently and more constructively could well occur as cognitive ideas from online community affect in person friendships.

As for problem solving, Netlog users indicate that public blogging "is interesting and opens avenues for conversation and interaction with others." The therapeutic significance of blogging is recognized by Netlog users. How blogging helps is explained this way, "I'm sure though it does help others out there who need to air their thoughts and don't mind the input of others…maybe even the odd one or two who do it because it's the only way they know to call out for help"

The search bar is identified as useful in problem solving. One user states search "allows you find what you're looking for work right down to specifics without much information being needed." Netlog users appear to believe that finding the exact person they need to communicate with is important in problem solving.

Netlog users can be seen to resolve problems by writing about them publicly in blogs. Finding people that are exact matches to personal preference is seen as useful in resolving personal questions and issues. Both of these techniques for problem solving convince that Netlog is teaching some authentic alternatives for personal resolution of problems. Cognitive development is occurring.

ICT phenomena encourage the user to break out of conventional techniques for solving problems. Reasonably, Netlog users take away from their ICT experience alternative techniques for reasoning with problems. Netlog is a clear instance where conceptual breakthroughs may well occur thanks to the cognitive contributions of ICT.

Another feature of Netlog mentioned by users is how the system rewards uploading photos with user credits. Netlog user comments suggest that developing communities on Netlog based on photos occur because Netlog rewards photos uploads. The exchange principal Netlog teaches giving credits for photo uploads to motivate people to attempt to succeed with Netlog. Internet communities – often-erotic community, according to this exchange logic, can most likely occur as Netlog users become personally projective.

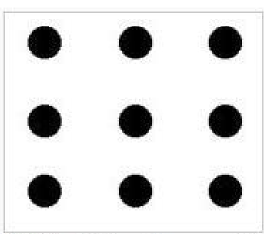
ICT has made as drastic a contribution to cognitive development by rewarding individuals being creative in the photos they upload. Establishing a Netlog community is explained to require a lot of uploaded photos. The cognitive implication is that there is not much possibility of succeeding with the advanced features of Netlog without an excellent sense of personal projection. Transferring this cognitive contribution to other ordinary pursuits could result in success for similar reasons. Many believe that people need to learn to be more open and more giving of themselves in order to make the connections that bring success in different situations. The cognitive reorganization that ICT encourages by rewarding personality able to be more personally projective is evidence that some substantially innovative ideas are originating from ICT phenomena such as Netlog.

COGNITIVE CONTRIBUTIONS

The strength that has allowed ICT to develop as substantially as has occurred in the last few decades is to some degree based upon the cognitive innovations these new technologies offer to users. When one analyzes ICT, the significant cognitive achievements of technology are very useful as an analytic perspective.

The famous Nine Dots Puzzle is useful in explaining how ICT is helping theorizing whether about international relations or interpersonal theory. Nine Dots was first published in Sam Loyd's 1914 *Cyclopedia of Puzzles* ("Thinking Outside the Box," Wikipedia). The use of Nine Dots has remained respectable with cognitive psychologists such as Richard E. Mayer including the puzzle his explanation of thinking to restructure problems. (Mayer, 1992, p. 75) Nine dots is useful in imagining how ICT restructures ideas in theory building. The objective is to connect the dots by drawing four straight, continuous lines, and never lifting the pencil from the paper.

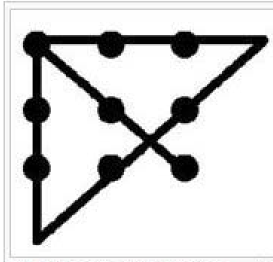
Figure One
The Nine Dots Puzzle



The "nine dots" puzzle.

Connect the dots by drawing four straight, continuous lines, without lifting the pencil from the paper.

Solution



One of many solutions to the puzzle.

(source: "Thinking Outside the Box," Wikipedia)

. ICT's influence is substantial in producing more effective techniques for understanding social realities and better methods for problem solving. The ICT analyst who focuses on this reason for technology's success is getting closer to the authentic contribution ICT is making. ICT analysis needs to explain how the technology is useful in restructuring the problem being considered. When the ICT analyst thinks in terms of cognitive contributions to problem solving, he explains ICT has been successful for rational reasons. This perspective on ICT analysis appears potentially to have much usefulness.

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Social Informatics: Experiences from Rural India

Deepthi Shanker
Humanities and Social Sciences
Indian Institute of Technology
Guwahati-781039, India

ABSTRACT

Social Informatics facilitates understanding of both technology and society from socio-technical perspective. It takes into account psychological factors and cultural context while understanding technology's interface with society. This paper is an attempt to understand community informatics in rural India. Do the rural people have the social capital to harness ICT technologies to serve their development goals? The paper highlights some of the developmental strategies and initiatives to promote social, political and community informatics through e-governance in Belandur Gram Panchayat[1] in Karnataka state of Indian subcontinent. Belandur Gram Panchayat is the first village in the country to introduce computers at village level governance

Keywords: Social and Community Informatics Information and Communication Technology, Rural India.

INTRODUCTION

The spread of ICT (Information and Communication Technologies) is often stated to be the harbinger of a new information revolution. Interaction with the ICTs is not just confined to work places. Application of it in routine domestic activities is rapidly increasing. Thus, attributes of these technologies increasingly dominate contemporary change and development. For instance large-scale computer mediated communications take place for household activity, routine communication, business, entertainment, learning etc. Computer mediated communications have become enjoyable and resulting into full fledged social activity. These rapid changes have a major impact upon the designing of the computers, based on the needs of the people thus making it people and community oriented. As a result of these changes, several disciplines like HCI, Social Computing, Social Informatics and Social engineering have emerged in the academia although there exist blurred boundaries between them. Social Informatics enquires into social and cultural aspects of the technological process.

SOCIAL INFORMATICS

Social Informatics is a growing interdisciplinary field of study which borrows liberally from disciplines like sociology, information sciences, education, economics, computer science, design, communications etc. Its broad areas could be categorized into ICTs interaction with society, ICT's applications in the social sciences, ICT as a tool in social research. Social Informatics is a critical, social and a scientific study of Information and Communication Technologies and its interaction with the existing social institutions and practices. With substantive enquiry areas like community informatics, cultural informatics, health informatics, political informatics and spatial informatics could eventually emerge as specialized fields. Besides dealing with the impact of computing technologies upon the socio-cultural processes, it enquires into the dynamics of social behavior of individuals and their interaction in the society which is a result of these technologies. It involves science, technology and society. As a domain of science, it seeks to describe the relationships among social behaviors and machines so that certain amount of uncertainty can be reduced between the interaction amongst the humans and the machines. As a domain of technology, it seeks to apply social and behavioral science to the design of information technology systems thus enabling efficient collaboration between them (Dryer, 1999). Apparently, as domain of society, it seeks to enquire into the social and cultural phenomenon which gets dictated by the process of digitalization and virtualization.

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[1] With the passing of 73rd and 74th constitutional amendment in April 1992, in India, the structure of governance has changed permanently from a two tier to a three tier system with union, state and pancahyats. There has been decentralization of powers, resources and functions with regular elections held in panchayats. In Karnataka state, Panchayat system came into existence on 1st of April 1994 and it resulted in 5659 Grama Panchayats. One such Gram Panchayat is the 'Bellandur Grama Panchayat' which comprises of five villages namely Bellandur, Devara Bisanahalli, Kariyammana Agrahara, Haralur, Ambalipura.

The new information era has brought in the fear that as life becomes technological; it tends to become less human. Hence, the emphasis now is on how these technologies can be imbibed and integrated into social lives. The success of these technologies lies in their potential to affect human social behaviors. That's precisely, why Social Informatics becomes important. But the challenge of academia lies in actually determining to what extent technology and social life can coexist. Or in other words, to what degree the assimilation between the two is possible.

PERSPECTIVES

There are different perspectives upon which the social impact of these technologies can be examined like Social Interface theory, Computer mediated communications theory or Computer supported cooperative work (CSCW), Community researcher's theory and theory of Interpersonal psychology. Social interface researchers examine social behavior by studying human responses towards technology while CSCW researchers study social behaviors in computer-mediated communication. Community researchers study community influences on behavior resulting out of these technologies and Interpersonal researchers study social behaviors in face to face interactions arising out of technologies. These theories can be applied while understanding social and community informatics. It argues that humans respond socially to artifacts and hence artifacts must be intentionally designed to encourage social responses. Social interface theory is built on the results of various studies demonstrating that humans respond socially in their interactions with machines. Meaning, humans are inclined to treat everything as social and natural. Hence, they subconsciously and automatically depend upon their natural and social experiences to aid their technological experiences. Researchers have proposed social interfaces as a way of using the responses to help human-computer interaction natural, enjoyable and efficient regardless of the mechanism behind it (Dryer, 1999).

SOCIAL CAPITAL AND SOCIAL INFORMATICS

The term 'Social Capital' was first used by French scholar, Pierre Bourdieu while referring to different forms of capital existing in the society namely, economic capital, cultural capital, social capital and symbolic capital etc. Bourdieu (1991: 243) explains capital as representing power. The term was later picked up and popularized by James Coleman and subsequently by Robert Putnam and other scholars. 'Social capital' largely refers to the social networks which consist of informal values and norms shared among the members of the community. To put it more precisely, Social Capital may be defined as those resources inherent in social relations which facilitate collective action. Thus, it is an informal network of association representing any group aimed towards a common purpose. Social Capital Recourses include natural human behavior like trust, reciprocity, association, compromise, bargaining etc. It is indeed interesting to connect Social Capital with Social Informatics, Community Informatics and ICT. Information & Communication Technology and development are closely interrelated. The potential for development due to application of Information Technologies are spectacular. Internet services, telecommunications, etc are just a few examples. Information and Communication Technology has the ability to connect the actors to resources, relationship and information beyond their immediate environment. Hence, it is believed to possess rich potential to increase Social Capital. Social Informatics facilitates in exploring such possibilities and benefits by bridging ICT with Social Capital.

There are several benefits arising out of the proper interaction with ICT and Social Capital. Remote villages or geographically isolated regions with limited resources could be easily connected to important nerve centers of business, education and entertainment. But those areas need to be equipped with basic infrastructure needed for the information and communication technologies to work like computer and phone line. Education and business opportunities can be doubled in such areas if the right application of IT is made. Selling goods through the internet offers greater access to different markets and can save time and transportation costs for negotiation. Both producers and consumers can reap maximum benefits. Firms and companies can have joint operations and collaborations thus enhancing business opportunities. These activities are normally facilitated by the traditionally available, already existing social capital resources in different societies. But however, these resources of social capital can be enhanced due to the several opportunities offered by the internet and other technologies. It could be a group of farmers from different corners coming together to explore the possibilities of reaping the benefits of IT by modern communication systems. Or it could be a set of craftsman within cooperatives joining hands together for better connectivity with the world markets. Social Informatics becomes crucial while examining behavior patterns of the individuals in the society during their interaction with the technology.

ICT & DEVELOPMENT IN INDIA

Social Informatics both as a theory and practice emerge as a result of increased deliberations made by ICT on the societies. It becomes imperative to examine the role of Information and Communication Technologies in the development process in India. In India the adoption of ICT as a driver of the economy became visible only since 1990s. Free market economy in India paved the way for gradual growth of ICT technologies and its penetration both in economy and society has resulted in a paradigm shift in the development process. Bill Gates has rightly said in his book "The Road Ahead" that the Information Highways are a mass phenomenon or nothing. For developing countries ICT is having a measurable impact on the socio-economic conditions of the people and it is gradually being accepted. Development economists feel that ICT should not be treated as an isolated sector, but should be used as a lens to re-think development strategies, as a tool to enable all sectors and as a new and powerful means to empower the poor. It is essential to understand that ICT is different from other technologies and technological revolutions. This will enable the effective use of ICT for development.

It is critical to understand how information and communication are vital to the lives and livelihoods of the poor and how ICT could enhance their access to markets, institutions, services, education and skills. One major contribution that ICT makes is to break the mutually reinforcing cycle of poverty and lack of information or access to ways of improving the fate of the poor. The poor lack access to information about income, earning opportunities and market prices for the goods they produce. To add further, most of the time they are unaware of their rights, health and hygiene, public and welfare services. The poverty stricken condition of the poor gets accentuated due to lack of knowledge, education and the skills to improve their livelihood. Unless there is a strong democracy, they may lack even the political leverage necessary to have their voices heard. These observations have been confirmed in several projects where ICT has been applied in breaking the poverty, low productivity cycle and bringing some hope to the poor. Computers provide a means of processing information efficiently. They can be used as a tool in management, business, local development, engineering and most importantly for governance in administration at different levels including the village level. The computer is not just a tool, but as described by Alvin Toffler in his work "Power Shift", a subversive, an electronic bulldozer, a change agent. Computer compels us to redefine our institutions. ICTs is adopted not only to improve the economy and raise the quality of life of the people but also to transform peoples' mind sets and facilitate rapid change (Ghosh, 2004).

There are several cases, which articulate the benefits derived from the rural communities out of ICT technologies. For instance, in Andhra Pradesh in one of the villages in Ranga Reddy district, the farming community has learned to use computers to manage their water resources, updating of village records and gained access to vegetable prices etc. M.S. Swaminathan Research Foundation has trained local villagers in areas around Pondicherry to monitor information needed for farmers, fisherman, cattle growers and artisans. The Foundation is known for promoting the use of technology and communications through a number of internet centers for getting information across to farmers, fishermen and from them to urban centers. In another experiment in Tamil Nadu, professors from IIT, Chennai formed *"n-Logue"*, an institution to bring low cost communications to the rural and remote areas. 'n-Logue' is a rural internet service provider dedicated to provide internet access to villages. Besides, recent experiences with experiments like Gramdoot in Rajasthan, Bhoomi in Karnataka, Gyandoot in Madhya Pradesh and e-Choupal across the country suggest that ICT has been quite useful for the rural masses and has enhanced the quality of rural life (Ghosh, 2004). These examples reinforce the perception that ICT is not for the elite only, but equally and perhaps more so, for the poor.

SOCIAL INFORMATICS & LAND RECORDS

Land record is the most vital document in any Indian farmer's life. It is the basis of the entire revenue administration, the area where the government pinches the farmer. For instance, buying, selling or pledging of land to get loans and several other interactions in the village depends upon the production of an authenticated land record document from the village officer who looks after the official matters. He is a powerful man who can play around with the lives of farmer as he has control over the small piece of paper, which documents the details of the land. It is the lifeline for most farmers. It is only recently Karnataka State government launched to computerize all the land records and give computer outputs for these records a legal status and to make them available at specified centers at a nominal cost. It is popularly known as '*Bhoomi Project*'. The project in simple terms digitized some two million-land records in 27 districts. In practice this was a mammoth effort of transferring to the computer the handwritten records, many of them decades or even centuries old and in local languages. The government implemented the scheme taluk by taluk so that each farmer switches from handwritten records to computerized ones. Gradually, the handwritten ones were declared as illegal from the date of implementation in each taluk. The most important outcome of the project is that now a farmer can walk into a kiosk and ask for a copy of his record for as low as charge of Rs 15 per copy within 30 minutes of applying, which is a record in e-governance. More than five million farmers have already availed the Bhoomi service from various kiosks.

BELLANDUR: AN ELECTRONIC VILLAGE

Bellandur, which is now known as electronic village falls under Belandur Gram Panchayat is situated 25 kilometers away from Bangalore, Karnataka. Bellandur Gram Panchayat is the first Panchayat in the country to introduce computers at village level governance making e-governance a big success. Bellandur's e-governance project started with a single computer that was brought to the village in 1998 to replace the Panchayat's old typewriter. This brought Bellandur to the notice of Compusol, an IBM and Microsoft joint venture company, which is involved in research and development of e-governance software packages to suit the Indian context. Working closely with the panchayat members and village residents, Compusol managed to devise software packages to suit the needs of panchayat administration, handling the recording of property details, tax collection, data management and so on. Since the software uses the local language, ordinary residents have experienced fewer problems in getting involved in the project. Following the computerization of tax collection, the panchayat had recovered a huge outstanding and this allowed the panchayat to channelise funds for development projects. There are scarce glimpses of ordinary village situations in Bellandur with cattle moving in a herd, tiled homes with cow dung cakes all over the walls. Instead, there are small structures and buildings everywhere giving a look of perfect mini-satellite town. Bellandur is rapidly losing the rural characteristics of a village due to speedy urbanization. The cultivated area is decreasing considerably as the agricultural lands are being converted into non-agricultural lands for speculative purpose of profit. Once a village, this place has slowly transformed into a township acquiring a new tag for itself as an ‘Electronic Village’.

SOCIAL INFORMATICS IN ‘BELLANDUR’

Bellandur e-governance initiative is unique because of demonstrative interplay and integration of Social Capital and Information Technology. Both Bhoomi and Belandur projects although initially aimed at computerization of land records in rural Karnataka, have now broadened to other aspects of developmental work too. Both the projects might have used the infrastructure of Panchayat Raj bodies at village and Taluk levels for their operation. But what makes the difference between them is the fact that Bhoomi project was a part of the Karnataka state government initiative which comes under the broad IT policy of Karnataka state government. Bellandur project of computerizing land records on the other hand was completely local people’s initiative and cooperation. In academic language, one tends to theorize that Social and Community Informatics were in operation at Bellandur.

Interviews with the Panchayat leader, members and village residents revealed several issues quite relevant to the discussion of social capital and community informatics in rural areas. Once the computer arrived into the village, a girl was sent for two months for computer training and she started handling the computer after she returned from the training. Information on Gram Sabha Resolutions, property details, expenditure statements, Gram Panchayats meeting resolutions, beneficiary lists etc were fed into the computer. Thus there was a facility where all the information could be stored in one place and accessed anytime. Eventually, computer literacy gradually spread among other key members of the villages too. Soon the news spread everywhere and Bellandur Gram Panchayat became popular for having a computer in its office. The press made frequent visits to note down the activities of this gram panchayat in detail. During that time, even the Karnataka state government offices did not have computers. A single computer at Bellandur Gram Panchayat office made the world look at Bellandur. Actually gram panchayat had no provision to buy the computer costing 67,000 rupees since the cheque power was limited to only 10,000. But Bellandur had ‘Village Development Committee’ (VDC) which contributed for purchasing the computer. Thus the project is not being funded by the government, but it is entirely and exclusively the result of a private initiative of the villagers themselves largely known as Village Development Committee. VDC and its activity reflect the collective action among the villagers. One can witness interplay of community and social informatics in several such tasks.

Although the villagers and the committee members were not expecting any special financial support from the government, they were indeed expecting support in technology. They wanted better technology to implement number of new programs. Access to appropriate software and technological support could have further strengthened community and social informatics. For instance, they wanted to do citizen’s ID to keep track of the migrants coming into Bellandur from different places. For that they needed software and support in technology to implement it. Unfortunately, they were not many initiatives either from public or the private sectors to aid them.

Mention has to be made of Jaganath Reddy, the man behind this entire story of success of the Bellandur Gram Panchayat. If not for his vision in wanting to make Bellandur a wired village, these accomplishments in the village would not have been possible. Besides, it is also crucial to mention that the residents of the village and their collective support were largely responsible for the gram panchayat activities to be computerized and for other developmental activities. Bellandur experiences reveal skillful management of community, communication and collaboration with the technology, which are believed to be the corner stones of Community and Social Informatics. Bellandur Gram Panchayat now proudly claims that they get all necessary records whenever they need them without having to wait for weeks. Besides these records are free from human arbitration and hence updating becomes easy. Computerized records make farmers free from harassment by the government officials, middlemen and village leaders as they have direct access to all information about their property which was earlier not possible. Advantages arising out of this system are many. Limited scope for manipulations, increased transparency, and increase in the collection of revenue are just some of them which are evident to the villagers. Disadvantages could be the delays, due to power outages and breakdown, delay due to Tashildar's thumbprint, glitches in software etc. Non familiarity and non accessibility to technologies too could make villager feel disconnected and disoriented in the initial stages. It is here where the designers have a crucial role to play in envisaging Social Informatics.

Designers need to keep in mind that familiarity, devise satisfaction, social application, accessibility, appeal, relevance, power, pervasiveness, communication are some of the important factors affecting the human computer interaction. Earlier research has indicated that devices can affect the mechanisms that determine when interactions are satisfying and productive. If the device has not been designed to support social interactions, they can appear to users as unattractive. The way devices can be used cannot be determined by their creators alone. Individuals too can influence the usage of devices as they are social creatures. The importance given to social relationships in our lives indicate that individuals tend to adopt those devices that support rather than inhibit such social relationships. Thus computing technology can be successful, if they are supported by human social lives. Designers need to understand the mechanisms behind interpersonal satisfaction and collaborative productivity. (Dryer, 1999)

CONCLUSIONS

Digital knowledge and the impact of ICTs on the rural communities have largely led to the diminishing of the traditional forms and practices of both participation and community organization. But, alternatively, they have opened up new communicational channels among people, which have led to newer forms of participation and organization. The fact that the success of Bellandur village is due to people's participation ensures that there are newer forms of participation processes emerging among the communities, which is leading towards development. Information technology holds great promise for creating positive economic growth in rural areas. The concept of Social capital has been lately applied to number of fields including ICT. The need for the development of social capital is crucial in order to nurture the developments of ICT among the rural communities. The interplay of social capital, knowledge sharing, technology, community building becomes visible as one explores several experiences of community informatics in different parts of the world. Social and Community Informatics has been the necessary component of 'Information & Communication Technology' investment in rural areas and the integration of the two is very essential.

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Connecting Social Science and Information Technology Through an Interface-Centric Framework of Analysis

Mikael Sundström, Ph D
Department of Political Science, Lund University
Box 52, SE-221 00, Lund, Sweden.

ABSTRACT

The gathering pace of IT innovation has, or ought to have had notable methodological repercussions for the social-science community (and beyond). Where yesterday the researcher could unhurriedly unlock the social-scientific significance of a chosen medium, secure in the knowledge that his or her work would have bearing for many years, by now there is every reason to confront a fear that the prodded IT implementation may in fact be gone or at least heavily altered by the time such comprehensive research is concluded. This paper will propose a complementing systematic "interface-centric" research model capable of interconnecting a non-finite variety of IT implementations *and* social science studies in a coherent way. The paper also outlines how users "downstream", whether political actors or technology operators can use the proposed framework to more easily approach and weight academic input when evaluating complex IT effects.

1. A METHODOLOGICAL CUL-DE-SAC

Exploring ways, a decade ago, to understand and systematise the evolving IT situation as a social scientist, the better to apply my field of expertise (which happened to be democratic theory) on this dynamic field, I noticed a real and urgent problem. It seemed to me that the gathering pace of IT innovation and evolution had rendered existing analytical strategies obsolete. The predominant social-scientific approach was to examine individual IT *implementations* with the aim to make "holistic" sense of its possible societal impact. Thus we find learned treatises about the French *minitel* system, about Bulletin Board Systems, about the fax, the telex, the video etc., where the various authors aim to examine how each technology affects the human condition, as based on some preferred theoretical perspective.

There was a notable advantage intrinsic to this "implementation-centric" approach. To place a specified technology at the very analytical heart, conceptually linked the many varied actors who had an interest in it. Academics, manufacturers, politicians and pundits (to identify but a few such actors) all shared a somewhat analogous idea what *minitel* was all about, and so could pick up on, and process, other actors' input. There was, to use an economic term, a great deal of information liquidity within each implementation sub-field.

The problem was and is that such a methodology requires a very long technological "half-life" to be viable. But where yesterday a researcher could unhurriedly unlock the social-scientific significance of a chosen medium, secure in the knowledge that his or her work would have bearing for many years, by now there is every reason to confront a fear that the prodded IT implementation may in fact be gone or at least heavily altered by the time such comprehensive research is concluded. To put it harshly: how relevant are those meticulously compiled studies on the social impact of the *minitel* or the telex machine today? Is an analysis of communication technology X reasonable when X.1 and X.2 lurk just around the corner?

It then occurred to me that an "implementation-centric" methodology really had proved inadequate even in its heyday. Yes, it was possible to study the impact of, say, the *minitel* from a variety of research angles. Yes, it was thus theoretically possible to amass complementing data from a variety of sources to triangulate the wider societal significance of *minitel*. But information liquidity, crucially, was limited to communication-technological sub-fields based on individual technologies. Great artificial barriers divided the pools of liquidity, even though it is easy to see that findings from any given field might have, indeed *ought* to have, an overarching impact on the others. After all the common theme is *communication* albeit in a variety of forms. It should of course be stated that many scholars use abstract theory to bridge these divides (perhaps to study many different implementations using a prepared set of analytical tools), but this simultaneously reduces liquidity: very few of his or her academic peers from other disciplines, let alone non-scholars, will have the time or the will to traverse such inaccessible bridges.

With a radically reduced technological half-life, a consequence of the building momentum of the Internet as a ubiquitously employed infrastructure, this crucial advantage of an implementation-centric approach are at any rate growing chimerical. When an author refers to the impact of "IT" or "the Internet", without any clarifying preamble, it comes across as a wistful throwback to a bygone era. Is the author really thinking that "IT" provides a conceptual common ground on a par with "minitel" two decades ago?

2. DESIGNING A NEW METHODOLOGY

Realising that the outlined methodology was dented beyond repair, I set myself the task to think through a methodology to supplant it. I began by establishing a set of guiding design parameters.

I wanted the replacement methodology to

- reside on an abstraction level which precluded any reliance on a long technological half-life
- be relevant across individual technological implementations
- provide inter-disciplinary information liquidity, by means of an information "storage technique" that was readily understandable and usable across disciplines and actor types.
- be constructed in a way that, ideally, allowed it to be grafted onto existing studies with a minimum of effort.

To keep individual implementations as methodological "gravity wells" of choice was impossible because their characteristics continually evolved. But what if the focus was the actual characteristics? Properly anatomised such characteristics would prove both durable over time and concrete enough to serve as common, tightly-knit, conceptualisations. The eventual test, for me, would be if

- it would be possible to build social-scientific constructs around or interconnected with these conceptualisations (I used my own democratic-theoretical foundation as test bed), and;
- it would be feasible to devise *policy* around them (this would suggest that non-academic actors could adopt and use the framework).

"Characteristics" is a vague term, and may be understood in many ways. My aim was to extract *communication dimensions* that were "a-empirical" in character (i.e. not exclusively bound to specific technologies), yet possible to make operational in a given empirical study. I decided to focus on the *interface characteristics* that face senders *and* recipients (this dual outlook is, I think, crucial). Regardless of the communicative situation, certain limitations and opportunities present themselves to a given sender and recipient. It may, or may not, for instance, be possible for the sender to stay anonymous when conveying a message, just as it may (or may not) be possible for the recipient to stay anonymous when picking it up. I basically aimed to locate a complete list of interface characteristics belonging to the same *class* as sender and recipient anonymity. Overlap or nesting among these dimensions were deemed unacceptable – the dimensions need to be "atomic" for me to argue in earnest that they do indeed belong to the same class as sender and recipient anonymity.

Every form of artificially mediated communication (i.e. every time an information technology implementation is employed) makes such dimensions readily observable to the keen eye – after all, both senders and recipients deal with interfaces when interacting with communication technology. This observation made appealing a strategy where various IT:s (actual implementations) were compared in order to extract final dimension candidates. To this end, I employed a simple snowballing methodology, where new IT:s were added to the comparison process until marginal gains became negligible. The net result of this undertaking was a list containing some thirty dimensions which seemed (and still seem) to conform to the stated criteria. *The pivotal realisation is that every studied communication technology can be reinterpreted as a combination of dimension states.*

Space constraints make it impossible to present each locate dimension in detail here, though a condensed list will be appended to the end of this paper, and I refer the reader to Sundström, 2001 for an expanded exposition. In this text I will use a token subset to emphasise certain methodological points. We have mentioned anonymity, in its two distinct (but nevertheless routinely overlooked) varieties: *sender* anonymity and *recipient* anonymity. *Pervasiveness* is the level to which the recipient is able to *avoid* a message (a message conveyed by a tub-thumper in the street is thus more pervasive than the message in a newspaper that you yourself have to pick up in the newsstand). *Information richness* is the transferable amount of data in a given time. Based on experience, I here ask the reader not to direct criticism at the adopted *labels*: it is the underlying *concepts* that are under scrutiny. I might have used mnemonic abortions like dimensions X, Y & Z to avoid controversy, but abstraction for abstraction's sake holds little appeal for me.

3. AN INTERFACE-CENTRIC MODEL AT WORK

At this stage, the various dimensions are pristine, in that they hold no significance beyond their functional (relative) existence in individual technological implementations. Since they spring from a pure technology review, they carry no integral normative baggage. They just are, or are not, or are to a specific degree, one might put it.

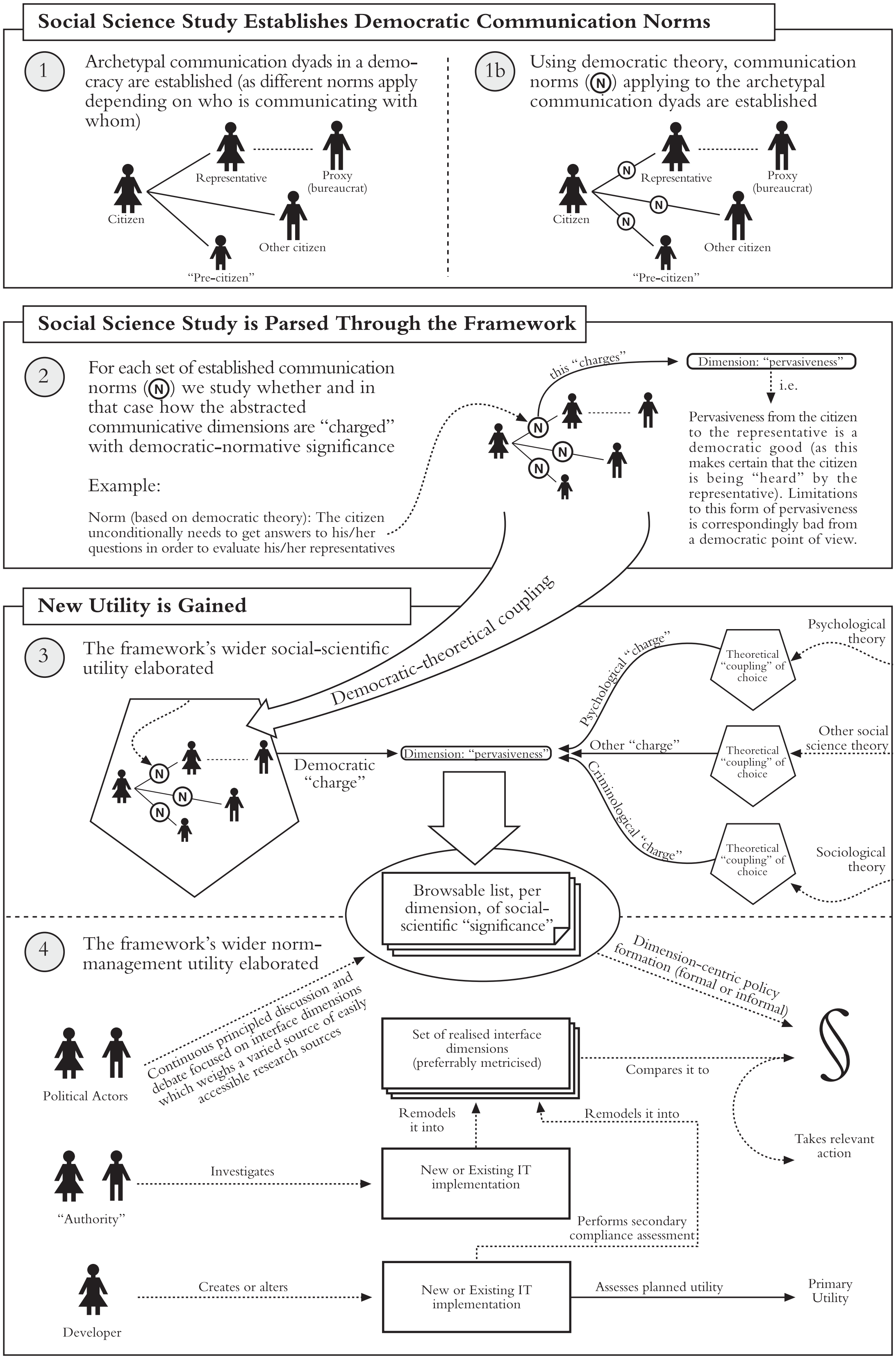
The true worth of the model becomes apparent when we realise that such a statement is patently untrue. We actually harbour very strong convictions indeed vis-à-vis certain of these dimensions. We have the intuitive – or well-informed as the case may be – sense that they affect how society works, whether for good or bad. And "we" include members from all the actor groups we have discussed *en route* – including the academic community.

Each dimension is thus more than ready to be "charged" with normative significance. I happen to base my own input, per relevant dimension (e.g. sender anonymity) on my reading of democratic theory. A psychologist will use the theoretical tools of his or her trade to provide further insights into the impact of sender anonymity. Etc. Downstream, practitioners, pundits and politicians will suddenly have easy access to a structured library of views drawing on theoretical traditions they will not be required to master. These informed views can in turn be weighted to prepare for real-world decisions on a variety of levels.

Figure 1 (below) illustrates the process in its (archetypal) entirety. In it, a sub-component of my own democratic-theoretical discussion is used to demonstrate how abstract theory can be "parsed" through the framework in order to charge a dimension (in this case *pervasiveness*) with normative significance. It seems prudent to reiterate the point that as such principled normative input is now uncoupled from communication technology *per se*, it should prove a robust feature in a rapidly altering communication landscape.

A final preparation before turning to the figure. Democratic theory is a diverse body of literature (and thus a good representative, it seems to me, of almost any given social science subdiscipline). Of importance here is that democratic scholars hardly ever address communication norms *directly*. It becomes a matter of sifting through (often convoluted) normative statements using the framework as a pan to extract the "dimension nuggets". When I note that an author claims that the better argument should win the day regardless of the originator's status, that author tells me that sender anonymity is a democratic good in *his* (not mine I hasten to add) conceptualisation – after all, the argument will then be uncoupled from the individual.

Figure 1 An Interface-centric Framework of Analysis at Work



NB. This is a bona fide study, but it will not (for obvious reasons) be presented *in extenso* in this paper, but is merely used as a relevant example

4. NEW UTILITY FOR THE ACADEMIC COMMUNITY

In the figure, I have compartmentalised two distinct, if interrelated, groups of beneficiaries. I will now proceed to briefly extend and clarify certain points relating to each – (3) and (4) in the figure.

Under (3) we find the scientific community hard at work, as researchers from a variety of fields take the opportunity to slot in findings in the relevant "dimensional holding boxes". *Clearly* this effort will involve considerable simplification. The "slotting process" brutally shears off complexity – but that, of course, is also an alluring point for everyone from beyond one's pinpointed field of expertise: findings may be simplified, but they are also made approachable. One thing I found when delving through studies about information technologies, new and old, were how hopelessly incompatible they appeared to be. To try to systematise findings from across studies proved migraine-inducing, as they all adopted their own idiosyncratic approaches, or, more commonly, *stubs* of idiosyncratic approaches. Widespread use of the presented interface-centric framework, if only to present a minimal subset of relevant findings, would lend the framework certain Rosetta-like qualities. We would quite simply gain a new way to sort and locate our peers' research efforts that somehow deals with, or at least intersects with, "communication" in a wider sense.

Now, it is of course possible to go all-out, and use the framework's dimensions to structure a research effort from the ground up. I confess to be under no illusion that wholesale adoption of such pervading strategies is in any way imminent (feel free to prove me wrong). Fortunately, the framework can be piggy-backed onto existing studies and still generate most of its suggested benefits. It is in that case a matter of asking oneself what one's completed study has to say about each dimension (if anything). *Any* "dimensional entry" will strengthen the framework, and make it gain traction.

5. NEW UTILITY FOR PRACTITIONERS

As soon as a social scientist adds to the common pool of knowledge about (for example) information *pervasiveness* and its consequences, we get a boost of utility downstream – (4) in the figure. Anyone concerned with strategic IT planning or policy making would for instance immediately be able to draw on a substantial and varied, yet uniquely accessible source of information about intrinsic interface characteristics, and their various perceived consequences, information that he or she is highly unlikely to come across in a compiled form otherwise.

Political actors are really *norm-managers*, and face a specific problem when technological change becomes too rapid or too complex. Instead of providing guiding norms in a timely manner, they are reduced to reactive bursts of activity to fend off some surfacing ill effect or other. The framework just might make it feasible to form pro-active policy around specific interface characteristics as such. It would for instance be quite possible to regulate *sender anonymity* and to disallow it, or allow it, based on the comprehensive guidance provided by the framework.

Consider the evolution of sender anonymity over "the horn" as they used to say. In its infancy, telephony offered little in the way of anonymity as local switch operators were likely to be able to identify callers. Things looked up for breathers and others questing for anonymity when the telephonic system grew in size, and even more so when human operators were replaced by automatic mechanical switches. *Electronic* switches then introduced *Caller ID* as an option for people to (somewhat) *reduce* sender anonymity, while certain dial-based services were offered to *circumvent* Caller ID. What has in fact driven this evolution, except technological and economic feasibility? At least in my native Sweden, no sign of a comprehensive review of (sender) anonymity and when and why such an option should be on offer has ever been carried out on the political level (or indeed elsewhere), and so all other actors are left without specific and overarching guidance in the matter. The very approach remains unexplored, even though there is no lack of (contending) ideas concerned with anonymity in the public debate. The framework, properly used, would certainly sow the seed of such a complementing policy focus.

A clarifier is in order. A "political actor" is sometimes understood as a person involved in the purely democratic-political sphere, but in this paper we use the term in its wider (and indeed truer) sense. Actors making policy (and thus instituting norms), on any level, are political actors. Much simplified, Microsoft's Chief Software Architect (no doubt in conjunction with a range of other officials) is a political actor, establishing certain norms to be generally adhered to. Other company entities act as authorities, making sure that these principles are upheld on the implementation level. The key realisation is that the framework carries with it similar benefits for "political norm-managers" on *every* level. Each subordinated level will of course have to take into account norms established on the more senior level(s) (e.g. the Chief Software Architect will have to abide by sub-national, national and international norms as expressed in laws, regulations and international treaties).

It finally seems intuitive to suggest that, since every existing or planned communication technology can be dissected into its component dimension states, advanced studies could examine and tentatively project "dimensional trends" to help inform business decisions. For the most part I happily leave this particular aspect of the framework for someone else to explore. It does however raise the issue of dimension *metrics.*

5. OF DIMENSIONS AND THE WANT OF METRICS

The extracted interface dimensions are just that: dimensions, ranging from nil to comprehensive. In a few cases we have external and more or less standardised measurement metrics to fall back on (e.g. bps for *information richness*). In most other cases we do not.

There is every reason to believe that coherent systematisation and measuring principles would be very usable indeed in a variety of analytical situations. Again consider *sender anonymity*. While we at this point may simplify matters by conceptualising this dimension as intrinsically binary in nature (either the sender *is* anonymous or s/he is *not*), real world anonymity is more likely to be a function of the *cost* an outsider would have to incur in order to unravel the (purported) anonymity. When this cost approaches infinity, the sender is for all intents and purposes truly anonymous. Such an enhanced conceptualisation, complete with its own dedicated metrics, would radically simplify comparative empirical discussion (e.g. whether or not this or that technology makes the sender able to stay this or that number of "units" more anonymous than this or that other technology). Indeed, a complementing methodological door would open, as quantitative analysis would suddenly become feasible.

"Metricised" dimensions would also provide a far better foundation for policy debates and initiatives. A crude example: "society should never accept a *sender anonymity* level exceeding, say, 72 'units' [however these may be defined], except in these specific circumstances where 95 is deemed acceptable".

This brief discussion emphasises an important point that extends the framework's basic premise and one that, properly implemented, would vastly extend its general applicability and utility. Scholarly "meta-analysis" of, and discourse about, any and every of the framework's communicative dimensions, and how they might be metricised would be profoundly beneficial.

6. FINAL COMMENTS

The framework I have presented is really based on a blindingly simple idea. Yet, a decade after I first began thinking about these matters, I still have not encountered an equivalent proposition. This is not to say that the integral *dimensions* are in any way unique – indeed they turn up in many a study either directly or indirectly. For me, this is in part good news, as such authors would immediately be able to add their findings to the common storage structure provided by the structure.

It is the *organised understanding* of the dimensions' *interrelationship* that seems to be overlooked or ignored. Tiny islands dot the map, yet no-one seems to realise that it is really an archipelago they are navigating.

I harbour no doubts that the framework can be mightily improved upon, and I welcome any and all input to that effect. But neither do I doubt the framework's potential promise. The obvious, looming, perhaps insurmountable, obstacle hinges on (a lack of) initial adoption. Had fifty social science studies' worth of normative input already been invested in it, the framework would probably have gained the required inertia to take off in earnest. With the results of just one meagre democratic study in its dimensional coffers, it still languishes in the neonatal clinic, and all bets are off. For now.

APPENDIX: THE DIMENSIONS IN BRIEF

Property	**Short description**
Access-time	The time it takes to establish a link between a sender and a (known) recipient.
Commoditisation	The extent to which any information-extrinsic matter must be part and parcel of the information exchange (e.g. the paper of a newspaper)
Connection validation	The extent to which the sender can ascertain that a link with the recipient has been established.
Cost of altering disseminated information.	The potential to alter already disseminated information, e.g. the potential to alter on-line HTML-pages. Cf the lack of such a potential in a television context
Directionality (bi- or uni-directional)	A bi-directional information mode allows the initial recipient to switch to a sender capacity using the link established by the initial sender (e.g. a telephone conversation). A uni-directional information mode forces the initial recipient to (try to) establish a new link if s/he should wish to switch to a sender capacity (e.g. replying to a letter).
Encoding method	The method by which the information is encoded "en route"
Environmental interference	The extent to which environmental factors can affect the information link.
Hyperlink transparency	The recipient's required effort to follow a "hyperlink" (i.e. a reference) to another information source.
Information density	The extent to which the sender intentionally includes material beyond the recipient's expected capacity to absorb (e.g. newspapers, where a majority of the articles will never be digested by the individual reader).
Information richness	The amount of data transferable in a given time
Information sequentiality	Whether or not the flow of information is temporally bound (compare television and a letter, where the contents of the latter may be absorbed in a non-linear fashion)
Interactivity	The relative enabling of partially or wholly overlapping roles as sender and recipient.
Level of primary human agent involvement	The extent to which the IT is dependent on human involvement to maintain a link between the sender and the recipient (e.g. the postman).
Level of secondary human agent involvement	The extent to which the IT is dependent on human involvement to maintain the integrity of the information channel as such (e.g. maintenance personnel in telcos).
Parallel sending area	The potential for multiple senders to send information via a single cohesive area which recipients can then access.
Pervasiveness	The extent to which the recipient is able to avoid information "en route"
Real-time transfer	Whether or not the mode of information exchange requires the sender and the recipient to be active simultaneously in order to function
Recipient access-point individualisation	The extent to which the IT's recipient access-point is private or public (e.g. telephone vs. wallpaper)
Recipient ano-	The extent to which a sender can stay

nymity	anonymous while receiving information
Recipient enabling cost	The recipient's initial cost to gain access to the information channel. E.g. the cost of a radio receiver.
Recipient transfer cost	The expenditure for the actual reception of information. E.g., cost of the electricity needed to keep a computer on-line.
Recipient validation of information exclusivity	The recipient's ability to ascertain that the received information has not been picked up and/or unravelled by an outside party.
Recipient validation of information integrity	The recipient's ability to ascertain that the received information matches the information originally disseminated by the sender.
Recipient verification of sender authenticity	The extent to which the recipient can determine that the sender is who s/he claims to be
Search and retrieve ability	The level to which information is searchable when the recipient wish to retrieve it (e.g. database systems)
Sender access-point individualisation	The extent to which the IT's sender access-point is private or public (e.g. telephone vs. letter-box)
Sender anonymity	The extent to which the sender can stay anonymous while using the information channel to transfer information. This is a dimension that hinges on the cost a second party must suffer to reveal the sender's identity. If that cost approaches infinity then the sender is for all intents and purposes anonymous.
Sender awareness	The extent to which the sender is aware that s/he has assumed a sending role.
Sender enabling cost:	The sender's initial cost to gain access to the information channel. E.g., expenses for technical equipment and licensing fees required to be allowed to operate a radio channel.
Sender transfer cost	The expenditure for the actual sending of information. E.g., the running cost for the use of the telephonic network.
Sender validation of information exclusivity	The sender's ability to ascertain that the disseminated information has not been picked up and/or unravelled by an outside party.
Sender verification of link integrity	The sender's ability to ascertain that the disseminated information has reached its intended recipient.
Subscription	The extent to which the recipient can automate a recurring reception of information

LITERATURE

This paper is unusually devoid of bibliographical references, but it is my fervent hope that the reader will not be offended by this, given that it is a piece relying on deductive logics more than anything else. This said, my thesis, in which I first introduced this line of thinking, lists a variety of inspirational sources, though most of them inform the sizable democratic-theoretical part of that book. I thus humbly refer the reader to the thesis for further information.

Sundström, Mikael. 2001. *Connecting Social Science and Information Technology. Democratic Privacy in the Information Age.* Lund: Department of Political Science. Also available at: http://www.svet.lu.se/Fulltext/Mikael_sundstrom.pdf

The legislation of Internet Information Transmitting[1]

——Impact of Informatics and Cybernetics on Chinese Legislation

Li Zhuoran
Institute of Science and Technology, Huazhong University of Science and Technology
Wuhan, Hubei, China

and

,Jui-Chu LIN
Taiwan University of Science and Technology
Taipei, Taiwan

ABSTRACT

With the development of network and digital technique in last 15 years, how to protect the right of copyright holder in the domain of world intellectual property right is becoming a significant issue involving conduct of transmitting on internet. Therefore, most counties of the world believed that the special right of internet information transmitting should be established, because many new technologies is unceasingly emerging, in some degree, setting up new rights for new technologies will influence the stability of copyright system. Hence, the world society tried to utilize the traditional concepts of duplication and publishing in copyright to solve the problem, but all of these methods failed at last. Similarly, the legislation of China also confronted the same difficulty. Obviously, the way to extend the meaning of copyright is not feasible, according to this, it's completely necessary to construct a totally new right to cope with the increasing problems, which is called right of internet information transmitting (IIT).

Key Words: Legislation, Internet Information Transmitting and Copyright

1.WHAT IS THE RIGHT OF IIT?

1) Concept of Right of IIT

Generally speaking, the meaning of the right of IIT is mainly expressed in WCT[2] and WPPT[3] formulated by WIPO[4], which is stipulated by the form of public transmitting right.[5] Form the legislation view, the right of IIT is aiming for the provider by using the way of wires or wireless to supply works to the public at any time and place. The new Copyright Law of China particularly emphasized the IIT right of performer, tape-recording and tape-recorder etc. The article 37 regulate that the performer has the right to permit others to transmit the performance via internet and acquire the rewards. Also, article 41 regulate that the tape-recorder has the right to allow others to have the permission of copy, publish, hire, and getting the rewards by transmitting the performance via internet. It can be perceived by above regulations that the right holder of IIT is somebody who has the copyright and relevant right. The object of the right of IIT is the works of literature, art or information of politics, economy, and science and technology etc. The major contents are that the right holder has the free to transmit the informatics works via internet within the range of law or agreed contract. Concerning with the attribute of IIT, the right of IIT is one independent right in copyright, especially in the property right of copyright.

Based on the situation of China's internet development and present legislation system, this concept of IIT is brought up to be influenced by WTO and its TRIPS, which is proposed in the form of IIT.

2) Characteristics of the Right of IIT

The right of IIT is rooting from copyright but not the same with traditional copyright, which is formed and developed on the foundation of the rights of exhibition, performance, show, and broadcasting. Principally aiming at mutual transmission through internet, the Copyright Law of China added this right. Specifically, the traditional copyright has some attributes of exclusiveness, timeliness and region, while the world internet service and application are challenging the original copyright. Definitely speaking, the right of IIT has the following features: transmitting, network, mutual and repeatedly usage.

(1) Transmitting: Because works is used by the

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[2] World Copyright Treaty

[3] World performance and Product Treaty

[4] World Intellectual Property Organization

[5] Wu Feng, 1995-2000: The Development of China Internet Mass Media Report. Modern Media,2000,(3).

condition of transmitting, the works accomplish its value by using, therefore, in some degree, transmitting is the prerequisite of realizing value. In addition that the right of IIT is passing through the internet as a way of media, that is to say, the formation of works provides another way of transmitting. During the process of IIT, the phenomenon information uploaded to internet and disseminated by internet is the most essential attribute of the right of IIT.

(2) Network: There are three forms of works' transmitting on internet: uploading, transshipment, and downloading. Internet is constituted of the requisite condition of public transmitting right, which is set up to be the lawmaking spirit by international treaty. Consequently, the right of IIT is limited in the three forms regulated by legislation, which decide the attribute of network is indispensable.

(3)Mutual: Internet itself possesses the attributes of free use and free exchange, simultaneously, which are highlighted in international treaty as well, is different from traditional single direction of transmitting. The user passively receives the information in the time of traditional copyright, that is, there is no optional right about time, place and contents. Moreover, the original style excluded the point to point private information transmission. In international treaty, transmission is only including the direction to public that is, transmitting the information to non-particular people, so by using the carriers of internet is acquiesced to transmitting toward non-particular people.

(4) Repeatedly Usage: Except the right of publication is one-off, any other copyrights can be repeatedly used. Because the kinds of receive comprise of immovable receive and mobile receive, in the three stages of IIT, every single stage may occur the infringement to obligee. When the right is obliged by others, the obligee has the right to suit several times. For this reason, the right of IIT could be repeatedly used.

3) The Range of Contents about the Right of IIT

The transmitting right on internet is different from the transmitting right in TV and broadcasting, which is a technical description of the right on internet. The rights of IIT by protecting from others involve: illegally copy or cause others to violate the copyright of right holder without permission; download works form internet and then revise, translate, publish, performance, broadcast or directly publish books, edit, translate and then selling, or violating the works of performance on internet including audio and video works.

4) The Difference between the Traditional Right of Public Transmission and the Right of IIT

The World Copyright Treaty continued using the concept of public transmission following by Berne Convention, and step further to broaden the concept of public transmission to internet environment. At the same time, other treaty regulated that the right of IIT and the right of public transmission are different from each other, none of them is involved in the other, that is to say, these two concepts are contained in the mass right of transmission. There is no matter with their respective existence. From the above facts, we can draw the conclusion that the right of IIT is coped with in different ways in different countries by different legislation system.

2. COMPARE BETWEEN CHINA AND OTHER COUNTRIES

1) The Legislation of the Right of IIT in International Society

Human society developed from natural selection, conduct selection to information selection, demonstrating that we have evolved to a new phase. Three essentials of the world comprise substance, energy and information, which are different in diverse times. Nowadays, different countries don't have a consensus in the concept and legislation in the right of IIT.

According to each situation of the countries, some legal specialists and scholars hold the opinion that how to endow the copyright holder with the network rights of transmission have three legislation modes. The first one is Implied Mode, which is to cover the right of publish, open performance and exhibition by existing copyright. The second one is Recombination Mode, which is to re-construct the right of different transmission right in various works, that is, uniting all of the transmission rights except the right of copy and publish. The third one is Adding Mode, which is not necessary to change the existing range of copyright, endowing the copyright holder to control the right of IIT and publish.

America is the most prosperous country in IT industry, which is the most advanced network technique country, also negatively influenced by the most amounts of factors. Correspondingly, the earliest network dispute appeared in America. [1]During the last ten years last century, many issues happened by utilizing the works without permitting. So President Clinton authorized to establish Information Infrastructure Technical Foundation (IITF), aiming to promote the development and application of information technology in America. The subordinate organization of IITF announced the report of information infrastructure IPR working team named Infrastructure and IPR. In America, the range of open performance and open exhibition is extensively, which is completely foresight, making the American Copyright Law elastic, so the mode of America is the flexible Implied Mode.

European countries faced with the IIT problems as early as America. Because of the long history of culture and legislation, their Copyright Law couldn't be flexible like American Legislation. Consequently, most of the European countries chose the mode of Re-construct Mode to reform their legislation system. Committee of European Union 1998 submitted Proposal Draft about Copyright of Information Society, which was to coordinate with the Copyright Treaty 1996. This proposal draft was approved by European Parliament May 22, 2001, which was promulgated and carried out in June 22, 2001.[6] This treaty regulated a concept of right of public transmission to coordinate different standpoint of the right of IIT.

In comparison, the American method is to augment the concept of publication, while European Union combined the right of transmission and copy. As regard to some countries, which don't

[6] Yang Jing. The compensation disbursed for the reason of infringement by Website. http: / /gb. chinabroadcast. cn /3821 /2004 /05 /11 /81@155433. htm

have the flexibility like America or national condition to take radical change like countries in EU, are suit to apply the mode of Adding Mode, including most developing countries in Asia, just like China. [2]

2) Legislation Attempt about the Right of IIT in China

Since China joined WTO 2001, IPR problem became the most important contents in China's trade relation with other countries. Within nearly 4 years negotiations about trade, IPR issue was the independent subject for discussion. Several countries and world organization paid attention to China's legislation development in protecting IPR, such as WTO, WIPO, UNESCO[7], America, EU, Japan etc. In the fifteenth conference between America and China, China government indicated that the accomplishment of IPR legislation would be accelerated.[8]

From the comparison worldwide, we can realize that most scholars deem that the right of IIT is greater than the rights of publish, performance and broadcast. According to Copyright Law, publish is to provide the tangible carriers for copying to public, while IIT don't lead to tangible carriers transfer, so we can not call that IIT is right of publish. As regard to performance, conventional speaking, which is limited in a live show, that is, performer's performance is an on-the-spot demonstration, needless to say the right of IIT. Broadcast is a way of transmission though TV or Broadcasting. Apparently, it's not relevant to the right of IIT.

Although the methods of explanation are not properly, the network cases could be deal with the existing legislation. According to this situation, China should firstly from the point of view in authorizing legislation, strictly following the regulation of Copyright Law. [3]All the network contents would be covered and coped with by world treaty. Other issues would be deal with by modify the existing Copyright Law or legislate new law.

About the principle of legislation, the way of China is the same to other countries, which is to acknowledge the existing and traditional principles. All of the principles are accommodated to IIT. [9]In fact, the fictitious world is part of the real world; the internet world cannot racially change the real world. Therefore the legislation principle should follow the traditional principle.

3. THE TRENDS OF THE RIGHT OF IIT IN CHINA

The trend of the legislation concerning with IIT can be summarized in four points:

Firstly, in the technique of legislation, traditional legislation can be extended and transplanted to IIT, which also can be modified and replenished. For instance, the IIT Law regulates nearly the same contents about forbidding to Public Management Statute, Radio Broadcasting Management Statute etc. But under the situation of network, the meaning of forbidding has changed. To begin with, the object of forbidding has been extended. In the old time, the object could be understood to be newspapers, broadcasting and TV. While in the theory of network, the object is to be anybody who can release information by using facility and technology. Hence, the object of the forbidding of network is all kinds of network media, organization and individual, not only the network media. Correspondingly, means of legal ban has been magnified, not only the making, publishing and transmitting are illegal, but also downloading, copying, consulting and using are all belong to illegal behavior. On the basis of this, when establishing a IIT Law, China should refer to the News and Transmission Law for revising and renewing, getting with the meeting of IIT situation. [4]

Secondly, comparing with the release of the control in traditional mass media, the control of China government to IIT is gradually strengthening. For example, in order to maintain the security of network, Government of China regulated some item in Computer System Security Statute, Internet Information Services Management Method etc. to stipulated rather severe obligation and duty to network media, which are not seen in traditional TV and Transmission Regulations. [5]Naturally, the increasingly strict management is comparative.

Thirdly, government set up special regulation to network TV in IIT. Government of China established special administrative management organization all over different level of the government. Moreover, China legislation special laws to regulate the IIT. The state council of China released Internet Information Service Management Method, stipulating that when establishing a media organization such as TV, publish or such service program, the process of keeping on record needs the agreement of related department; The services of ICP, ISP for information service were imposed considerably severe duty and obligation;. The Temporary Regulation of Internet Website of News Report clearly regulated that the business of news report applied the examine and approve system; the website with link overseas should be approved by Information Office under the State Council; Non-comprehensive news department couldn't carry in the press, the news should come from the central authorities, news department of province lever, in the meantime, this department should sign an agreement with these news organization, obtaining the right to carry and print in the press. News is part of information; China greatly emphasized it by legislating special law and statute. Thus it can be seen, the management of comprehensive news transmission is the most importance and rigid.

Fourthly, the effectiveness of laws is universally low. Except of the Decision of Maintaining the Security of Internet, others laws released by the State Council and other Ministries. Besides, the efficacy of the law is very low, but this is convenient for changing and revising according to the situation.

Overall, China's legislation has gotten many fruitful achievements: reference to security of IPR, information confidential and computer system etc has formed certain basis, but at the same time, we should understand that the tasks of legislation are very weighty, especially in government information resource management, the standard of information market, the powerless of privacy, and the disorderly legislation. For these reasons, the legislation of China should be adjusted and arranged to form a frame, only finish this, the legislation of

[7] United Nations Educational

[8] Xia Yali. The Protection of IPR When Join WTO. Economic and Law, 2000,(4) : 15 18.

[9] Wei Shuizheng. Course of News Transmission Law. Beijing: Chinese People University Press,2002.251.

information legal system could be gradually built up and perfected.

4. THE PRINCIPLES OF IIT LEGISLATION

The fundamental purpose of Copyright is to adjust the benefits between the users of works and public. Therefore, many countries tried to limit the right of copyright and related right to balance the benefits among authors, transmission organization (or individual) and public. This limitation is used to be reasonable use and legal permission system.

Nowadays, scholars and specialist in China deem that the principles of legislation are: firstly, following by the article 1 of Copyright Law that protecting the copyright of works of literature, art, and science, and relevant rights and interests, encouraging works of benefit to spiritual civilization and material civilization, promoting socialist and science; secondly, from the national situation, adequately considering public profit and the need of industry development; thirdly, amply think over the limitation of copyright; fourthly, appropriately consider the regulations in world treaty, especially two new treaties China had joint, regulating that the regulation in Berne Convention signed by each other should be extended to digital circumstances. Equally, these regulations are deemed as new exception and limitation situation by these countries. [6] In fact, these regulations don't reduce or broaden the suitable range regulated by Berne Convention.

Take technique measures for example. This concept was added in 2001 when revising the Copyright Law. Up to now, there is no other law stipulating this right. Technique measures are the protection of right holder, especially under the network situation, which are the main measures to set on product maintaining the investment of human and material resources could get back. Once the technique measures are broken, the contents will lose safekeeping. According to this, if the regulation of technique measures is not available, the copyright and relevant rights are unsafe. So we can take action to regulate: (1) to directly define technique measures; (2) to regulate related technique measures involving technique measures outside network; (3) conduct of evading is banned; (4) to regulate more technique measures over 5 types; (5) abuse of right is forbidden; (6) explanation is needed when set up. All above are transplanted or emulated from the legislation of worldwide treaty or domestic legislation of foreign countries. [7]

5. CONCLUSIONS

IIT is without borders, fictitious, which is doomed that IIT cannot be regulated by legislation only. Moreover, the developing technique of internet is decreasing the forecast and stability of legislation. In the meanwhile of building of the legal system, some methods could be put into practice; such as establishing self-discipline system of user, exploiting filter-technique against malignant message, adopting legal rules, self-control and technique manipulation etc.

Briefly, the fundamental goal of the legislation of IIT is to make advantage of network information transmitting, let Chinese civilian enjoy ample freedom of speech, realize the legal rights and interests of society and individual.

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Social and Political Influences on Information Technology Adoption among Civil Society Organisations in New Zealand: A Preliminary Report

Theodore E. Zorn

IT adoption decisions are traditionally framed in terms of tangible, seemingly objective benefits such as their potential to improve operational efficiency, cut costs, or serve clients better. However, recent literature suggests that such decisions are in fact made in a socio-political arena that involves, externally, organisations jockeying for position among others in their institutional fields and, internally, individuals vying for favourable career enhancing positions (Peled, 2001; Tantoush & Clegg, 2001). Thus, social/political influences are important to consider in understanding adoption decisions, especially given that IT implementation has such a high failure rate. Such research enables a better understanding of the social and political environment in which IT decisions are made by civil society, or Not-for-profit (NFP) organisations, which can enhance success rates for organisations and offer guidance funding and policy-making institutions.

The paper reviews the literature on ICT adoption and use in civil society organisations, reports the results of the survey analysis, and discusses implications for both theory and practice.

This paper is based on a survey of more than 1000 not-for-profit and community group organisations in New Zealand. The purpose of the paper is to identify the relative influence of a number of influences on organisations' adoption of sophisticated IT, with particular attention to social and political influences. Such influences may include a need to impress or satisfy stakeholders (such as funders, clients, and government regulators), competition with similar organisations, marketization and managerialism (i.e., the pressure to emulate the private sector), and staff values. Previous studies have demonstrated that social pressures influence certain IT adoption decisions in private industry, such as websites (Flanagin, 2000)and supply chain systems (Wright & Cropanzano, 2004). Unlike the cited studies, the present study considers ICT broadly—as opposed to a single technology such as websites or supply chain systems—and focuses specifically on the not-for-profit sector.

ICT Use in the Not-for-Profit Sector

ICT use has proliferated enormously throughout most sectors of the economies of developed countries. Like other general purpose technologies, computer-based networks have become more widespread as additional applications and critical mass of users develops. While this is true in all sectors, the not-for-profit sector has generally lagged behind the for-profit sector, in large part because of lack of resources, but also because of different cultural values within the sector. Traditionally, NFPs have been less driven by efficiency goals, which have largely motivated the private sector's uses of ICTs. For-profit organisations typically adopt computers to attain promised efficiencies and gain a competitive advantage over competitors (Levy & Murnane, 2004).

With NFPs typically facing very limited resources such as tight budgets, the opportunities for efficiency gains are also attractive to them. And, while competitive advantage is not typically associated with NFPs, the landscape for the NFP sector has been changing in recent years, such that they are under more pressure for accountability and placed in a competitive position vis a vis other nonprofits for government contracts (e.g., Harris, 2000; Offenheiser, Holcombe, & Hopkins, 1999; Ryan, 1999). Furthermore, there has been for a number of years now a cry from some quarters to emulate the efficiencies of the private sector (e.g., Ryan, 1999).

Adopting ICTs has been suggested as a major opportunity for NFPs in improving efficiencies, responding to the increasing demand for accountability, and increasing the effectiveness of their services (Beckley, Elliott, & Prickett, 1996; Burt & Taylor, 2000; Glasrud, 1999). NFPs, for example, have been advised to use the Internet to target funds available from government, create websites to advertise and markets programs, increase the effectiveness of procurement, and enhance communication with stakeholders (Elliott, Katsioloudes, & Weldon, 1998).

However, a major stumbling block to ICT adoption in the NFP sector is lack of resources. Internal knowledge about ICT applications is likely to be limited as are funds for purchasing systems and technical support.

Thus, a CEO or trustee of an NFP would certainly see that there are potential instrumental advantages in adopting ICTs to improve the management and functioning of his or her organisation. And, the perceived advantages of ICTs are not surprisingly one important predictor of adoption (Flanagin, 2000). Research has also shown that characteristics of the organisation predict the likelihood of adopting innovations. For example, decentralization of authority (Brockner, DeWitt, Grover, & Reed, 1992), and formalization (Ettlie, Bridges, & O'Keefe, 1984) are both correlated with innovation adoption in previous research. In NFPs, size of the organization can also be expected to relate to adoption of expensive resources such as ICTs, since smaller, cash-strapped organisations are less likely to have resources to devote to ICT acquisition. And finally, key decision makers' knowledge of ICT and the availability of technical support are likely to be important factors.

Beyond these instrumental, structural, and practical factors, research from a variety of theoretical vantage points has suggested that management practice, including the adoption of ICTs, is an inherently social and political process. Thus, the current study builds on literature addressing the diffusion of management practices and the social construction of management knowledge. In this literature, management practices such as ICT adoption are seen as normative belief structures, the diffusion of which are influenced by social and political pressures rather than simply the logical or march of progress or "rational" advance of knowledge (Abrahamson, 1996; Jackson, 2001) (Zorn, Page, & Cheney, 2000) have explained how being immersed in socio-cultural discourses promoting particular values and practices leads managers to draw on these discourses as resources in developing and selling strategic organizational changes and leads staff to see such changes as logical "best practice."

Thus, the present study was concerned with the nature and type of influences that might influence ICT adoption, and particularly the relative weight of socio-political influences compared to instrumental and structural factors. A number of socio-political factors have been demonstrated or suspected to influence the adoption of innovations such as ICTs in prior research, including institutional pressures (Flanagin, 2000), competitor scanning (Brockner et al., 1992), and perceived leadership within an organizational field (Flanagin, 2000). Given recent changes in the NFP sector, we might further speculate that other social influences may predict ICT adoption. These may include: professionalization, or the claim to authoritative expertise and accompanying demeanour (Cheney & Ashcraft, 2007); marketization, or the degree to which the organization emulates the practices of the private sector (Fairclough, 1993), and competition intensity, or the degree to which members perceive the organization to be in competition for resources.

The goal of this exploratory study is to examine the relative influence of these various influences on ICT adoption.

Method

A comprehensive seven-page questionnaire was mailed to organisations in late November 2005 to a large number of NFP organisations in New Zealand.

Sample

A total of 2,775 surveys were sent out, however 224 were returned due to invalid addresses, and another eight were returned because the organisations no longer existed. Hence, 2,543 surveys were received by valid organisations, of which 1,046 organisations returned completed surveys, indicating a response rate of 41%. Because of partial responses by some respondents, the N for some tests is less than 1046.

Names and addresses of the organisations were obtained from the Ministry of Economic Development's Societies and Trusts Online website (www.societies.govt.nz), which includes all registered charitable trusts and incorporated societies. The goal was to include a wide range of NFPs in terms of location, size, and type. Thus, organisations were chosen for inclusion by first selecting an array of locations (by town or city) that represented a mix of North Island and South Island, and urban and rural. After locations were selected, all organisations listed as having an address for each location was downloaded and included in the final list.

Measures

The survey questionnaire was constructed to achieve both practical and theoretical goals. It was intended to assess NFP organisations' current forms and degrees of ICT uses; the primary influences driving their adoption of ICTs; their intended ICT use for the future; the major barriers or obstacles they perceive to effective ICT use; and the forms of support they desired from government or other sources to enable effective ICT use. The survey items were generated in consultation with a panel of advisors that included members of various government ministries and representatives of the NFP sector, as well as drawing on the literature. A draft version was developed and submitted to the panel of advisors for feedback, and subsequently refined. The portion of the survey that we focus on in this paper is that part that specifically addresses adoption and uses of ICTs, and factors influencing adoption and use.

Dependent variables. Dependent variables for ICT adoption were operationalized first through a single question, "Does your organisation currently have a website?" to which respondents answered yes or no. Also, the questionnaire included a set of questions asking about current uses of ICTs as shown in Table 1 to which respondents responded on a 5 point scale ranging from strongly agree to strongly disagree. These items were intended to measure both basic and advanced uses of ICTs. A principal components factor analysis with varimax rotation resulted in a three-factor structure. Five items loaded on the first factor, which we called *Basic Uses* of ICTs. These items were primarily focused on using computers for e-mail and record keeping. Four items loaded on the second factor, which we called *Stakeholder Engagement Uses.* These were focused on more advanced outreach uses, such as fundraising, advocacy campaigns, and acquiring training. Three items loaded on the third factor, which we called *Resource Acquisition Uses.* These three items focused on accessing funding and government information. Several items were included in the questionnaire that did not load on any factor and were therefore excluded from subsequent analysis.

Independent measures. A number of items were included to measure influences on ICT adoption. Size of the organisation was measured by size of annual budget and number of paid staff. Participants were asked to estimate annual budget at one of nine levels ("Less than \$10,000", \$10,000-20,000… "More than \$50 million"). Level of technical knowledge was measured by two items: "Evaluate the adequacy of the technical support available to you" and "Evaluate your organisation's key decision-makers' level of knowledge about computer technologies." Responses to each were on a 5-point Likert scale. One question was used to assess level of decision maker's knowledge of ICT ("Evaluate your organisation's key decision-makers' level of knowledge about computer technologies") and one item to assess level of technical support ("Evaluate the adequacy of the technical support available to you").

A set of questions were developed from the literature review to assess social and political influences on ICT adoption. The questionnaire included several items intended to measure each of the following variables: professionalism, accountability, competition intensity, competitor scanning, marketization, formalization, and centralization. A principal components factor analysis with varimax rotation resulted in an eight-factor structure. Six items loaded on the first factor, which we called professionalism (e.g., "Our organization prides itself on having staff who are experts at what they do"). Four factors loaded on the second factor, accountability (e.g., "We must collect data systematically in order to comply with government or funders' requirements"). Three items loaded on the third factor, competition awareness (e.g., "We monitor the moves of "competitors" very closely). Three items loaded on the fourth factor, institutional pressure (e.g., "Typically, organizations in our field rely heavily on ICTs"). Two factors loaded on the fifth factor, centralisation (e.g., "There is frequent participation of staff in decisions on the adoption of new policies", reversed). Two items loaded on the sixth factor, autocracy (e.g., "Little action can be taken by staff until a superior approves a decision"), two on the seventh, competition intensity (e.g., "There is tough competition in our sector for funding and support"), and two on the eighth, formalisation (e.g., "Most staff in our organisation make up their own operating procedures on the job", reversed).

In addition to these items, one item measured the degree to which organisations considered themselves to be a leader in their field ("Relative to your direct peer organisations, to what extent would you consider your organisation to be a leader in your field or sector?").

Results

To identify the variables that were significant predictors of website adoption, stepwise binary logistic regression was used. This procedure is appropriate to identify influences on a categorical dependent variable. It is similar to discriminate analysis, but with fewer assumptions (Kinnear & Gray, 2006). All of the independent variables were included and the analysis enters independent variables in a stepwise fashion to identify the model that best predicts correct classification. Of the 679 valid cases used in the analysis, 278 (41%) had a website and 401 (59%) did not. Thus, to be useful, the regression model needed to improve on the 59% chance classification. Classification results were calculated to determine the predictive utility of the overall model. The best model was created with a six-step solution in which the following variables were entered in sequence: institutional pressure, adequacy of technical support, budget, formality, leadership in field, and accountability. The Nagelkerke R^2 for this model was .25, indicating that it accounted for a moderate amount of variance in predicting whether organisations have a website, and the success rate of classification increased from 59% to 70%, a modest but significant increase.

To explore the influences on the three varieties of current uses of ICT, stepwise multiple regressions were used. Again, the independent variables were entered stepwise in each analysis. Three variables explained basic uses of ICT: institutional pressure, professionalism, and centralisation ($F[3, 640] = 31.45$, $R^2 = .124$, $p < .001$). Together these variables explained 12% of the variance in basic uses of ICT, as shown in Table 1 below.

Table 1: Regression Analysis with Basic Uses of ICT as Dependent Variable

Variables	ß	F change	Adjusted R^2	R2 change
Institutional pressure	.299	63.26	.09	
Professionalism	.180	19.38	.114	.025
Centralization	-.123	8.86	.124	.010

Seven variables explained stakeholder engagement uses of ICT: accountability, leadership in the field, competition awareness, key decision maker knowledge, professionalism, annual budget, and autocracy ($F[7, 630] = 16.62$, $R^2 = .147$, $p < .001$). Together these variables explained 14.7% of the variance in uses of ICT for stakeholder engagement, as shown in Table 2 below.

Table 2: Regression Analysis with Stakeholder Engagement Uses of ICT as Dependent Variable

Variables	ß	F change	Adjusted R^2	R2 change
Accountability	.292	59.15	.084	
Leadership	.157	16.71	.106	.022
Comp awareness	.150	12.75	.122	.016
DM knowledge	.099	6.69	.130	.008
Professionalism	-.102	5.15	.135	.005
Annual budget	.101	5.84	.142	.007
Autocracy	.079	4.32	.147	.005

Four variables explained resource acquisition uses of ICT: accountability, institutional pressure, competition intensity, and key decision maker knowledge ($F[4, 640] = 50.21$, $R^2 = .234$, $p < .001$). Together these variables explained 23.4% of the variance in uses of ICT for compliance, as shown in Table 3 below.

Table 3: Regression Analysis with Resource Acquisition Uses of ICT as Dependent Variable

Variables	ß	F change	Adjusted R^2	R2 change
Accountability	.418	135.88	.173	
Institutional pressure	.205	28.27	.207	.034
Comp intensity	.142	12.83	.221	.014
DM knowledge	.122	11.85	.234	.013

Discussion

The study was intended to explore influences on ICT use by NFP organisations. A variety of influences was explored. Consistent with the thrust of our argument, social and political influences explained unique variance above and beyond practical and structural considerations.

Perhaps surprisingly, in every analysis, social and political influences were more powerful predictors than practical and structural influences. This is particularly interesting in light of the common discourse that suggests that NFPs primary limitation in adopting ICTs is budget constraints, and that larger, better funded NFPs will be most likely to adopt and use ICTs. Similarly, it might be expected that lack of organisational knowledge and technical support would be the biggest obstacles. While such practical matters did play a role in our analyses, they were in each case less influential than socio-political influences.

The variables predicting website adoption were, in order of influence, institutional pressure, adequacy of technical support, budget, formality, leadership in field, and accountability. Thus, consistent with Flanagin's (2000) findings in the private sector, NFP organisations were most likely to adopt websites if they perceived it was the "thing to do" for organisations in their institutional field. This is. Budget and technical support were important, but relatively less so. In short, organisations were most likely to have a website if they perceived it as appropriate in their sector, they had adequate budget and technical support, were less formalized in their work practices, perceived themselves to be leaders in their field, and were less accountable to higher authorities.

In terms of predicting uses of ICTs, it is first important to distinguish the particular kinds of uses. Factor analysis revealed that NFP organisations use ICTs for three primary organisational functions: (a) basic uses, which included communication and information exchange and record keeping; (b) stakeholder engagement, which included reaching out to members and supporters in a variety of ways through ICTs, and (c) acquisition of resources, which included acquiring funding and information from government sources. This is an important finding in itself, since it identifies clusters of common uses among NFP organisations.

Regression analysis indicated that basic uses of ICT were best predicted by only social-political influences, specifically, institutional pressure, professionalism, and centralisation. Organisations that perceived basic uses of ICT as appropriate in their sector, had a strong sense of professionalism, and were relatively decentralized (notice the negative Beta weight) were most likely to use ICT for basic purposes.

Regression analysis indicated that stakeholder engagement uses of ICT were best predicted by a mix of practical and social-political influences. Specifically, the predictors were Accountability, Leadership, Competition awareness, Decision-makers' knowledge of ICTs, Professionalism, Annual budget, and Autocracy. That is, NFP organisations were most likely to use ICTs to engage stakeholders when they perceived they were accountable to higher authorities, perceived themselves to be a leader in their field, were aware of competition in their sector, had decision-makers knowledgeable about ICT, had a lesser sense of professionalism (notice the negative beta weight), a large annual budget, and a relatively autocratic culture.

Regression analysis indicated that resource acquisition uses of ICT were best predicted by Accountability, Institutional pressure, Competition intensity, and Decision-makers' knowledge. That is, NFP organisations were most likely to use ICTs to acquire resources when they perceived that: they were accountable to higher authorities, using ICT is appropriate in their sector, competition in their sector is intense, and decision makers were knowledgeable about ICTs.

The study is limited in a variety of ways. In particular, a relatively modest amount of variance is accounted for in the various analyses. However, it is important theoretically because it demonstrates that social and political pressures, which have been demonstrated to influence private sector organisations' adoption of ICTs, also operate in the NFP sector. It is practically important because, if there are advantages to be gained by NFP organisations adopting ICTs, these social and political influences will have to be addressed along with practical matters such as budget, support, and knowledge of ICTs.

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Service Delivery and ICT on Election Day: A Position Paper on Delivering New Election Technology to Voters

Terri Susan **FINE**
Department of Political Science
University of Central Florida
Orlando, FL 32816-1356, USA

and

Aubrey **JEWETT**
Department of Political Science
University of Central Florida
Orlando, FL 32816-1356, USA

ABSTRACT

This paper advocates for changing Election Day from Tuesday to a weekend day in U.S. elections. The motivation for advocating this policy change is to help counties recruit poll workers. Others who advocate for changing Election Day have done so on behalf of enhancing voter turnout. Our argument takes a new approach in advocating an Election Day date change that focuses on its value for recruiting needed poll workers. The enactment of the Help America Vote Act in 2002, coupled with statutory changes at the state level, creates a need for more poll workers, particularly those with advanced technical skills and knowledge of languages other than English. We argue here that college students represent an ideal poll worker population whose opportunities to work the polls are limited when elections take place on days that classes normally meet. An added benefit to recruiting college-age poll workers is that they might continue working the polls for the next several decades. As the average poll worker in the United States is 72, recruiting younger poll workers will address short and long term needs. Data included in this paper are derived from an Elections Assistance Commission Grant #060046 awarded to the authors in August 2006.

1. INTRODUCTION

In this paper, we advocate for a federal law that will shift Election Day from Tuesday to a weekend day in all localities in the United States. Unlike others who advocate for changing Election Day to weekends for the sake of enhancing voter turnout, we contend that changing Election Day will improve how elections function from a service delivery perspective. Specifically, moving Election Day to weekends will significantly enhance poll worker recruitment and retention in the short and long term.

Recruiting competent and available poll workers has become an issue of national concern as national and state level policy changes mandate that electronic voting systems be in place and available to voters. Recruiting poll workers who are comfortable with high technology voting systems, and recruiting sufficient numbers of them, compels us to consider that the available pool of potential poll workers who meet these criteria may not be available to work the polls on Tuesdays, which is the traditional Election Day.

Many explanations reveal why Election Day is held on a Tuesday that date back well over 100 years. Article II, Section I of the United States Constitution mandates that Congress determine the date for choosing electors. Electors make up the Electoral College, which selects the president. In 1845, Congress decided that the first Tuesday after the first Monday of November would serve as the national Election Day. November was chosen because it came between crop harvesting and spring planting (Until 1933, inauguration day was in early March. It was moved back to January in 1933 with the 20th amendment). Tuesday was selected so that persons who had to travel long distances to vote would be able to after the Christian Sabbath on Sunday. Additionally, persons who had to pay poll taxes might have money remaining Tuesday following payday the previous Friday.

More recently, several states have broadened available voting opportunities and voting days. "Early voting" is one option that allows voters to vote at designated sites up to two weeks before Election Day, which, along with absentee voting (available in all states), allows voters to vote before Election Day.

The 2000 presidential election compelled the federal government and many states to reconsider their balloting procedures. Florida was one state that was subject to particularly harsh criticism as several counties did not employ voting mechanisms that allowed all votes to be counted as intended. In response to these concerns, the federal and several state governments passed laws that mandated election equipment changes.

2. THE HELP AMERICA VOTE ACT

The Help America Vote Act (HAVA), signed by President George W. Bush in 2002, established a program to provide funds to states to replace punch card voting systems. HAVA prompted numerous state law changes to facilitate its implementation. In Florida, for example, electronic voting systems were mandated to be in place and available to all voters. These machines use touchscreen technology which allows voters to make unlimited changes before casting ballots. By contrast, paper ballots that utilize optical scan technology allow only three tries per voter (except for paper ballots cast through absentee ballots, which cannot be traced back to any particular voter for corrections). Touchscreens do not allow overvotes (selecting more than one choice per office or ballot initiative) while they notify voters of undervotes (no choice selected for a particular race or initiative) so that they can be corrected, if desired.

In Florida, touchscreen technology was utilized for all primary, special and general elections from 2004 to 2006 (Run-off elections were eliminated with the 2002 elections in Florida). In mid-2007, Governor Charlie Crist signed into law a ban on touchscreen machines although several states still utilize touchscreen vote technology.

Additional requirements mandated by the Help America Vote Act include broadened access to voters with disabilities. Polling places must allow greater and more accessible voting opportunities to voters with disabilities. And, elections must be made more accessible to language minorities who must now have access to bilingual pollworkers in those counties that meet the 5% language minority minimum that mandates bilingual ballots. Before HAVA, counties that had 5% of a single language minority were required to have access to a ballot in their own language (usually provided as a bilingual ballot, and not a single language ballot in that language) as mandated by the Voting Rights Act 1972 amendments. Because of HAVA, at least one poll worker who speaks that language fluently must work in every precinct in those counties affected by that Voting Rights Act provision.

The Help America Vote Act changed elections in three meaningful ways: integration of enhanced voting technology and broadened access to voters with disabilities or limited English skills. These three changes, taken individually and together, create a need for more poll workers. Further, integrating technologies that utilize ATM-type machines require that persons comfortable with such technologies be assigned to supervise their use.

HAVA also created the Elections Assistance Commission (EAC), which administers grants for programs associated with HAVA implementation. These grants include a poll worker recruitment project that targets college campuses. In 2006, the EAC administered $300,000 across 19 recipients for poll worker recruitment. The average award was $15,789 and the awards ranged from $10,000 to $20,000 each.

3. THE CASE FOR RECRUITING COLLEGE STUDENT POLL WORKERS

The EAC's decision to recruit poll workers on college campuses speaks to four important advantages for successful recruitment. First, college students today are the "i-POD generation" that grew up teaching themselves how to use new technologies as they emerged. Colleges and universities across the country are now requiring that students have access to a computer, and are placing many paper and pencil functions, such as registration and course schedules, entirely on-line. College students' comfort with technology render them amenable to learning how to administer touchscreen technologies and other assistive technologies mandated or implemented as a result of HAVA.

A second program advantage is that college students represent the younger generation. Most students entering college for the first time do so at age 18, which is also the minimum federal voting age. In the United States, poll workers average 72 years old; one would expect that average to be even higher in Florida, which has an elderly population proportion larger than the United States as a whole. Focusing on college campuses provides poll worker recruiters with favorable access to younger persons who might work the polls regularly for as many years as they are able once they are recuirted while in college. Fostering a commitment to working the polls at a young age may stem the need for poll workers in the near and distant future as, once these students work the polls, they may take on a lifetime commitment.

The third advantage for recruiting on college campuses is that recruiters have access to potentially many students in small and large groups. Recruiters can recruit in classes and club meetings, as well as ask that recruitment materials be posted on course and club websites.

Finally, college students have experienced far more exposure to racial, ethnic, gender, ability and lingual diversity than any generation that preceded them. This means that working with diverse voting populations might be far more comfortable for college students than for older generations who may not have attended integrated elementary and secondary schools, lived in integrated neighborhoods, or worked with diverse populations.

The HAVA College Poll Worker Program is, then, well suited to implement core elements of HAVA that include recruiting persons who may potentially serve as poll workers for many decades, recruiting persons who are comfortable with voting and assistive technology, and working with diverse populations, and increasing the overall number of poll workers.

4. RECRUITING COLLEGE STUDENT POLL WORKERS

Still, the college student experience makes working the polls somewhat difficult. Even though students may be excused from classes on Election Day, and may arrange to make up examinations and quizzes so that they may work as poll workers, they may wish to avoid missing course material or postponing a quiz or an exam. Students may be concerned about falling behind in their courses or being given a different test as a makeup from what was taken by the rest of the class on exam day. It is important to note that college students may be enrolled in as many as six courses that meet on a single day (at the University of Central Florida, for example, classes are offered between 7:30am and 9:45 pm Monday through Thursday, and at other times on Fridays and weekends).

Working the polls requires a minimum 14 hour commitment, sometimes more, in a single day. In Florida, the polls are open from 7am-7pm (federal law mandates that polls may not stay open less than 12 hours on Election Day), and poll workers must arrive at their precincts no later than 6am. Whoever is in line at 7pm is eligible to vote, even if the polls must stay open for several hours. Once the polls close, poll workers must remain until all of the ballots and voting equipment has been properly packed and readied for pick-up or drop-off at a designated ballot station, and all of the votes modemed in to the Supervisor of Elections office.

The authors of this article are one of the 19 EAC College Student Poll Worker Program grant recipients. Based on our experiences recruiting college student poll workers, it is our contention that Election Day should be changed to a weekend day in order to enhance college student poll worker recruitment efforts. In the following pages, we will outline our recruitment experiences, which will reinforce our position that recruiting needed poll workers who are technologically savvy, comfortable working with diverse populations, and a potential short and long term poll worker resource, will best happen should Election Day be moved to a day that college classes are not normally offered. Our position is unique in that those who advocate an Election Day change do so for the sake of providing convenience to voters and enhancing turnout, and not for the sake of improving poll worker recruitment. Those who do advocate an Election Day change have had many of their concerns allayed through early voting initiatives. In Florida, early voting must take place for each of the 14 days that precede Election Day, and must be available at least four hours per day for each day of that 14 day period.

The authors' poll worker recruitment efforts focused on the University of Central Florida (UCF), main campus and Valencia Community College (VCC), east campus. Students were contacted using several means: classroom visits, student club/fraternity/sorority visits, tabling outside the Student Union and other high foot traffic areas, and information sent to students through course Internet sites. Students registered their interest through a designated website, and the Orange County (FL) Supervisor of Elections contacted them. Monday, October 9, 2006 was the deadline for students to register their interest in working the polls, which was the same day as any other potential poll worker, and the last possible date to register to vote for the November 7, 2006 election. Students continued with the process of becoming poll workers after they were contacted by the Supervisor of Elections office were required to attend an orientation session. Two orientation sessions were held at the UCF campus, while one was held at the VCC campus. Unlike other potential poll workers who had to attend orientation at the Supervisor of Elections office downtown, we were able to secure orientation sessions convenient to the students. Students unable to attend any of the three orientation stations were invited to attend orientation at the Supervisor of Elections office.

Orientation is the first step to becoming a poll worker. The orientation gauges student interest in performing various jobs on Election Day. As part of the orientation, attendees are provided descriptions of each poll worker job, and designate their preferred position and precinct location.

Due to HAVA and state statutory changes written in response to it, there were three Election Day poll worker positions available in Orange County that required knowledge of, and comfort with, electronic voting technology. The touchscreen technician was responsible for overseeing voters using touchscreen machines. The Internet Oath Person conducts Internet based research on the secure Supervisor of Elections site for those voters whose names do not appear on the precinct voter registry. Finally, in 2006, Orange County created a runner position responsible for operating a mobile repair unit for voting equipment.

Each person who works the polls must undergo position-specific training. Several training sessions are scheduled for each position lasting from 3-6 hours per position (most training sessions last 3-4 hours, while clerk training tends to last 6 hours as clerks must learn to do each of the other jobs). The position-specific training takes place at the Supervisor of Elections office. Students recruited through the College Student Poll Worker Program participated in the training along with all other poll worker trainees at that office.

The EAC-funded recruitment effort resulted in 333 students expressing an interest in working the polls. Of those 333, 191 were UCF students while 142 were VCC students. Of those who signed up, 100 UCF students attended orientation while 60 VCC students did the same. This means that we experienced a 48% drop-off among UCF students and a 58% drop-off among VCC students when comparing those expressing an interest in working the polls and those who attended orientation. The next stage, training, also showed a drop-off. Of those UCF students attending orientation, 52 (a 48% drop-off) completed training. Forty-one VCC students (a 42% drop-off) who attended orientation also completed training. Finally, of those who trained, 34 VCC students worked the polls (a 17% drop-off), while 50 UCF students did the same (a 4% drop-off).

In the end, 84 students, or 25% of those who originally expressed interest in working the polls, actually worked on Election Day. Several students notified the Supervisor of Elections office at various stages in the orientation and training process that they were unable to work for various reasons. Anecdotal evidence suggests that students considered the time commitment on a school day, transit time to and from the assigned polling place, and opted not to work the polls. Further, students found out at some point between the date that they first signed up, their orientation or their training session, that an as-yet undetermined assignment date, such as an exam, quiz or paper, would take place or be due on Election Day or the day afterward. They decided against working the polls out of fear that the consequences for working on Election Day would have a negative and significant impact on their academic record.

Of the students who expressed interest in working the polls, ages ranged from 18-39 for UCF students and 18-47 for VCC students. The average age of those who expressed interest was 22 for UCF students and 24 for VCC students. Considering these students' ages finds that 60% of the UCF students who expressed interest in working the polls were 22 and younger, while 2/3 of the VCC students expressing interest were age 24 and younger. Of those students who actually worked on Election Day, the average age for both schools' poll worker recruits was 21. Over 60% of the UCF students were age 24 and younger, while over 90% of those VCC students who worked on Election Day were age 24 and younger. These data show us that most college students recruited through the EAC College Student Poll Worker program were among the youngest voter demographic.

The principal investigators interviewed the Deputy Supervisor of Elections to debrief on the project. The deputy told us that the percentage of workers to persons who expressed interest in the program, 25%, was similar to that found in the general Orange County population. This means that, even though the reasons for the drop-off between those who expressed interest, to those who attended orientation, to those who trained, to those who worked, likely differed from the general Orange County population, the percentage drop-off did not. Students and non-students who expressed initial interest in working the polls were equally likely to drop out of the program at various points in the process.

5. CONCLUSION: MOVING ELECTION DAY TO A WEEKEND DAY TO RECRUIT MORE AND BETTER POLL WORKERS

These results speak to the value of moving Election Day to a day that colleges do not generally offer classes, such as weekend days. The EAC-funded effort shows that targeting college students using a college-based recruiting effort, coupled with easing the orientation process, helped us recruit a potentially rich Election Day resource. As the number of needed poll workers has increased due to HAVA and pertinent state-level statutory changes, coupled with the need for technologically savvy poll workers due to changes in election law that now mandate working with high-tech machines and computers, the value of recruiting college students on college campuses cannot be understated. The added value of the low average poll worker age from among the college student population, when compared to the national average of 72, also speaks to the benefits of habituating these younger persons to the civic value and experience of working the polls. It would be our hope that whatever hesitancy students may have had when considering the 14+ hour workday were allayed based on their actual experience. Once that first experience has passed, we would further hope that these students would continue working the polls for the next several years, if not decades, long after their college careers had ended.

At the same time, it is important to note that the reasons for student drop-off differed from non-students who expressed an interest in working the polls who eventually did not work simply due to their circumstances. Addressing the reasons for student drop-off, which are more than likely college-related, would require that the college-related reasons be confronted and allayed by moving Election Day to a weekend day. The advantages of such a statutory change would ease the burdens brought about by HAVA and state-level statutory changes, while at the same time making the voting experience easier for voters.

USE OF INFORMATION TECHNOLOGY IN MANAGING THE ORGANIZATIONS

DR.SUJEET KUMAR DUBEY

India, on the threshold of the 21st Century, is currently experiencing an information explosion, thanks to the dramatic advance of IT which is sure to affect various aspects of life. Including organization. The very concepts of structure and processes of managing the organization are already undergoing significant changes under the impact of IT. More significant, however, will be its impact on administrative culture. The fantastic advances made every day in IT have been a culture shock to the managing the organization in the late 1990s, notwithstanding the fact that there is roughly a gap of a quarter of a century or so between the first appearance of some technological inventions in the west and its adoption in India., the organization and administration in India began to think seriously for adopting it only in the 1990s after accepting the policy of liberalization. Just as the industrial scenario depicted in Carles Dicken's Bleak house and Hard times is today a forgotten memory, so will be the conventional procedures and processes to managing the organization in India in the next decade or so. Today, with the help of wireless internet, any information can be reached anywhere in the world within minutes. The telecom giants in the west have already brought in wireless universal devices and portable portals which give high-speed access to a plethora of services from credit card and banking to stock market trends, from voice messaging to headline news,. The computer can retain data in its memory in an unbelievable quality and those data can be retrieved so easily that the age of paperless and fileless administration has arrived.

The 1st generation of information Age was characterized by relatively straightforward automated data processing. The 2nd generation has moved to automated decision-making, more technology-based telecommunications and the so-called information superhighway. The access to information superhighway is through telephone, personal computer, television and new hybrids of these devices. The superhighway is the increased capacity in telecommunication network. It is also the multiple available means of communication, from wired telephone to cellular phones to satellite delivery to an antenna. The 3rd generation of IT is mobile telecom age with satellite and wireless towers as the new technology. Decision-support system, expert system and electronic mail-putting every member of an organization in direct communication with everyone else, even around the world through the internet-have become commonplace. Such information explosion has tremendous implications in the field of management.

Internet and electronic data interchange (DEI)

E-mail uses electronic circuitry to transmit written messages via computer terminals instantly to other people within the organization or to those in other organization(s) around the world. Through the internet-the fast-growing interconnection of computer networks around the globe-millions of people can now obtain information on virtually anything and potentially communicate with anyone who has a computer. In addition to sending messages, E-mail can be used for transferring computer files (e.g., spread sheets, data base files, address lists, etc.) as well as for electronic Data Interchange (EDI) which is an automated form of ordering and inventory control. This is process by which customers, suppliers and manufacturers can communicate directly on a computer-to computer basis. By means of EDI, response to queries is up. That gives an enormous competitive advantage. E-mail providers may also be hooked to various computer data based that give users access to latest news, financial information, credit reports, airline and railway schedules, electronic banking and even home shopping.

Management Information

- The operational or transaction documents are the basic source of internal data in the organization. But, as such, they are not suitable for management planning, coordination and control.

Information Requirement at Various Levels

The requirement of information at any level in the organization depends on the nature of activities performed at that level.

The long-range plans and the yearly operating plans are the basis for formulation of individual objectives or goals, both of the numeric type and of the event type. An example of a numeric goal is a specified sales or shipment volume, while and event goal might be the delivery of a new product on a specific date of completion of a new facility.

Control of performance against the plan involves three main stages:

(i) Setting of performance standards (Usually expressed as financial budgets, sales targets, time scales or physical measures); (2) Measurement of performance (usually by observation, interview or analysis of reports from subordinates; and (3) Correction of deviation from the plan (Usually buy modifying plans. Or standard of performance or by revising staff/resource allocation).

INFORMATION ATTRIBUTES AND ORGANISATIONAL LEVELS

Databank Information System

A databank information system (Fig.3) performs only the first two activities described above, i.e. it observes the objects and activities in the organization, measures and records them and maintains a pool of data for use by the decision-maker.

There is relatively little human intervention because the managing body for the organization has confidence in the premises upon which the computer acts.

EMERGING TRENDS IN APPLICATION OF IT IN ORGANIZATIONS

Business and management is going through similar changes today which the industrial revolution brought in the methods of production. Some of these changes can be summarized in the following paras.

Industrial Revolution gave us technologies and methods of mass production which made it possible to produce high quality products at very low costs. Industrial Revolution also brought about large-scale displacement of workforce from production activities to administration activities

Internet and Internet

Internet and intranets have opened new frontiers of IT application. Flow of information within the organization and also from various external sources has become very smooth and instantaneous. Enterprise Resource planning of ERP integrates all the functions of the business organization. The moment a new sales order is received, its implication in r\terms of production schedule, raw material requirements, cash flow, etc., can be worked out and planned accordingly. Managers in the organization can retrieve data from internal and external database and process it for decision-making according to their requirements without delay.

Satellite communication and internet has opened new opportunities for India in software exports. India is emerging as a major source of software and off-shore services.

Strategic Implications of Internet Use by Transnational Terrorist Networks*

Roger D. Masters
Department of Government, Dartmouth College, Hanover, NH (USA)

Introduction: Generic Effects of the Internet

While nuclear deterrence was effective versus the USSR, the end of the Cold War has been followed by a radically new strategic weapons system epitomized by the actions of the Islamic fundamentalists of Osama's Al Qaeda. States have partly been replaced by dispersed networks like Al Qaeda as a key threat to global stability. The geographic diffusion of ethnic or religious groups has become dangerous in part because the internet is a communication system that makes possible transnational networks of information transfer. While the Al Jazeera website provides a visible indication of this potential, hidden subfields in another website (accessible only by secret password) could provide Al Qaeda with even less visible communication.

These effects have important policy implications. Transformations in communication have created a need to rethink basic strategic doctrines. Faced with transnational terrorist insurgencies, it's impossible to guarantee the survival of a foreign regime with a military presence and threats of retaliation against subversive attack. Hence the extension of American security guarantees – in the past sometimes combined with military alliance and lasting American troop presence – would have sharply different strategic implications in Iraq than it did in South Korea.

The Internet and Terrorism

Strategic policies need re-examination because, as 9/11 revealed, a transnational network of "true believers" capable of recruiting suicide bombers creates a new weapons delivery system. Insofar as a suicide bomber with a proper supporting team can convert civilian technologies (like commercial aircraft) into a WMD, the network of members embedded in more than one country makes nuclear retaliation and deterrence impossible. Any attack on civilian targets -- and esp. a nuclear attack -- would simply facilitate the recruitment of terrorists (by other Muslim networks in addition to Al Qaeda).

Bureaucratic, top-down command structures are increasingly being replaced by these networks as threats to American security. And, more important, there are millions of Muslim immigrant workers in some NATO countries (like both France and Germany). This further serves to undermine the feasibility of nuclear retaliation for a terrorist attack, esp. because such actions can be coordinated through the Internet without relying entirely on the movement of terrorists and materiel across national frontiers. As a result, a demographic phenomenon – large numbers of Muslim immigrants in Western European industrial societies (playing an economic role comparable to Hispanics in the U.S.) – creates an unexpected effect of communication through the internet.

Failure to understand the replacement of centralized states by international networks has compromised our strategy in Iraq. In such groups, the internet can paradoxically contribute greatly to the recruitment of extremists who, for cultural or religious reasons, join networks committed to attacking the U.S. and other symbols of secular Western social practices and norms.

> There are between 70 and 100 groups that make up the Iraqi insurgency, and they are organized … like a bazaar. It's pointless to decapitate the head of the insurgency or disrupt its command structure, because the insurgency doesn't have these things. Instead, it is a swarm of disparate companies that share information, learn from each other's experiments and respond quickly to environmental signals."[1]

Obviously the internet can be a crucial means of the "information sharing" and command in such networks.

To be sure, the internet can also have a countervailing effect, as illustrated by the behavior of young children in Bagdhad. In many households in the Iraqi capital, due to fear of terrorist violence, children go to school and return home immediately after the end of classes (often under guard). Once home, children are no longer allowed to play in the streets. With the free time available, many apparently play American computer games – *in English* –on line. Need it be added that, for parents more strongly committed to cultural or religious tradition, this behavior (whether of their own or others' children) can be infuriating? Over the long run, therefore, American culture on the internet could be more potent than troops and helicopters in both inciting and undermining Islamic Jihad.

The increased market for low cost international communication is reinforced by the relatively low birthrate in developed societies, which creates a demand for low-wage immigrant workers (who in the French context are Arabs from North Africa, playing a role comparable to the illegal Hispanics from Mexico and central America in the U.S.) Use of the internet, when combined with these demographic changes, has played a role in minimizing support for the U.S. among our European NATO allies. Given the unrest among unemployed Muslim workers in the Parisian region (including burning cars in Paris), it should hardly have been a surprise that the French were not eager to send troops into Iraq. Due to the numbers of Muslim immigrants elsewhere in Western Europe, the European community likewise had little interest in supporting the Bush policy in Iraq too visibly. For European governments except Great Britain, however, the best solution was often to treat the issue as a national one, so that anger from the Bush administration would be directed to France.

From the perspective of American power, these events reflect the end of Cold War bipolarity. The dangers of mutually assured destruction from any breakdown of nuclear deterrence (a powerful deterrent to any Soviet aggression in Europe) have been replaced by a new strategic environment in which nuclear weapons cannot deter suicide bombers recruited by a Jihadist network spread through the Muslim population in numerous countries in the mid-East and Western Europe (not to mention Indonesia and elsewhere).

While the internet permits interactive communication, helping Osama bin Laden to orchestrate the terrorist attacks of 9/11, even passive exposure to a website like *http://english.aljazeera.net/NR/* has led to the formation of copy-cat terrorist groups. Hence the six "radical Islamists" arrested in early May 2007 while planning to bomb Fort Dix, New Jersey were “a leaderless, homegrown cell of immigrants from Jordan, Turkey and the former Yugoslavia who came together because of a shared infatuation with Internet images of jihad.”[2]

Small bands of dedicated extremists, including a few willing to act as suicide bombers, are thus a new weapons delivery system capable of acting over intercontinental distances. As a result, the strategic calculus that was so effective in the Cold War (since the “mutual balance of terror” made it possible for economic and social competition to undermine the U.S.S.R.) has now been fundamentally changed.

For the U.S., the consequence has been a decline in role of NATO. By engaging in unilateral intervention, the U.S. has further weakened our own leadership role in an alliance that once provided defense and security to Western Europe. The total strategic cost of this factor remains to be seen, but if the foregoing analysis is plausible, the future of America's ability to provide defensive guarantees to any ally (especially in Asia) should have higher priority than assuring our leadership role in NATO.

Political Implications of Transformed Modes of Communication

Many other social and political changes arise as a consequence of the emergence of the Internet as a major means of communication. This should hardly be a surprise since each major new mode of communication in human history has marked a major change in socio-political structures and institutions. A few examples of political and social effects of transformations of communication technologies throughout history illustrate the underlying principle:

• **Speech**, quite obviously, marked a major transformation of human groups from those observed among primates: the mere fact of naming created communicable identities for individuals, nuclear families, lineages or clans, tribes, and other social groups. Equally important, speech permitted a codification of customs or conventions. Through chant and song, some spoken messages could be formalized to transmit tales, myths, and religious rituals giving cohesion to human societies.

• **Writing**, by making possible the transmission of verbal messages across larger spaces and times, permitted the extension of shared identity, customs, and – above all – codified laws and centralized governments. Since those who could read thereby had access to information not available to the illiterate, writing also led to more complex distinctions of status, class, and functional expertise. As a result, cultures and political institutions could spread over populations of hitherto unprecedented extent (such as the Persian, Roman, or Incan Empires) and religious laws and traditions could take a form lasting with minimal change over centuries (like the *Old Testament, New Testament,* or *Baghavad Gita*).

• **Printing,** by transcending the limitations of manual writing, made written messages accessible to dispersed groups sharing common linguistic and cultural practices. This made possible new types of social and religious movements. For example, previously traditional (Catholic) Christianity in Europe had rested on a clerical hierarchy and monastic orders which had possession and use of the written texts (bibles were often chained to a pulpit and made accessible to lay readers only with ecclesiastical permission); with Gutenberg’s Bible, laity could also own or consult bibles at will – leading to the Protestant Reformation (epitomized by Luther’s doctrine of the "priesthood of all believers"). In the political realm, this mode of communication led to the emergence of the nation-state as the predominant form of government institutions. When combined with improved means of transportation, printing also made possible imperial domination over greater geographic dispersion than ever before (as illustrated by the British Empire).

• **Radio and Television** -- mass media not transmitted through writing -- made possible simultaneous communication to national populations and instantaneous reception of messages throughout an entire nation-state. These technologies integrated global politics more extensively than ever before while paradoxically making it possible to mobilize (and tyrannize) the population of national states to a degree not previously common. The result – World Wars I and II, and the Cold War – also depended in part on the emergence of an international scientific and technological culture increasing the potential scope and devastation associated with military weapons.

• **Computers and the Internet** have once again transformed social and political life in ways not immediately expected by its inventors. The processes described at the outset are familiar to all those who find themselves spending several hours a day reading and answering email (thereby leaving less time for direct personal contacts in one's local community). There are, however, a wide variety of features and uses of the internet that have potential strategic implications, sometimes favoring a dominant or powerful state (as the U.S. today), but sometimes facilitating aggressive actions of rivals *or* subtly undercutting traditional military planning.

It's therefore useful to mention briefly some of the diverse effects associated with these radical changes in information technology. In each case, the potential for enemy groups or societies to access or disrupt these systems create a new strategic environment. As a result, for each of the following, both uses by a government seeking to defend or extend its power and hostile actions undermining an enemy by non violent means need to be considered.

• **Information storage and transfer**. Computer files, whether saved on a hard drive or disk – as well as those sent by email – do not leave a "paper trail." On the one hand, immense amounts of data can be accumulated, analyzed, and communicated in ways hitherto impossible. The most obvious uses of this technology concern complex databases and multivariate analysis in planning and executing either military or civilian policies. Whether merely the social security and income tax system, career data on all military personnel, or budgetary planning and execution, centralized governments increasingly take these systems for granted.

Hostile interruption of these systems is possible not only for a major state (be it the U.S. acting against Russia and Russians acting against Americans); unlike land warfare between massed armies, strategic invasion and disruption of information systems is possible for decentralized networks of ideologically or theologically committed activists. Indeed, even a small group of free-lance terrorists with one or two highly sophisticated computer specialists could produce untold chaos in a target society. For example, it would have been relatively cumbersome for a small group to accumulate the names, addresses, and telephone numbers of elected legislators, of members of the judiciary, and of key executive officials at the Federal, State, or Local levels in the U.S. Password protection is not immune to subversion, and if the target is disruption of communication rather than access to the substance of messages, merely flooding the computer network with SPAM or suitably disguised emails could produce a brief paralysis timed to coincide with a terrorist attack.

Transfer of stored information to be used for this purpose would doubtless be easiest to plan and hardest to interrupt by using disks. Enclosing large files in a standard email, even if sent to a carefully masked address, would be open to interception or notice. In contrast, a disk carried by a currier allied with the network or mailed to a drop address would be somewhat harder to intercept. The means of transmitting datasets in this way are limited only by ingenuity: while carrying laptops on transatlantic flights has become sufficiently routine that this is one means a currier could use, a disk simply slipped inside a magazine sent as printed matter would have the same harmful effects. And given the low cost of multiplying the disks carrying the same data, even if some curriers or mailed envelopes were intercepted, there's a strong probability that at least one of a large number of identical disks would reach its targeted individual.

• **Web sites as means of recruitment, information dissemination, and hidden communication.** Understanding how hostile networks of terrorists can use web sites as means of recruiting, organizing, informing, and activated members around the world can also indicate how the U.S. can use the same techniques aggressively. Just as American planners long relied on the "Voice of America" to communicate our policy goals to potential supporters in enemy countries during the twentieth century, in recent years Islamists have discovered how Al Jazeera's web site can be used for similar purposes. The sending group can target a population either to inform or recruit those potentially disposed to agree with their web site, and those who have already been recruited through the information and propaganda it contains.

The tendency of some children in Bagdhad to play American computer games when sent home after school has been mentioned: apart from spreading the experience of pleasure associated with our culture, such uses of our web sites that are freely chosen by citizens in foreign societies can introduce social conflict that can only be prevented by blocking access to the internet by a substantial proportion of the public (including school children). The result could easily be that the unwelcome effects of American web sites could reduce the numbers of those who are computer-skilled in a foreign population. The converse is obviously even more important for a developed society like the U.S. or Western Europe, where the reliance on immigration (due to low birth rates) creates social "markets" for subversive ideas. As a result, the use of religious or ideological web sites can provide a means of recruiting and organizing terrorist groups that is difficult if not impossible to censor or prevent. This potential is especially serious given the possibility that computer specialists will discover how to hide a terrorist section in the web site of a university where many foreign students study and some might have access to the site's home computer.

As the foregoing summary shows, repeated transformations of social and political life, changing the size, integration and strategic relationships between social units, have accompanied the development of new modes of communication. It can hardly be otherwise with the personal computer and internet. With changes of this order, no single observer or theoretical framework is likely to exhaust the important effects of new and rapidly changing technologies and equipment. For policy-making reasons, one major change deserves the attention it was given at the outset.

Conclusion: the New Strategic Environment

In the nuclear age, long range delivery of violent weapons reached a hitherto unimagined capacity to destroy entire communities with a single salvo. When rival states each enjoyed possession of nuclear weapons and delivery systems, first use was almost guaranteed to elicit nuclear retaliation. Thanks to the ability to deter a devastating second strike, weapons use was deterred by self-interest. The resulting stability, generally called the "delicate balance of terror," produced strategic self –restraint by both the U.S.S.R. and the U.S.

This strategic environment has been disturbed by the emergence of transnational networks seeking to modify the political order, using the internet as their communication system. Terrorism is the fashionable name for this sort of strategic action, using new communication systems to recruit and organize suicide bombings that more powerful states seem unable to deter. The foregoing survey of strategic and political transformations associated with prior innovations in modes of communication indicates that these recent effects are likely to be of great long-term importance.

The generic "Political" implications of recent "**Technologies and Applications of Information Systems"** depend on complex economic and demographic factors that modify the way internet technology can be used by a small minority of the population –- and have thereby transformed military strategy. For example, transnational subversion is harder to disrupt because it is not as easy to monitor the use of web sites for behavioral coordination since coded messages can so easily be hidden in an apparently anodyne message (for which the coding has been separately translated by surface mail or personal contact). Even if future developments show these fears are exaggerated, they illustrate unanticipated effects that have accompanied all prior revolutionary changes in communication technology -- and therefore show the need for scholars to engage in interdisciplinary dialogue on the topic of the present conference.

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[1] David Brooks, "The Insurgent Advantage," *New York Times* (May 18, 2007), p A27.

[2] Dale Russakoff & Dan Eggen, "6 Allegedly Had Fort Dix Terror Plot," Washington Post News Service, *Valley News* [Hanover, NH), May 9, 2007, p. 1.

SKILL DEVELOPMENT THROUGH DISTANCE EDUCATION AT THE TERTIARY LEVEL – BUILDING A CASE FOR INTERVENTION BY IGNOU, INDIA

Prof. Pandav NAYAK
Professor of Political Science
School of Social Sciences
Indira Gandhi National Open University
Maidan Garhi
NEW DELHI – 110 068 (INDIA)

ABSTRACT

Importance of skill development as a human resource has considerably been enhanced in the context of India competing to be a global economic power and especially, the forthcoming phase of 'demographic dividend' which it is going to experience shortly. Current conventional education system is not so much equipped as Distance Education to contribute to dissemination of this knowledge and training. IGNOU as the apex body in ODL should immediately intervene to raise the fruits of VET especially at the tertiary level since it has so far remained stuck in lower levels of educating the society.

Keywords : Demographic, Dividend, ODL, VET

***Extracts from* Independence Day Speech, August, 2006**

"*We will need to ensure a far greater availability of educational opportunities at the higher education level so that we have not just a literate youth but also a skilled youth, with skills which can fetch them gainful employment. As our economy booms and as our industry grows, I hear a pressing complaint about an imminent shortage of skilled employees. As a country endowed with huge human resources, we can not let this be a constraint."* **Prime Minister of India**

Recognition of this importance of skill education has a hoary past; it dates back to 1854 – which advocated diversification of general education in India. From that time till date, VET has passed through many recorded milestones, the latest being National Curriculu8m Framework, 2005.(1)

'INCLUSIVE GROWTH' *is the most 'politically correct' way of summarizing India's goal today.*

A. It actually is the title of The ELEVENTH PLAN APPROACH PAPER : "TOWARDS FASTER AND MORE INCLUSIVE GROWTH".
B. World Bank had also identified last year two most pressing challenges for public action in India : (i) Institutional reforms to enhance capacity of public sector institutions for effective delivery of core services and (ii) sustaining continuing pace through making the process of growth more inclusive across sectors, regions and classes. (2)

How to include more people in the growth process which is becoming faster now ? This is crucial not only for India to compete with China but more importantly, to emerge as a super power. Absence of institutionalized skill development has been a creeping sensation of loss in this pilgrimage to the super power status.

GROWTH STRATEGIES DURING LAST SIXTY YEARS *GENERATED ONLY 'EXCLUSIVE GROWTH'*

- Till the 1970s (including the Nehruvian times), there was reliance on *extremes* of heavy and cottage industries. Light and labour intensive industries suffered. Most people in this huge economic space remained uncovered, by employment.
- Thereafter till date (including the globalization era of liberal economic reforms) a service-led growth strategy led to 'jobless growth'. IT & ITES sector leads this brigade.

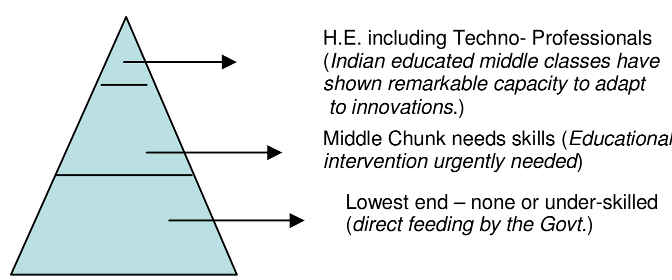
CONSEQUENCES (ECONOMY-WIDE)

- Among 30 millions registered in various Employment Exchange Offices of India (2006), 83% do not have any kind of skill to show. (3)
- Whereas the Indian workforce is 415 millions strong today, the IT & ITES sector has given employment to *not more than one million employees.* (4)
- While income inequality is ever on rise (a CEO : an agricultural worker 32000 :1), there has been negligible increase in the employment generation for vast masses of Indians. (5)
- Rise in output is not associated with generation of employment opportunities. As with IT & ITES sector, similar is in the case of, for example, Tata Steel, which according to the estimate of the Financial Times, London) increased its output five times during 1991-2004 while halving its workforce. (6)

These smart cases of growth stories have spawned 'exclusive growth'. Need of he hour is to include people in growth. How can education sector, especially ODL contribute to this ?

CONSEQUENCES (AS REFLECTED IN THE EDUCATION SECTOR)

Can be better understood through an analogy of a pyramid.



The top segment of Higher Education has fared hardly satisfactorily from the skilling point of view : [7]

1. The enrolment figure is around 7%.
2. 84% of the students enrolled belong to the general education streams of Arts, science and Commerce.
3. Only 14% pursue techno-professionally focussed Diploma and Certificate programmers.

The middle segment no less heavily populated than the lowest, is in need of skills. But India's performance for this sector is far below the normal expectation,[8] as the following indicators show :

1. Enrolment in the Vocational Areas is less than 5%. Compare it with 98% in South Korea and 60 to 80 in OECD countries.
2. Though 6000 ITIs have been established but they were rubbished by the same logic of wasteful education which afflicts Higher Education.
3. As the National Knowledge Commission Report has sharply pointed out recently, here is a negative association between vocational education and manual labour so far as general perception of the people is concerned, which is why few parents send their wards to vocational schools.

C) The lowest segment hugely populated is either without or little, if any skills. They are served by Food for Work Programmes or Schemes like NREG, Jawahar Yojna, etc.

A STATUS REPORT ON SKILLS EDUCATION reveals the following features given episodically :

The report of the National Knowledge Commission, 2007 asks for (a) a robust regulatory and accreditation framework (b) as far as possible certain aspects of general education should be retained in the VET curriculum (c) links should be established between the vocational education system on the one hand, and the school and higher education on the other, and (d) several delivery models need to be innovated for an urgent, balanced and comprehensive coverage of VET in India. The report highlights the importance of public-private partnership to register a quantum jump both in numbers and quality. The *new ILO recommendations* on "Human Resources Development : Education, Training and Lifelong Learning" (No.195) calls on member States to develop and implement education, training and lifelong learning policies that promote people's employability throughout their lives. The three pillars identified for building and maintaining individual's employability: (a) quality education, (b) pre-employment and (c) learning throughout life.

If the govt. of the day failed to focus on the market-oriented technical education necessary for healthy and fast industrialization, *the private sector is no less to blame*. This is clear from the shirking of responsibility on the part of the private sector to invest in R&D whose total figure hovers around only one percent of the GDP.

National Curriculum Framework, 2005 brought out by NCERT proposed :

i) The introduction of productive work as a pedagogic medium in the school curriculum i.e. work-centred education, and
ii) A new programme of VET, which is to be conceived and implemented in a mission mode, involving the establishment of separate VET centres.
iii) Such VET centres are to evolve in collaboration with, and vastly expanding the scope of institutions like ITIs, polytechnics, technical schools, Krishi Vigyan Kendras, rural development agencies, primary health centres (and their auxilliary services), engineering, agricultural and medical colleges, S&T laboratories, cooperatives and specialised industrial training in both the private and public sectors, etc.

A mention may also be made of the recently set up University-Industry Council representing a formal partnership among the Confederation of Indian Industry (CII), the All India Council for Technical Education (AICTE) and 348 Universities across the country. Dedicated to promote innovation in technical education, this Council was inaugurated on May 20, 2007 by President A P J Abdul Kalam, who emphasized the need for a multi-pronged strategy : remove drop-out, value-oriented education, capacity building and entrepreneurship. On the mission of education as a capacity builder, President Kalam bemoaned at the current state of affairs : "*Together, the Centre and the states have the capacity to provide employment to only 10% of the 10 million people we inject into the market every year*". [9]

The Fact Sheet on higher education level VET in India is most discouraging. It will not be an exaggeration to observe along with Abid Hussain Committee's (set up by University of Delhi) observation that "no careful preparation for launching of vocational programmes has been made". This Committee recommended that core faculty should be trained, new teaching methods evolved, and courses should be employment-oriented. The UGC had made a beginning in this regard by launching in 1994 a Scheme of "Career Orientation to Education". About 35 courses have been introduced under this Scheme in different colleges in the country but they have been "found inadequate in developing requisite vocational competencies" due to partial vocational bias infused in these under-graduate courses. In 2000, the UGC also introduced the concept of "Generic and Communication Skills" but its response/success rate has not been reported so far.

With all its limitations, vocational education in India has remained school-bound. Though, NIOS is making robust plans to expand its coverage at the school level. IGNOU should supplement this drive by catering to the higher education needs through distance mode for which creation of SOVET has been suggested as an intervention measure.

FOR A VALUE-ADDED PARTICIPATION BY THE ODL

Within the education sector, the conventional face-to-face education is not as well-equipped as the distance education system is, to meet the new challenges of globalization. These challenges often come in the form of new markets, new jobs, new skills, reskilling and retiring of the old sets etc. The conventional system is not suitable to meet these challenges for the speed and flexi-nature of these requirements On the other hand, Distance Education,[(10)] especially in its advanced stage of *online education revolution*, can make it possible for even the 'virtual' class-rooms look more real than the face-to-face real ones. Online education can make available customized courses to learner's convenience. With the help of Learning Management Systems (LMS) tools, it can make courses lively and interesting. There is an 'inclusive learning environment' in which every participant has an equal 'say' unlike in a conventional set-up where few smart ones steal the show over many others inside the classroom. There are many other cutting-edge technologies which help generate a *human touch* in an otherwise primarily text-based environment. Many software are now available to overcome the alienation caused by the distance and create a real classroom situation over global distance. Instructors can deliver live lectures while the audience can pose questions (voice-enabled) real-time and receive also real-time responses. Many software have rich features like real-time survey, remote control of a participant computer at a distance for some problem resolution (exactly like a teacher going to a student in the class-room to teach her hands-on) Online training also helps (much better than in an offline situation) to review the training already given, so as to introduce changes for future improvement. The inherent characteristics of the open learning system may be able to address many of the problems encountered in the implementation of VET at secondary and tertiary levels. UNESCO's[(11)] recommendations are given theme wise. One of the recommendations is "To make the maximum contribution to lifelong learning; TVE (Technical & Vocational Education) must be open, flexible and learner -oriented." Another recommendation specifies," there must be flexibility in programme administration and curriculum design to facilitate a smooth passage through lifelong learning and provide continuous entry, exit and re-entry points.

With so much of efficiency achieved through ICT driven delivery models and collaborative learning, ODL is an ideal education sector to accept this challenge and intervene at the tertiary level.

STRATEGIES TO IMPROVE UPON THE PRESENT LEVEL OF VET

How to raise the enrolment percentage in the VET from the present 5%. Especially, how can ODL/IGNOU help in this venture ?

Designing of such strategies can not overlook the following parameters:

1) India is going to experience benefits of a 'demographic dividend'. By 2030, the average age of an Indian is 29 years whereas the Americans, Europeans and Japanese would be entering old age. According to an estimate (Mckinsey Quarterly Report), more than 20% of the global work-load is going to shift to India (and China) in view of this demographic change. Therefore, most of them need to be skilled and *urgently.*[(12)]
2) The above is not at the expense of the current benefits accruing from the IT & ITES sector; rather it should complement with India's already earned advantage. According to Nandan Nilekani,[(13)] India's macro-economic figures are currently excellent :

i) India's savings rate has always been high, but it was never so high as now at 2%.
ii) Foreign investments are 34% of GDP.
iii) IT exports lined up today are an equivalent of what was achieved during last 30 years. And this is to be finished in next 5 years, worth $60 billion and with a potential of generating 3.2 million jobs.

Indian economy has largely been buoyant owing largely to IT exports but if it is not to slip (in terms of sustaining this fast growth) the huge socio-economic spread needs to be skilled, re-skilled, re-oriented.

3) A note of caution is an important feature of this skilling education. The central challenge is not only to engineer a quantum jump in the VET enrolment, it should, at the same time, be 'rebranded' which takes both quality and the image for transformation.
4) In order to avoid wastefulness, it is necessary that VET education should not be 'practical skills' only. Many industries are running their skill-specific courses. But education goes beyond servicing for skills. Some understanding of the societal environs, the Communicational aspects and above all, the general competencies in which a skill-set is sourced should also be taught to these students.
5) A vertical integration of the School level and Higher education level courses should be planned holistically with exit flexibilities given to students to drop out or pursue higher education through a designed set of integrative channels connecting VE with higher education. There is a need to develop a National Vocational Qualification framework to provide a unified system of VET based on national skills standard. The NVQ system with flexible multi-entry and multi-exit options as found in New Zealand, UK, the Phillipines, S.Korea etc. may be adapted suiting to our requirements.

6) It is in this re-engineered set-up that Bachelor's & Master's degrees with vocational specialisations can be planned and given.

IGNOU, the Apex Body of the Distance Education system in the country, should set up a School of VET to address the needs outlined above. Such a School should develop courses preferably in regional languages and reflecting regional peculiarities. A balanced focus on learning of skills and general education will be emphasized. Specific partnership between IGNOU National Institute of Open Schooling will be encouraged for qualitative spread of VET. The organisation of such a School will take an innovative blending of the functioning of the Schools and the outfield reaching towards the learners as under the present system in IGNOU. A salient feature of the School will be to certify the talents available in the society, mostly in the informal sector.

The thrust, quintessentially, is to prepare '*branded VET students*' who can be easily absorbed by the market and acceptable to the society with their educational degree. The absence of this has been recently deplored by the NKC which has recommended in its recent report for devoting ten per cent of the total public expenditure on education, to VET.

It may be mentioned here that vocational education activities are not new to IGNOU whose Schools are already having many Vocational Programmes as given below. But the above argument for a dedicated School is centrally premised on H.E. level vocational education as a national mission. The current state of diffused development of courses should yield place to the challenge of this national mission which is to have a multi-pronged approach to involve and include people in bringing about and sharing the benefits of growth.

VOCATIONAL AND RELATED PROGRAMMES AT IGNOU (2007)

PROGRAMMES	DEVELOPED	UNDER PLANNING & DEVELOPMENT
Master's level	6	3
Bachelor's level	8	--
P.G. Diploma	21	20
Diploma	9	10
Certificate	23	22
Training (only) for N.E. Region	10	
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	77	55

Proposed short-term Entrepreneurship Training Programmes of the North-Eastern Project, IGNOU : 18

Programmes Developed	:	77
Under Development	:	55
North-Eastern Project (proposed)	:	18

TOTAL	:	**150**
		===

CONCLUSION

Postscript two important developments which have taken place after the conceptualisation of the above case deserves mention. They are :

(i) provisioning of Rs. 500 millions for skill development in the 2007-08 annual budget of the nation,and
(ii) announcement of creation of a national mission for skill development.

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Using Information and Communication Technology in Literacy Classroom: Why Teachers are Reluctant?

By:
Associate Professor Dr. Mahzan Arshad
University of Malaya

Introduction

Information and Communication Technology (ICT) has a great influence in the field of education since its introduction to be used in classroom activities several decades ago. We hope that today computer is widely used in most subjects taught in school. We also hope that Internet is the source of information for many topics that teachers discussed in their classrooms. Students should be using information on the Internet to do their classroom projects or home work that have been given to them. Getting hooked to the ICT should not only change classroom environments, but also change the way teachers evaluate their student's works. Computers either desk tops or note book should be available to teachers and students to make ICT as important educational tools in the teaching and learning processes.

However not all school are able to provide teachers and students with such ICT rich environment. Since the introduction of smart school concept in Malaysia in1999, less than 300 schools have been recognized as schools that fall under such concept. Not much has been successfully done to improve student-computer ratio in most schools. The number of computer available in school are still much lower than the number of students even though four major subjects are suppose to be taught by using ICT. Limited Internet connection was also a major hindrance for using ICT in classroom. So much have been discussed on using ICT in the classroom but in reality not much have been done to enhance the number of teachers who are using or willing to use the technology in teaching. This paper tries to answer the question of why literacy teachers are reluctant to use ICT in their classroom. Are literacy teachers ready in terms of preparation, knowledge, and skills to use ICT in the process of teaching and learning?

Background of the study

Computers have been introduced in Malaysian school in early 1980's. At the early stage schools were encouraged to set up computer club and the money collected from club were used to build computer's laboratories. Some school raised funds through Parent Teachers Association to buy computers and to build computer labs. Classes were held with the goal to introduce the skills of using computers among students who have registered as members of the club (Yusuf, 1998). Most of the instructors for these classes were not the teachers in the school and they were not subject teachers too. They were hired to teach computer related skills to the students who were enrolled in the classes.

The use of computers for instructional purposes begins in mid 1990's fifteen years after the first generation of computers were being used in schools (Vasantha, 2000). The Ministry of Education with the collaboration with Malaysia Institute of Microelectronic (MIMOS) has set up a task force to facilitate the use of computers in the process of teaching and learning of school subjects. Teachers were sent for computer literacy courses and were exposed to Computer Integrated Leaning (CIL) and Computer Assisted Learning (CAL) (Vasantha, 2000). The use of ICT in the process of learning and teaching was further enhanced by introducing the teaching of science and mathematics in English in 2001. Almost all science and mathematics teachers were given a note book computer and an LCD projector to be used in their classroom.

Modules of using ICT in the process of teaching and learning were written by the ICT unit in the Division of Educational Research and Planning Unit in the Ministry of Education, a special unit that has been set up to help teachers improved their skills in using ICT (The Ministry of Education, 2001). These modules help teachers to understand the basic concept of CIL and CAL, plan their teaching by using ICT effectively, guided them to plan classroom activities by using ICT, and show examples and models of teaching specific subjects or topics by using ICT. The modules emphasized on the use of ICT as the tool of learning, as a medium of communication in the process of teaching, and as an exploratory tools to seek information.

After all the efforts that have been taken to use ICT in teaching by the ministry, studies have shown that not many teachers are using it in their classroom. Vasantha (2001) in her study on the use of Internet among public and private secondary schools in Malaysia shows that teachers were still reluctant to use computer in their classroom for various reasons. Most common reasons were the limited numbers computers in schools and unstable or frequent interruption of Internet connection during lessons. Asykin Asan (2002) study stated that teacher's lack of knowledge to use computer for instructional purposes was the most important problem encountered in implementing the use of ICT in the process of teaching and learning. According to Cagiltay (2001) teachers were not sufficiently trained to use computers in their classroom but they agreed that technology will significantly influence education and that ultimate goal of computer literacy training should have computer literate teacher who are willing to utilize ICT successfully in the classroom. The recent study aimed to seek more information on why teachers, specifically literacy teachers were not using ICT in their classroom.

Research questions

This study aimed to answer four research questions:

1. What are the perceptions of literacy teachers in using ICT?
2. Are literacy teachers skillful in using ICT?
3. What are the problems faced by literacy teachers in using ICT?
4. What are the perceptions of literacy teachers about the effectiveness of using ICT?

Methodology

The study tries to answer the question of why literacy teachers were reluctant to use ICT in their classroom instruction. Survey method was used to answer this question.

The participants consisted of 320 literacy teachers from five states representing five major zones in Malaysia. All of the participants are secondary school teachers, teaching in Malaysian public schools. The largest numbers of participants were from Selangor, 27.3% followed by participants from Wilayah Persekutuan 23.8%, Pahang 17.5%, Johor 12.8%, Perak 12.5%, and the smallest number were from Terengganu 6.3%.

The distribution of participants according teaching experience ranged from 1 to 5 years (25.3%), 6 to 10 years (22.2%), 11 to 15 years (29.4%, 16-20 years (15.9%, 21-25 years 3.1% and 26-30 years (4.1%). Most of the samples have been teaching Malay literacy between 6 to 20 years (83.7%). Two hundred fifty-six of them have bachelor degree, eighteen have masters, and one has a Ph.D. The rest hold either a diploma or school certificates examination.

Instruments of the study consisted of two parts questionnaires. The first part consisted of 12 demographic questions (states, districts, school category, sex, age, ethnic, teaching experience, teaching experience in literacy, academic qualification, professional qualification, subject options, and level of teaching literacy in schools. The second part consisted of four categories of questions, the level of using ICT in teaching of literacy, teacher's skills in using ICT, ICT facilities in schools, and using ICT in the process of teaching and learning of literacy. Five Likert scales protocols from 1 to 5 were used to answer the questionnaires. Score 1 reflects if the participant feel strongly disagree with the statement, 2 disagree, 3 somehow disagree, 4 agree and 5 strongly agree.

The selections of states that represent every part of Malaysia were discussed by the researcher and his collaborators. Permission was obtained from the Section of Educational Policy, Research and Development, Ministry of Education and State Education Department to carry out the study in schools. Permission from the school principle was also obtained to distribute questionnaire in selected schools. The questionnaires were distributed among literacy teacher and collected a week later to be processed. All answered questionnaires were analyzed by using SPSS program to answer the research questions.

Findings

Research question 1 asked the perceptions of literacy teachers in using ICT in their classrooms. The following table shows the distribution of scores for each questionnaire in relation to literacy teacher's perception of using ICT in classroom:

Table 1:
The perception of literacy teachers in using ICT:

	Strongly Disagree	Disagree	Somehow Disagree	Agree	Strongly Agree
Frequently used ICT	9.7%	20%	37.8%	28.8%	3.8%
Used more conventional method	7.2%	16.6%	34.7%	37.2%	4.4%
ICT helps to enhance T& L	0.6%	3.4%	17.2%	54.1%	24.7%
ICT helps to enhance self-learning	1.3%	7.5%	32.2%	48.1%	10.6%
ICT helps to make teachers to be more creative in their teaching	1.6%	2.8%	20.3%	55.6%	19.7%
ICT frequently being misused	10%	17.2%	36.6%	30%	5.3%
Limited language-based skills	1.9%	15%	36.6%	39.1%	7.5%
ICT as facilitators in T&L	1.3%	5.0%	18.1%	54.1%	21.6%
ICT helps to enhance students thinking and creative skills	1.6%	2.8%	18.4%	59.1%	18.1%

Table 1 shows that only 32.6% literacy teachers responded agree and strongly agree of using ICT in their classroom. More than 40% agree and strongly agree that they were still using conventional method. However their perceptions towards the use of ICT in literacy classroom were very positive. For example 78.8% of them agreed and strongly agreed that using ICT helps to enhance the process of teaching and learning, 59% agreed and strongly agreed that ICT helps to enhance self-learning among students, 75.3% agreed and strongly agreed that ICT helps teachers to be more creative in their teaching, and 77.2% agreed and strongly agreed that ICT helps to enhance student's thinking skills. They also agreed and strongly agreed that ICT facilitate teaching and learning and somewhat disagree that ICT being misused in the process of teaching and learning. They also somewhat disagreed that the use of ICT limits language-based activities.

Table 2: Are literacy teachers skillful in using ICT?

	Strongly Disagree	Disagree	Somehow Disagree	Agree	Strongly Agree
Not skillful in using ICT	6.9%	22.2%	45.0%	23.1%	2.8%
No confident in using ICT	5.9%	25.6%	45.3%	21.3%	1.9%
Not interested in using ICT	16.3%	26.6%	40.0%	15.9%	1.3%
More convenient to use conventional method of teaching	7.2%	16.6%	34.7%	37.2%	4.4%
Were trained to use ICT	6.9%	17.2%	27.2%	40.3%	8.4%
Prepared to use ICT	2.8%	10.9%	31.9%	45.3%	9.1%

Table 2 shows how skillful are literacy teachers in using ICT. The data show that most of the teachers participated in the study somehow disagreed that they are not skillful in using ICT and have no confidence in using ICT. Less than 30% agreed and strongly agreed that they are not skillful and have no confidence in using ICT. Most of them are interested in using ICT but somehow more than 40% said that they are more convenient in using conventional method of teaching. More than 50% of literacy teachers responded that they were trained and were prepared to use ICT.

Table 3: What are the problems faced by literacy teachers in using ICT?

	Strongly Disagree	Disagree	Somehow Disagree	Agree	Strongly Agree
Given priority to use ICT	11.6%	15.9%	31.3%	32.2%	9.1%
Not enough ICT facilities	6.3%	20.6%	31.3%	31.1%	8.8%
Not enough time to use ICT	5.0%	24.4%	34.7%	30.0%	5.9%
Frequently failure of ICT equipments	3.4%	18.8%	43.4%	29.1%	5.3%
Stringent regulation of using ICT	2.5%	17.5%	46.3%	26.6%	7.2%
Cost effective	1.3%	12.5%	41.6%	37.2%	7.5%
Good maintenance of ICT facilities	2.8%	15.0%	35.9%	41.6%	4.7%
School provides ICT technician	10.0%	15.3%	29.1%	35.0%	10.6%
Schedule of using ICT is suitable	5.9%	15.9%	39.7%	32.8%	5.6%
ICT were use after school hours	13.4%	20.3%	40.3%	23.4%	2.5%

Table 3 shows the problem faced by literacy teachers in using ICT in their classroom. More than 40% said that they were not given priority to use ICT in their school, not enough ICT facilities in school, maintenance of ICT still not efficient, and their school still lack of ICT technician. More than 60% believed that ICT is not cost effective in Malaysia. Most disagreed and somehow disagreed that ICT equipment frequently failed and stringent rule in using ICT stop them from using ICT. Lastly most participants responded that the schedules of using ICT in their school are not suitable and they are somehow disagreed that they have to use ICT after school hours.

Table 4: What are the perceptions of literacy teachers about the effectiveness of using ICT?

	Strongly Disagree	Disagree	Somehow Disagree	Agree	Strongly Agree
ICT software were suitable with Literacy curriculum	5.3%	11.6%	36.6%	41.3%	5.3%
Objectives of lesson were achievable	1.9%	11.9%	31.9%	49.9%	5.3%
T&L were effective and systematic	0.3%	9.4%	24.7%	54.1%	11.6%
T&L were more interesting to student	0.6%	2.5%	15.0%	57.2%	24.7%
Facilitate exploration of knowledge	0.0%	3.1%	13.8%	57.2%	24.7%
Enhanced group work	1.6%	5.6%	24.7%	52.2%	15.9%
Suitable for enrichment activities	0.3%	3.8%	15.6%	55.0%	25.3%
Limit verbal communication	1.6%	9.7%	31.9%	45.6%	10.9%
Abundance numbers of software in literacy subject	6.3%	16.9%	39.7%	30.6%	6.6%
Abundance numbers of web site in literacy subject	5.6%	15.9%	41.3%	31.9%	5.3%

Table 4 shows responses of literacy teachers when they were asked about the effectiveness of using ICT. Less than 50% responded that ICT software available in the market are suitable with literacy curriculum in their school. More than 50% said that at the end of the lesson most of the objectives were achievable by using ICT. They also responded positively when asked about effectiveness of ICT, the process of teaching and learning become more interesting, ICT helps to enhance group work, and suitable for enrichment activities. More than 70% agree and strongly agree with each statement. More than 55% teachers agree and strongly agree that ICT limit verbal communication. In terms of availability of software and web site in literacy subject more teachers responded disagree and somehow disagree. More 60% said that numbers of software and web site for this subject are still small.

Discussion and Conclusion

The study focused on the use of ICT among literacy teachers in Malaysian secondary school. It was found that teachers were not using ICT frequently and more convenient using conventional method in their literacy classroom. The finding supports the finding of Supyan Baba (2000) which stated that the use of ICT is still low among teachers in Malaysian school. However the study found most teachers believed that using ICT helps to enhance teaching and learning makes them more creative in their teaching. ICT also helps to facilitate learning and enhance student's creative and critical thinking skills. The finding shows that they are not reluctant to use the tools but several other factors stopped them from using the tools in teaching. Two of the reasons that they responded in relation with the issues were ICT software has limited language based contents and ICT are often being misused in the process of teaching and learning in classroom.

The study also found that literacy teachers are somehow skillful in using ICT. The data show that most of the teachers participated in the study responded that they are confident in using ICT in the process of teaching. However the finding was contrary to the findings of Askin Asan (2002) and Vasantha (1999) studies which reveal that teachers were incompetence of using ICT in their teaching. According to their study, due to teacher's lack of competence in using ICT they were more comfortable using text books or reference books. However this study in some way support the findings of Askin and Vasantha because it was found that more than fifty percent respondent that they were not given proper training in using ICT in the teaching of literacy. May be because of this reason this study found that they are more convenient in using conventional method of teaching.

The findings of the study shows that literacy teachers were still not given priority to use ICT in their school if compare to science and mathematics colleague. ICT facilities in school were still limited especially Internet connections which faced frequent interruption during school hours. The maintenance of ICT was still not efficient and their school still lack of ICT technician. Further more most of the respondents believed that ICT is not cost effective in Malaysia. However, most participants said that stringent the rules in using ICT in their schools were not the reason why they were not using ICT. Most of the participants responded that the schedules of using ICT in their school were suitable and they can use ICT within normal school hours.

Finally the study tries to gather the responses of teachers in relation to the effectiveness of using ICT in literacy classroom. Many teachers responded that ICT software available in the market are not suitable with literacy curriculum in their school. However they said that at the end of the lesson most of the objectives in activities in classroom using ICT were achievable. The study also found that most teachers responded positively when asked about effectiveness of ICT. According to the study the process of teaching and learning can be more interesting by using ICT. At the same time ICT helps to enhance group work among student. Most teachers use ICT for enrichment activities. However a weakness of using ICT that we have found in the study was it limits verbal communication among literacy learners, a component that is very important in language teaching. The others were the availability of software and web site in literacy subject numbers of software and web site for this subject are still limited.

The study has answers the question to what extent literacy teachers are reluctant to use ICT in their classroom. Their perceptions toward using ICT in their classroom were very positive. However several hindrances made them reluctant to use the tool in the process of teaching and learning.

Principal Leadership Which Empowers Teachers For EISTA 2007

H. L. Wendy Pan
Department of Education, National Taiwan Normal University
Taipei 106, Taiwan

ABSTRACT

In this global trend of decentralization, a number of reform policies have been implemented in Taiwan. Especially the policy of Grade1 Grade 9 New Curriculum, it greatly emphasizes teacher professional autonomy. Thus, how principals use strategies to empower teachers becomes a significant issue. In this paper, quantitative and qualitative data were collected to empirically investigate the issue. In the quantitative study, a survey was used to examine principal empowering strategies and teacher empowerment. And in the qualitative study, interviews were employed to analyze the empowering strategies contrast the higher and lower empowered schools. The findings suggested positive results such as principals' use of empowering strategies do relate to teacher empowerment. This study offers practical implication for showing how principals empower teachers in the school field.

Keywords: school leadership, teacher empowerment

1.BACKGROUND

Under the influence of globalization and localization, Taiwan's education, driven by the ideology of educational deregulation, has made great changes. Market orientation, accountability, democratic participation accompanied with professionalism and educators' autonomy all led to the delegation of some power from the central level to the local government and schools. In the *Education Basic Law*, educational affairs that need to be undertaken are clearly stipulated. And the new system of principal recruitment, the establishment of a Teachers' Review Committee and Teachers' Association in schools, and parents' participation in the school meeting have indeed altered the power balance in schools. Such innovation broadens the dimensions of teacher decision-making. It also permits the school consumers—the parents—to have a say in school affairs. Under this context, the challenges school leaders have to face and the responsibilities school leaders have to take are quite different from the past. Reconceptualizing the concept of power and sharing decision making with school participants are the new lessons for principals to learn.

2.METHODS

The study includes two parts, one quantitative and one qualitative. In the quantitative study, a survey was conducted. A national sample of approximately 1300 elementary and secondary school participants was recruited to examine how they perceive empowerment and how they perceive the use of empowering strategies in principals. After the survey, eight schools were selected as higher and lower empowered schools according to their scores in the scale of teacher empowerment. And four to five faculties, including the principal, director of the office, teachers and the president of the School Teacher Association if the school had the association, were interviewed.

3.FINDINGS

The quantitative study reveals that teachers scored 4.53 in a 6-point scale of teacher empowerment. Elementary and secondary teachers got similar scores, 4.54 and 4.52 respectively. Among the five dimensions of the scale, the one of self-efficacy was ranked the highest (4.77), followed by professional growth (4.74), autonomy (4.60), professional status (4.51) and the one of professional impact got the lowest score (4.04). The finding may be analyzed using the concept of teacher empowerment proposed by Wilson and Coolican (1996). Two categories of teacher empowerment—extrinsic and intrinsic power are suggested. The exercise of extrinsic power is an approach to improve teacher's professional status. Teachers may gain the information and knowledge needed to perform their job and to participate in decision-making. Site-based management is an example of the realization of teachers' extrinsic power. Intrinsic power refers to teachers' personal attitudes rather than the ability to control others. A teacher with intrinsic power is confident when demonstrating their skills. The realization of such power can be judged by teachers' self-determination, ability to make decisions, and sense of efficiency. They believe that the best source of authority comes from within. The results shown in the study of Pan (2007) thus indicate that there is room for schools moving toward an empowering community where teachers may have chances for shared governance and professional growth.

In order to explore how school leadership relates to teacher empowerment, empowering strategies employed by the principals were investigated. Two clusters of higher and lower empowered schools were analyzed. It was found that there are significant differences between the empowering strategies employed by the principals in higher and lower schools. Among the strategies, the largest differences between the two groups of school are: 1. if the principal may adopt opinions from different School Sections to make decision; 2. if the principal may assign the right person for the right tasks and delegate his/her power; 3. if the principal may build school visions with staff; 4. if the principal may plan the short-, mid- and long-term school plan with staff; 5. if the principal may enhance the morale of staff and breakthrough the obstacle faced.

The quantitative findings are also supported by the qualitative data. Several strategies, such as shaping harmonious atmosphere, acting as model, steering schools with visions and goals, having teachers voices heard and promoting teachers for professional growth, were found to contrast the higher and lower empowered schools.

Shaping harmonious school atmosphere

In principal interviews, shaping harmonious atmosphere was frequently mentioned as the priority task for school leaders. It can be easily comprehended when taking the cultural context into account. In oriental societies, the needs to foster spirit of community and pleasant environment without radical conflicts are reflected in the staff. As Hallinger and Kantamara (2000) and Walker and Dimmock (2002) observed in Asia, ensuring harmony among staff is a focus for the principals.

Besides, in a group-oriented society, losing face is considered as a serious issue. People care about their "face" so that respecting others to avoid letting people lose face is an important principle in interpersonal relationships. In the lower empowered schools, the negative perception from teachers can be partly attributed to the reactions that they were not respected by the principal. Furthermore, caring may be viewed as the extension of respect. In the higher empowered schools, principals used various ways to express their caring for their subordinates. Considerate personality was clearly manifested in the principals' behaviors such as noticing other's needs and giving assistance. Even writing birthday cards was considered as a sign of caring, which usually touched the staff's hearts.

> *She (the principal) is very considerate. She always notices how teachers are doing. If a teacher is not so good, she will approach him/her. She's empathetic.*
> *He writes birthday card to the staff. In the past, if he had time, he wrote in calligraphy. His calligraphy is pretty. Although he might not be able to give the card in person to every teacher since we have more than 100 classes. This is a big school. However, I did receive a card from him once.*

Acting as a model
In Chinese "Analect", it is said that excellence in the emperor may be compared to the wind; that in the people, to the grass. When the grass is put upon by the wind, it must bend (The Analect, 13: 19; quoted in Ware, 1977, p. 120). Since the leader exerts great influence on the followers, the virtue of the leader is highly regarded. Just as what Sergiovanni (1992) argued that a higher level of leadership is to be found in the professional and moral domains. Hence, moral leadership implies a moral standing on the part of the leader. This contention actually has its strong grounding in Chinese intellectual traditions (Wong, 1998).

Carrying the moral implication of leadership, principals in higher empowered schools usually demanded themselves to set good examples with their own conducts. They arrived at schools early in the morning, greeting students at the school gate. They rolled up their sleeves working with staff to implement school policies. Having principals as models did encourage teachers more willing to face the challenges. A teacher described the principal as follows:

> *He himself is a model. He did the thing first. Of course, he has the capacity for doing it. He needs to have the capacity to enforce the policy.*

Steering schools with visions and goals
Setting clear vision and goals is a key element maintained in the studies of transformational leadership (Leithwood, Janzi, & Steinbach, 1999). In Taiwan, after the Grade 1 to Grade 9 New Curriculum was implemented in 2002, schools are required to have their school visions. Either the "bottom-up" or the "top-down and bottom-up integrated" approach was used to develop school visions, which furthermore were communicated via meetings, internet and booklets. In order to make one's vision clear to all the stakeholders, a principal in the study indicated: *"I would like to inform parents in my school district that our school has a new principal coming, so I wrote articles, a kind of "soft article," to let people know what I think."* Creative idea for publicizing school visions were also seen in the schools. A principal articulated that they made bookmarks with school visions stated, which were distributed to each school member.

However, having visions without specific goals does not promise the visions materialized. In the higher empowered schools, the goals were prescribed for guiding the directions that the teachers worked toward. For example, there was a school encountering a serious problem with student mortality. How to attract district students returning back was a great challenge for the principal. A specific increasing rate of student enrollment was set, and it was communicated as a shared goal for all school participants. Then, different approaches were used for achieving the goal, such as creating school features to attract students and communicating school measures to the parents. In contrast, one lower empowered school, with the same challenge of losing students, the principal only had vague visions. It incurred the school stagnancy. Besides, the conflicts between the teachers and the leader deteriorated the problem.

Having teachers voices heard
Taiwan's society is moving toward democratic participation. When decentralization is called for, how to recruit teachers' voices become a task for school principals. There are several ways to have teachers voices heard. Sometimes the principals walked around the campus to find out what the teachers needed. Meetings of school affairs and homeroom teachers were the occasions the staff might exchange opinions. In addition to the formal channels for communication, the principals in the higher empowered schools chatted privately with teachers. From the care they expressed, complaints and opinions for school innovations flew out of the teachers. The staff stated that the principal did listen to what they said. However, in the lower empowered schools, teachers complained that the time of meetings was not enough for discussions. Administrative briefing occupied most of the time. It signified that the meetings held were used as symbol for democratic participation instead of providing a forum for open discussions. One faculty expressed:

> *In the meetings, discussion time is not much. Most of the time is for the administrators' briefing. But, I feel that a lot of things need to be discussed. Meeting time is short……*

A step further for having teachers voice heard is to involve them in school decision making. Traditionally, teachers only regard classroom teaching as their business. Hence, how to prompt teachers to step out of their classroom and get involved in school affairs especially relating to curriculum decisions concerns today's leaders. Blasé and Blasé (1994) defined "teacher empowerment" as "decision participation, authority over issues concerning professional life both at the classroom level and at the school level, and opportunities to acquire knowledge necessary to warrant such authority" (p. 8). By empowering teachers, principals need to reconceptualize power. Sharing power becomes a new concept in this wave of education reforms. However, "power with" is a construct invented in the Western context. In a society of higher power distance, decision makers always go to the individuals in the positions of authority. Calling for democratic participation takes time both for the principal and teacher to adjust. It may illustrate that there are schools still have the principals dominate school governance. But still, there are schools having smoother transitions. A number of committees were set up for teachers participating in making decisions of school affairs. The principals mentioned:

> *I am not like the older generation, who thought the power is theirs. I tend to believe that the power belongs to the whole school community. The power is delegating to teachers.*
> *I am in the process of releasing power and creating room for public discourse. Public discourse is an important mechanism for teacher decision-making.*

Promoting teachers for professional growth
Reflections lead teachers to break habitual ways of recognizing and dealing with situations (MacKinnon & Erickson, 1992) and to discover their existing frame of thinking. Principals in the studies asked teachers to reflect on their routine teachings. Thought provoking questions, such as *"what kind of educational philosophy you used? What kind of instructional theory you used in your teaching? What kind of teaching activities you designed? And what kind of teaching methods you used?"* were raised by principals.

To build a professional community is another job observed in the principals. Louis and Kruse (1995) identified five dimensions of a professional community as reflective dialogue, deprivatization of practice, focus on student learning, collaboration, and shared values. The principals in the studies used the teams of learning areas of "Language," "Math," "Social Studies," "Science and Technology," "Health and Physical Education," and "Arts and Humanities" to create forums for professional dialogues. A period of fixed time was arranged school wide to meet and talk. And agenda for discussions was set up before meeting. In order to promote the quality of dialogues, reading materials were sent out to teachers periodically. And the products of curriculum development were posted on the internet for knowledge sharing.

Transformational leadership responds to teachers' esteem, achievement and self-actualizing needs (Sergiovanni, 1995). The principals interviewed set the performance stage for teachers. Under the school leadership, teachers' performance earned them recognition from parents, community and the professional circle. And sharing experiences of curriculum development with outside people creates the higher level of achievement motivation for teachers. It was proved as an effective way to inspire as well as to empower school participants.

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A Case Study of High School Student's Creativity Enhanced by STS Approach For EISTA 2007

Chien Yu
Department of Industrial Technology Education, National Taiwan Normal University
Taipei 106, Taiwan

ABSTRACT

This is a case study of one group pre-post test design. The purposes of the study were: (1) to develop an instructional module of technology history which was based on the National Digital Archives to meet the goals mandated by 2006 National Curriculum Standard on Living Technology; (2) to promote high school students' creativity with the developed instructional module; and (3) to promote Living Technology teachers' will to use the resources of the National Digital Archives. A school selected in the study was located in Kaoshuing City with 95 classes (including junior high students). Four classes of 10th grade students were recruited. Students were classified in different groups with personal will. Every group is consisted of 5 members. During the study, the students were asked to use resources of the National Digital Archives as assistance to construct their design of a ceramic container used for getting water from a water barrel. The duration of the study was 8 weeks and the pre-post tests were implemented before and after the study. The creativity test employed in the study was a Chinese version of Williams Creativity Assessment Packer （CAP）. Two parts of the test, the Test of Divergent Thinking, and the Test of Divergent Feeling were used. It was found that in the Test of Divergent Thinking, the difference between pre- and post test on subtests of fluency, openness, originality, elaboration, and theme is significant. The score of posttest is higher than that of pretest except for the subtest of elaboration. The total score of pre- and posttest on the Test of Divergent Thinking is significant, and the latter is higher than the former. And there is no significant difference between scores of pre- and posttest on subtest of flexibility. Besides, in the Test of Divergent Feeling, there is significant difference between scores of pre- and posttest on subtests of taking risking, imagination, curiosity, except for subtest of challenge. The score of posttest is higher than that of pretest. The total score of posttest in the Test of Divergent Feeling is higher than that of pretest. In the promotion of using the resources provided by the National Digital Archives, a workshop was held with positive reaction from participants of junior and senior high school teachers of living technology. A website was developed with instructional resources of one complete instructional module of senior high school living technology, 4 instructional module of junior high school living technology, and 3 preliminary ideas of instructional materials of high school living technology.

Keywords: technology history, instructional module, creativity, living technology

1.BACKGROUND

How to enhance the student's creativity has been widely accepted by instructors in different fields and was stated in goals and objectives of Taiwan's national curriculum standards. There is no exception for Living Technology to promote student's creativity as a required subject of junior and senior high school. The instructional strategies used in Technology Education of Living Technology are: interpretation of industry, integration of inter-technology subsystem, interdisciplinary approach (such as MST or Science, Technology, and Society, STS) etc. (Kemp & Schwaller, 1988). The reasons of why STS Approach was chosen in this study were: 1. to enhance student's understanding of the close relationship among science, technology and society; 2. to promote student's awareness of the issues of STS; 3. to advance student's understanding of the application of technology, and 4. to enhance student's creativity (Yu, San Kung, Wang, & Yeh, 2001). The sources used in developing the instructional materials of STS Approach were the National Digital Archives Database (NDAD).

2.PURPOSES

1. To develop a STS module of Living Technology for high school students with the resources of the National Digital Archives Database.
2. To examine the effect of STS module on high school student's creativity.
3. To promote the application of the National Digital Archives Database in the development of instructional materials in Living Technology field.

3.RESEARCH METHODS

There are three parts to describe the development of instructional module of STS with NDAD, a quasi-experiment design, and the promotion of application with NADA in Living Technology field.

The development of instructional module of STS with NDAD

An eight-hour instructional unit with the title of 'between sinking and floating: a design and making of water container' was developed by an experienced high school teacher for the newly implemented curriculum standard for high school since 2007 semester year. The idea of this instructional module came from a famous ceramic vase named as '2-ear with sharp bottom pot' which was made 3000 years ago. The pot was found in 'half slope hill culture site' in Sang Shi Province and was used for acquiring water from river. With dynamic balance of the pot, our ancestors can pick up the upper clean water from the river. The main ideas of the module were: 1. introduction of creative thinking with 'brain storming'; 2. the awareness of NDAD and the making of ceramics; 3. the introduction of a theme with 'the evolution of ceramics' from NDAD; 4. guiding student's thinking and discussion with the relationship between the making of ceramics and human living, and the interaction between technology and society; 5. dividing class into 8-9 groups each with 4-5 students; facilitating student's discussion with science theory and the way to make pot; 6. the making of prototype pot; 7. testing and making necessary revision and finalizing the pot (with plain burning); and 8. making the final test and group's presentation.

A Quasi-Experiment Design
Four 10th grade-class were selected from a high school Kaoshuing City (located in southern part of Taiwan, with more than 1 million population). Boy and girl students were assigned in every class and they were freed to form the group. Both pre- and post- test design were administered with the Chinese version of Creativity Assessment Packet (CAP). Two parts of CAP were used in the study: Creative Thinking and Creative Inclination.

The Promotion of Application with NADA in Living Technology Field
As the project was sponsored by NDAD of Taiwan's National Science Council, one of the purposes was to promote the utilization of NDAD. The project team has developed several activities to enhance living technology teacher's awareness and using the rich resources provided by NDAD. The activities were: a seminar of NDAD with 30 participants, putting the records of consultant's speech in the website, and assisting 4 junior high school Living Technology teachers to develop 4 activities based on NDAD.

4.RESULTS

Creative Thinking
The t-test was used to analyze the difference between the scores of pre- and post- test with Creative Thinking. As shown in Table 1, except 'Flexibility'(without no significant difference between pre- and post test scores, and pre-test score was a little higher than that of post-test), there were significant differences found between pre- and post- test with: Fluency, Openness, Originality , Naming and Total Score ($p < .01$), and Elaboration ($p < .05$)(post test score was higher than that of pre-test).

Table 1. The comparison between pre- and post- test of Creative Thinking

Item	M	Sd	t	P
pre-Fluency	10.55	2.11	3.96**	0.00
post-Fluency	11.21	1.72		
pre-Openness	22.35	5.64	7.38 **	0.00
post- Openness	25.99	5.24		
pre-Flexibility	6.64	1.67	-.31	0.76
post-Flexibility	6.59	1.50		
pre-Originality	13.62	4.88	8.45**	0.00
post- Originality	16.92	4.29		
pre-Elaboration	10.68	5.18	-2.04*	0.04
post- Elaboration	9.82	4.85		
pre-Naming	12.85	4.03	9.92 **	0.00
post-Naming	17.11	5.03		
pre-Total	76.69	18.32	7.39**	0.00
pre-Total	87.64	16.13		

*p<.05, **p<.01

Creative Inclination
Refer to students' Creative Inclination, There exists difference between pre- and post test scores in Risk Taking, Curiosity, Imagination, and Total Scores and post-test scores are higher than those of pre-test. There was no difference between pre- and post test scores in Challenge.

Table 2. The comparison between pre- and post- test of Creative Inclination

Item	M	Sd	t	P
pre-Risk Taking	27. 17	2.89	2.53**	0.01
post- Risk Taking	27. 82	3.68		
pre-Curiosity	30.86	3.77	2.38 *	0.02
post-Curiosity	31.60	4.64		
pre-Imagination	28.26	4.60	5.30**	0.00
post- Imagination	29.89	3.94		
pre-Challenge	29.41	3.28	-.05	0.96
post- Challenge	29.40	3.88		
pre-Total	115.71	10.67	3.43 **	0.00
pre-Total	118.71	14.26		

*p<.05, **p<.01

5.CONCLUSIONS

There were 4 conclusions of this study:

1. There were very rich resources in the National Digital Archives Database can be used for development o instructional materials for Living Technology. Five instructional module or units were developed by senior and junior high school teachers.
2. The STS module used in the study for high school students has positive impact on students' Creative Thinking in Fluency, Openness, Originality , Naming, Elaboration and Total Scores.
3. The STS module used in the study for high school students has positive impact on students' Creative Inclination in Risk Taking, Curiosity, Imagination, and Total Scores.
4. Secondary high school teachers had expressed quite high interest in design and development of instructional activities.

6.RECOMMOMDATIONS

1. It is better to offer budget to develop instructional materials in the fields of Manufacturing Technology, Communication Technology, Construction Technology, and Transportation Technology, and/or to develop cross technology subsystems activities.
2. The Mathematics-Society-Technology and other instructional strategies may be employed in the development of activities for Living Technology in both of Junior and Senior High School Levels.
3. The experiment size should be expanded to ensure the effectiveness of the research.

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A Novel Intelligent and Fast Question Answering System for World Wide Web

Saadettin Bolat, Ali Rıza Aşkun, Dilara Demirbulak, Reza Hassanpour

Çankaya University, Ankara - TURKEY

ABSTRACT

The World Wide Web has expanded to include on-line access to an almost unlimited number of documents. However, this enormous source of information brings with it the problem of searching the documents efficiently and easily. We have developed a Web-based Question Answering System, which primarily focuses on open domain fact-based short answer questions and also some definition questions. The most important characteristics of the system are its capability in understanding questions given in a natural language style and the effective search which avoids transferring a large amount of unnecessary data. Experimental results show the superiority of the proposed method to available similar systems in terms of accuracy.

Keywords: Question-Answer systems, Natural Language Processing, WWW searching

1. INTRODUCTION

Since the late 19th century metamorphosis has been observed in the information systems which have engendered a myriad of applications. World Wide Web (www) and question answering systems are two of these applications. Question answering (QA) systems can be described as a particular type of search engine that allows a user to ask a question using natural language instead of an artificial query language. Recently, researchers have been attracted to the task of developing open-domain QA systems based on collections of real world documents [1, 2, 3, 4, 5, 6, 7, 8], especially the World Wide Web. The general idea behind the Web based QA is to be able to answer questions written in natural language, by finding the answer in a collection of documents (which may be Web pages or plain text). Unlike traditional Web search engines, however the goal is to find a specific answer, rather than a collection of hundreds of possibly irrelevant links. Examples are "Name 10 capital cities". Definition questions, such as "What is aspirin?" which require answers covering essential (e.g. "aspirin is a drug") as well as non-essential (e.g. "aspirin is a blood-thinner") descriptions. Primarily, the question answering systems follow two directions: one of the directions is using TREC QA track data as the test corpus and developing search engines for information retrieval and developing answer extraction techniques to find answers in that corpus; the other direction is using the Web as a resource of question answering and using the commercial search engines for information retrieval related to the questions and do further processing to find the answers. Question answering systems participating in TREC QA track have to find answers by examining the short passages from a limited size text corpus to a list of questions. Webclopedia [9] is a question answering system evaluated at the TREC-9 question answering track. It was based on information retrieval and natural language processing techniques. A given question is first parsed by a machine-learning based grammar parser to create a query to retrieve the top ranked documents. Documents are retrieved by using an information retrieval engine. To decrease the amount of text to be processed, the top ranked documents are then split into segments and further ranked. Potential answers are then extracted and sorted according to a ranking function involving the match with the question type and manually constructed patterns. A question answering system [10] evaluated at the TREC-8 question answering track described a method based on information retrieval and named-entity extraction technology. The passages are retrieved by using a ranking algorithm based on IDF (inverse document frequency, a measure of the spread of a word among documents in a corpus) weights of words, plus pairs of words that the sentence and query have in common. To determine the answer category, a parser is used by the system. After ranking passages and determining the answer category, potential answers are extracted and ranked using various quality heuristics. QUANTUM [11], which stands for Question Answering Technology of the University of Montreal, carries out a 4 step process so as to provide an answer which are; question analysis, passage retrieval and tagging, candidate extraction and scoring. The system uses a tokenizer, a part-of-speech tagger and a noun phrase chunker (NP chunker) for question analysis. While each question is analyzed based on the question word, the focus and the discriminant, the answers are looked into in terms of the candidate and the variant of the question discriminant. The focus of the question is the word or noun phrase that influences QUANTUM's mechanisms for the extraction of candidate answers. TextRoller is the best question answering system participated in TREC-10 question answering track [12]. A pattern-based approach was used for answer identification. In this approach, NLP techniques are no longer used. Instead, various indicative patterns, which are totally heuristically and inductively defined, for different types of questions are used in pattern matching from passages, and answer selection and ranking of those answers. Contrary to question answering systems participating TREC QA track, Web based systems try to find answers to questions by examining a huge collection of Web documents rather than a limited size corpus. AskMSR [1, 2, 8] is a question answering system, which takes the advantage of the tremendous data resource that Web, provides as the infrastructure of the system. The system is mainly formed by four components as follows. A tiling algorithm, used to retrieve similar answers and provide longer answers, is applied. "Alan B. Shepard", "Shepard" and "Alan Shepard" are tiled into "Alan B. Shepard" as the final answer to be presented to the user. [3] is a Web based question answering system that takes the advantage of the snippets in the search results returned by a search engine like Google. Initially the user poses a natural language question. Then, question is forwarded to the search engine by the system where the top 100 search results are collected. Rather than downloading all the documents; the snippets in the search results are analyzed. Next, the questions are classified via Support Vector Machine (SVM) [13] by the system. AnswerBus [4] is an open-domain question answering system based on sentence level Web information retrieval. It serves in English, German, French, Spanish, Italian and Portuguese and uses 5 search engines directories to retrieve

Web pages that potentially contain answer. The main feature of our Web based QA system is that it primarily focuses on open domain fact-based short answer questions and also some definition questions (e.g. “What is aspirin?”). The system takes the advantage of Web which is an ideal source of answers to a large variety of questions; however, it avoids the slow search problem by designing the system based only on snippets which bring about time efficiency. Secondly, the serach engine specific queries created via sentence substrings were based on prescriptive grammar rules. Thus, better search results were retrieved as a result of using Web which has the data reduncancy feature. Next, the use of NER results in a good filtering approach to candidate sentences when the type of the answer is determined.

2. QUESTION ANALYZER AND ANSWER TYPE IDENTIFIER

The first step in question answering systems is analyzing the question and understanding what is being asked. The Question Analyzer and Answer Type Identifier component is responsible for determining the syntactic structure of the question and identifying the semantic type of the expected answer. Although the question word is often a good indication of the semantic type of the expected answer, this is not true for what and which questions. We examined more than 300 questions containing wh-words with respect to the mapping between wh-words and expected answer types. This component can recognize 5 types of wh-questions. These are “who”, “where”, “when”, “what” and “which” questions. “What” and “which” questions can cover almost all different types including person, date, organization, definition, location, number, percent, money, nominal, etc. “Who” questions can cover person, description, jobtitle and organization types. “Where” questions can cover location, organization, address and nominal types. “When” questions can cover date types. The approach used in the implementation of this component is similar to the systems [1, 2, 4, 5, 8, 10, 11]. A tokenizer, a POS tagger and a set of hand-made analysis templates are used to analyze the questions. From “what” questions, our system doesn’t find the exact answer type except date. Instead of finding the exact answer type by investigating the head noun’s type, we use head noun as additional information in the search engine specific query (see section 3.2.3). Hand-made analysis templates which are created with the help of applied linguists are the crucial parts of this component. POS tagger is only used in order to locate the verbs, to check the verb tenses and to create correct tenses of verbs. The Question Analyzer and Answer Type Identifier component relies on both word-based linguistic information and sentence-level syntactic analysis to analyze the question. Word-based analysis of the question tokens is done to help determining the type of expected answer (if possible) and the type of template which will be used to appropriately fragment the question sentence. Template matching and sentence-level syntactic analysis are used to help creating the syntactic structure of the candidate answer of the question, and assigning an expected answer type (if possible) to the question. As it can be clearly seen, word-based analysis and sentence-level syntactic analysis are two complementary parts in this component. The description of how this component works on different wh-questions in detail is as follows: For all questions, this component first tokenizes the question and identifies the words in the question. After identifying the first word (question word) the appropriate object related with the question word is created for further analysis of the question. Assume user asks a “who” question. After the object is created, according to the 3 hand-made templates listed in Table 1, possible expected answer types are determined. Also the information (beVerb, Phrase_One, Verb) is extracted from the sentence, and is passed to the Possible Answer Creator component for the creation possible answer structures.

Table 1 Hand-made templates for question analysis of “who” questions

Template	Expected Answer Types
Who <beVerb> <Phrase_One> ?	Description / Jobtitle
Who <beVerb> the <Phrase_One> ?	Person / Organization
Who <Verb> <Phrase_One> ?	

Table 2 Hand-made templates for question analysis of “where” questions

Template	Expected Answer Types
Where <beVerb> <Phrase_One> ?	Location / Organization / Address
Where <beVerb> <Phrase_One> <Verb3> <Phrase_Two> ?	
Where <doVerb> <Phrase_One> <Verb1> <Phrase_Two> ?	

Table 3 Hand-made templates for question analysis of “when” questions

Template	Expected Answer Types
When <beVerb> <Phrase_One> ?	Date
When <doVerb> <Phrase_One> <Verb1> <Phrase_Two> ?	
When <beVerb> <Phrase_One> <Verb3> <Phrase_Two> ?	

Table 4 Hand-made templates for question analysis of “what” questions

Template	Expected Answer Types
What <beVerb> <Phrase_One> called?	Definition
What does <Phrase_One> stand for / mean?	
What <beVerb> <Phrase_One*> ? (Phrase_One* = Phrases including words size, width, population, height, length, number, area, volume, weight, rate, speed, velocity, period, temperature, frequency, pressure, force, power, energy, size, diameter, radius, mass)	Number
What <beVerb> <Phrase_One> ?	Person / Organization / Definition / Location / Number / Percent / Money / Nominal / Jobtitle
What type of <Phrase_One> <beVerb> <Verb3>	
What <doVerb> <Phrase_One> <Verb1> <Phrase_Two> ?	
What <Phrase_One> <Verb1/Verb3> <Phrase_Two> ?	
What <Phrase_One> <beVerb> <Phrase_Two> ?	
What <Phrase_One> <doVerb> <Phrase_Two> <Verb1> <Phrase_Three> ?	
What <date/day/year> <beVerb> <Phrase> ?	Date
What <date/day/year> <doVerb> <Phrase_One> <Verb1> <Phrase_Two> ?	
What <date/day/year> <beVerb> <Phrase_One> <Verb3> <Phrase_Two> ?	

Table 5 Hand-made templates for question analysis of “which” questions

Template	Expected Answer Types
Which <Phrase_One> <beVerb> <Phrase_Two> ?	Person / Organization /

Which <Phrase_One> <doVerb> <Phrase_Two> <Verb1> <Phrase_Three> ?	Location / Nominal
Which <date/day/year> <beVerb> <Phrase> ?	Date
Which <date/day/year> <doVerb> <Phrase_One> <Verb1> <Phrase_Two> ?	
Which <date/day/year> <beVerb> <Phrase_One> <Verb3> <Phrase_Two> ?	

3. POSSIBLE SENTENCE SUBSTRING AND QUERY CREATOR

After analyzing the questions and determining the expected answer types, the next step is creating the sentence substrings likely to appear in the sentence that contains the answer of the question and creating the search engine (Google) specific queries by using these possible answer substrings so that the search engine can find the best snippets. The question answering systems [1, 2, 4, 5, 6, 7, 8] are similar to our approach in possible sentence substring and query formulation aspects. Although LAMP is similar to our approach in several respects, LAMP submits the original question itself to the search engine. Our system creates exact possible sentence substrings and queries rather than inexact queries. Another important function of this component is to determine the place of answer likely to appear in the sentence with respect to the sentence substring created. Possible Answer and Query Creator component is responsible for doing these operations and it uses the information acquired by the Question Analyzer and Answer Type Identifier. The description of how this component works on different wh-questions in detail is as follows: After the process of Question Analyzer and Answer Type Identifier component is completed, sentence substrings are created according to the supplied information about the structure of the question acquired by the Question Analyzer and Answer Type Identifier and hand-made templates. For "who" questions, hand-made templates, matching sentence substrings likely to appear in sentence that contains the answer and the places of answer expected to be found with respect to sentence substrings are listed in Table 6.

Table 6 Hand-made templates and sentence substrings of "who" questions

Template	Sentence Substrings, Answer Place
Who <beVerb> <Phrase_One> ?	• <Phrase_One> <beVerb>, right
Who <beVerb> the <Phrase_One> ?	• the <Phrase_One> <beVerb>, right • <beVerb> the <Phrase_One>, left
Who <Verb> <Phrase_One> ?	• <Verb> <Phrase_One>, left • <Phrase_One> <beVerb> <Verb3> by, right

Table 7 Hand-made templates and sentence substrings of "where" questions

Template	Sentence Substrings, Answer Place
Where <beVerb> <Phrase_One> ?	• <Phrase_One> <beVerb> in, right • <Phrase_One> <beVerb> located in, right • <Phrase_One> <beVerb> near, right
Where <beVerb> <Phrase_One> <Verb3> <Phrase_Two> ?	• <Phrase_One> <beVerb> <Verb3> <Phrase_Two> in, right
Where <doVerb> <Phrase_One> <Verb1> <Phrase_Two> ?	• <Phrase_One> <Verb1/Verb2> <Phrase_Two> in, right

Table 8 Hand-made templates and sentence substrings of "when" questions

Template	Sentence Substrings, Answer Place
When <beVerb> <Phrase_One> ?	• <Phrase_One> <beVerb> in, right • <Phrase_One> <beVerb> on, right
When <doVerb> <Phrase_One> <Verb1> <Phrase_Two> ?	• <Phrase_One> <Verb1/Verb2> <Phrase_Two> in, right • <Phrase_One> <Verb1/Verb2> <Phrase_Two> on, right
When <beVerb> <Phrase_One> <Verb3> <Phrase_Two> ?	• <Phrase_One> <beVerb> <Verb3> <Phrase_Two> in, right • <Phrase_One> <beVerb> <Verb3> <Phrase_Two> on, right

Table 9 Hand-made templates and sentence substrings of "what" questions

Template	Sentence Substrings, Answer Place
What <beVerb> <Phrase_One> called?	• <Phrase_One> <beVerb> called, right
What does <Phrase_One> stand for / mean?	• <Phrase_One> stands for/ means, right
What <beVerb> <Phrase_One> ?	• <Phrase_One> <beVerb>, right
What type of <Phrase_One> <beVerb> <Phrase_Two> ?	• <beVerb> <Phrase_Two>, right
What <doVerb> <Phrase_One> <Verb1> <Phrase_Two> ?	• <Phrase_One> <Verb1/Verb2> <Phrase_Two>, right
What <Phrase_One> <Verb1/Verb2> <Phrase_Two> ?	<Verb1/Verb2> <Phrase_Two>, left the <Phrase_One> <Verb1/Verb2> <Phrase_Two>, left/right
What <date/day/year> <beVerb> <Phrase_One> ?	• <Phrase_One> <beVerb> in, right • <Phrase_One> <beVerb> on, right
What <date/day/year> <beVerb> <Phrase_One> <Verb3> <Phrase_Two> ?	• <Phrase_One> <beVerb> <Verb3> <Phrase_Two> in, right • <Phrase_One> <beVerb> <Verb3> <Phrase_Two> on, right

Table 10 Hand-made templates and sentence substrings of "which" questions

Template	Sentence Substrings, Answer Place
Which <Phrase_One> <beVerb> <Phrase_Two> ?	• <beVerb> <Phrase_Two>, left • <Phrase_Two>, left • the <Phrase_One> <Phrase_Two>, left/right
Which <Phrase_One> <doVerb> <Phrase_Two> <Verb1> <Phrase_Three> ?	• "<Phrase_Two> <Verb1/Verb2>" "<Phrase_Three>", right* • the <Phrase_One> <Phrase_Two> <Verb1/Verb2> <Phrase_Three>, right/left • the <Phrase_One> <Phrase_Two> <Verb1/Verb2>, right/left
Which <date/day/year> <beVerb> <Phrase> ?	• <Phrase_One> <beVerb> in, right • <Phrase_One> <beVerb> on, right
Which <date/day/year> <doVerb> <Phrase_One> <Verb1> <Phrase_Two> ?	• <Phrase_One> <Verb1/Verb2> <Phrase_Two> in, right • <Phrase_One> <Verb1/Verb2> <Phrase_Two> on, right
Which <date/day/year> <beVerb> <Phrase_One> <Verb3> <Phrase_Two> ?	• <Phrase_One> <beVerb> <Verb3> <Phrase_Two> in, right • <Phrase_One> <beVerb> <Verb3> <Phrase_Two> on, right

4. WEB SEARCH RESULT RETRIEVER

Web Search Result Retriever component is responsible for retrieving the search results obtained by the search engine. The reason for processing search results rather than downloading and analyzing the original documents is time-efficiency. From this aspect, our system is similar to LAMP. The description of how this component works in detail is as follows: The generated queries are first submitted to Google one by one, and the necessary information returned as the search results of Google are extracted by using a parser which is specifically written for Google. This parser extracts the URLs, headers and short summaries (snippets) for further processing. Figure 3 shows the extracted parts of a query. The quality of documents in the Web is low, so the extracted answer from a single document can't be trusted as the correct answer. Due to this fact, quantity can be used as an effective substitute for quality, and multiple occurrences of the same answer in different documents may provide sufficient justification [6, 7, 14]. For each query, the system wants Google to get 20 search results (if possible) to overcome the lack of quality problem stated before. According to our observation on Google, if the query is formulated appropriately, the answer appears within 20 results.

SNIPPET # 0
HEADER: Colchester Bomb Bugger

SNIPPET: didn't ought to 'ave trusted" were the main brains behind the United Nations- the organization formed after the first atomic bomb was dropped in 1945 - under

URL: www.orwelltoday.com/colchesterbomb.shtml

Figure 3. Extracted parts (header, snippet, URL) of search result

After extracting the snippets, this component counts the number of occurrences of each word, except the stopwords, appears in the snippets. Stopwords are very commonly used words, such as the, a, an, of, for, to, etc. It has been shown that the correct answer to a question usually occurs more than the incorrect ones on the search results of that question [2]. In addition to the candidate answer redundancy, the number of distinct passages in which a candidate answer occurs, is an important factor in finding the correct answer to a question [14, 15]. The main idea of counting the number of occurrences of words is using the data redundancy in the Web, and overcoming the unreliability of quality of the data in the Web using their repetition.

Sentence Extractor and Scorer

Sentence Extractor and Scorer component is responsible for extracting the sentences from the snippets and scoring them. The sentences in the snippets are extracted after tagged by the ANNIE NER. Figure 4 shows untagged version of a sample snippet, tagged version of this sample snippet and the extracted sentences from this snippet.

Original Snippet:
The next day, many people visited the peace park. This is a park directly under where the first atomic bomb was dropped in 1945.

Tagged Snippet:

*<paragraph>****<Sentence>***The next day, many people visited the peace park.***</Sentence> <Sentence>***This is a park directly under where the first atomic bomb was dropped in 1945.***</Sentence>****</paragraph>*

Extracted Sentences:
The next day, many people visited the peace park.

This is a park directly under where the first atomic bomb was dropped in 1945.

Figure 4. Original snippet, tagged snippet and extracted sentences

After all the sentences are extracted from the snippets, ANNIE NER is run on them to find the named entities (person, location, date, organization, etc.) and the number of occurrences of each named entity. The reason of using named entity recognizer is to decrease the number of candidate answers, LAMP and QUANTUM are two of the systems using such named entity recognizers. While running the ANNIE NER, not all the named entities are found; only the necessary named entities for the question are found. For example, for a when question only named entities which are type of date are found out, because the expected answer type of the when question is date. Figure 5 shows an original sentence and the tagged version of this sentence.

Original Sentence:
This is a park directly under where the first atomic bomb was dropped in 1945.

Tagged Sentence:
This is a park directly under where the first atomic bomb was dropped in ***<Date>***1945***</Date>***.

Figure 5. Original and tagged sentence

For a sentence, to be an answer to a question it has to contain the possible sentence substring generated by the Possible Sentence Substring and Query Generator component. If the sentence doesn't contain a possible sentence substring it is discarded by the system, and it is not scored. For example, for the extracted sentences shown in Figure 4, the first one is discarded because it doesn't contain the phrase "the first atomic bomb was dropped in". So, only the second extracted sentence will be scored by the system. Candidate redundancy [14], the number of distinct passages in which a candidate answer occurs, is at the core of our sentence scoring strategy. The sentence scoring strategy of the system depends on the place, count of the words and named entities. The formulas are shown in Figure 6 According to the following criteria a score is given to each sentence:

SentenceScore = LeftSubstringScore + RightSubstringScore

LeftSubstringScore = SumOfScoresOfNamedEntities + SumOfScoresOfOtherWords
RightSubstringScore = SumOfScoresOfNamedEntities + SumOfScoresOfOtherWords
SumOfScoreOfNamedEntities = 7.5 × CountOfNamedEntities (if place is correct)
= 2.5 × CountOfNamedEntities (otherwise)
SumOfScoreOfWords = 0.5 × CountOfWords (if place is correct)
= 0 (if place is wrong)
= 0.25 × CountOfWords *
* If the place of the expected answer can be either left or right.

Figure 6. Sentence scoring criteria

After scores of all sentences are calculated, the sentences are ranked according to their scores. Finally, the system returns 5 top ranked sentences containing the answers, snippets which contain the sentences and the URLs of the documents containing the snippets as output.

5. RESULTS AND CONCLUSIONS

The performance of our system has been evaluated using several test questions from TREC 8, TREC 9, TREC 10, TREC 11 and TREC 12. The questions have been selected considering their syntactic structures. We tried to select questions having different grammatical structures in order to test all templates created by our system. Mean Reciprocal Rank (MRR) is an evaluation metric which the question answering systems (required to return 5 ranked answers to each question) participated in TREC 8, TREC 9 and TREC 10 are evaluated by this metric. We also use MRR metric to evaluate our results, because our system also returns top 5 ranked answers. MRR is calculated as follows. Each question is assigned a score that is the inverse rank of the first correct answer occurring within the top 5 ranked answers. If there is no correct answer, the question is assigned to a score of zero. To obtain the score of the system as a whole, the average of the scores of the questions is calculated. We used MRR metric to measure our system's accuracy. Using MRR metric represents a more fair assessment of our system's performance because the aim of our system is to offer a correct answer within 5 candidate sentences rather than to return a single correct answer. We present users paragraph-level chunks of text with appropriate sentence containing the answer because studies have shown that users prefer paragraph level chunks instead of exact answers only [16]. Also, we have compared our system with AnswerBus question answering system due to the fact that it is an online, publicly accessible system on the Web, and similar to our approach in several aspects. The top five answers were evaluated manually to determine the answers' accuracy. 57 "who", 37 "when", 30 "where" and 42 "what/which" questions were used to evaluate both of the systems. The results of this evaluation are shown in Table 11, Table 12, Table 13 and Table 14.

Table 11 Evaluation results of "who" questions

Question	AnswerBus	Our System
	Rank of Answer	
Who was Galileo?	0	2
Who was the first man to fly across the Pacific Ocean?	0	0
Who developed the Macintosh computer?	1	2
Who wrote the hymn "Amazing Grace"?	1	1
Who founded American Red Cross?	0	1
Who is the Prime Minister of Canada? (current)	0	2

Table 12 Evaluation results of "when" questions

Question	AnswerBus	Our System
	Rank of Answer	
When did Hawaii become a state?	1	1
When did Idaho become a state?	2	1
When was John F. Kennedy elected as President?	0	1
When was Rosa Parks born?	1	1
When were William Shakespeare's twins born?	5	0

Table 13 Evaluation results of "where" questions

Question	AnswerBus	Our System
	Rank of Answer	
Where is John Wayne airport?	5	1
Where are the Rocky Mountains?	0	1
Where is the Orinoco River?	0	1
Where is the Mall of America?	1	1
Where is Prince Edward Island?	0	1

Table 14 Evaluation results of "what/which" questions

Question	AnswerBus	Our System
	Rank of Answer	
What do frogs eat?	2	1
What / Which year did the Titanic sink?	0	1
What / Which river in the US is known as the Big Muddy?	4	0
What are invertebrates?	0	3
What were Christopher Columbus' three ships?	1	1
What did Alfred Noble invent?	2	2
What is Australia's national flower?	1	1

Table 15 Comparison of number of correct answers and MRR scores of AnswerBus and our system

Question Type	q#	AnswerBus		Our System	
		c#	MRR	c#	MRR
who	**57**	26	0.34	44	0.74
when	**37**	25	0.47	33	0.86
where	**30**	16	0.40	28	0.91
what/which	**42**	20	0.36	35	0.72

As it can be clearly seen from Table 15, MRR scores of our system are higher than AnswerBus for all question types. Although, our approach is similar to AnswerBus in various aspects, there is a big difference between the MRR scores of two systems. In our opinion, the reason of this difference lies in query creation step. We create exact queries containing possible answer substrings rather than inexact queries, but AnswerBus creates inexact queries. Because of this Google brings us better search results that potentially contain the answers, and this makes our system better than AnswerBus in the selected question data set. Also, as it can be clearly seen from the Table 11, Table 12, Table 13 and Table 14 our system mostly presents users answers in the first rank, but AnswerBus doesn't. Although our system's performance is better than our expectations, there are some problems that we examined while testing. For example, some questions can't be recognized by our question classification and type identifier component. The reason of this problem is POS tagger that we use. In some questions like "When did Hindenberg crash?" and "When was President Kennedy shot?" POS tagger couldn't tag the verbs (crash, shot). Thus, our system returns "I can't recognize your question" message to the user rather than a correct answer. Another problem that we noticed is long questions lead the system not to present any answer. The reason of this problem is query creation containing exact phrase approach of our system. In some questions like "What was the largest crowd to ever come see Michael Jordan?", "Who is the actress known for her role in the movie Gypsy?" we recognized that the documents in the Web don't contain such long exact phrases. Some other words could appear between the words of exact phrase and because of this Google couldn't bring us search results. Thus, our system couldn't present any answer. We also recognized that although our system couldn't present an answer to the question "Where is Procter and Gamble headquartered in the US?" it could present the correct answer to the question "Where is Procter and Gamble based?" which asks the same information with the unanswered one. Same situation happened for the questions "When did John F. Kennedy get elected as President?" and "When was John F. Kennedy elected as President?" Our system couldn't present an answer for the first one, but could present the correct answer for the second one. So, we deduced that the grammatical structure of the questions affect the performance of our system. The reason of this effect is our exact query creation process depends on only the grammatical structure of the question. Finally, we recognized that if a question asks for an answer which is time dependent, the replication of the data in the Web documents highly affect the performance of the system. For example, the question "Who is the tallest man in the world?" asks for the living tallest man in the world now, but search results which are brought by Google don't contain the correct answer frequently. So, the correct answer couldn't be presented within top 5 ranked answers. Despite the problems that we mentioned above and the apparent simplicity of our approach, the performance of our system is satisfactory. Our approach takes the advantage of Web which contains enormous amount of documents available online and takes the advantage of redundancy (multiple answer occurrences) available in the Web documents. Since our system doesn't download and analyze the original Web documents and doesn't require sophisticated natural language processing (co-reference resolution, semantic analysis, making inferences) on search results, it is time efficient. The query formulation approach by using POS tagger and hand-made templates greatly affect the performance of our system. Also, our system considers the actual user preferences. We provide paragraph-sized chunks of text with appropriate sentence containing the answer, because users prefer paragraph-sized chunks over the exact answer only [16]. Creating an environment where the learners pose questions to the Web-based systems and decipher the context to get back only the information that is pertinent would provide a fast and easy mean to them to carry out research and analysis as well as provide equal standards, opportunities and easy path for optimum and meaningful learning experience. The second stage of this longititudial study focused on this aspect.

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A Case Study: Internet Based Collaborative and Cooperative Learning

Asst. Prof. Dr. Dilara DEMİRBULAK
Çankaya University, Ankara - TURKEY

and

Dr. Ali Rıza AŞKUN
Çankaya University, Ankara - TURKEY

ABSTRACT

The Internet has improved the quality and quantity of communication all over the world by providing opportunity to electronically deliver and share knowledge instantly all over the world. As for the impact of this on education the ones relevant for this study are the need to integrate educational technology and collaborative learning into curriculum. This is the third phase of a longitudinal study. It was carried out at an English Language Teacher Training Certificate Program, "Methodology" course at a Higher Education institution. The same course was being given by one instructor to two different groups of learners who had not met each other. Each week a different method was focused on by different groups of learners. Each group presented the principles of the method using the method itself and then discussions were carried out. The presentations were video-taped and discussions were carried out based on key points presented via power-point. The learners in the two courses focusing on the same methodology were asked to interact by means of the internet and their output was evaluated. Based on the results of data gathered it could be said that virtual teams learner outputs were effective and in some cases were more effective than the face to face teams.

Keywords: Virtual Teams, WWW, Collaborative Learning

1. INTRODUCTION

The development of human resources became a vital issue and education became the prime catalyst in todays` world. This resulted in an increase in the demand for education. As this demand was increasing rapid developments in information and technology were observed. Therefore, education had to broaden its scope, vary its offerings but integrate technology into education. The courses in higher education are being redesigned in order to adapt to the new use of technologies such as interactive computer programs and the WEB to create a robust learning environment. Technological trainings are offered on campuses and such courses are included within the curricula of almost all the disciplines to make computers more "user friendly". However, redesigning the curricula to adapt to the new use of technologies and designing a new user friendly computer system that understands natural language for improved learning environment also requires cooperation and collaboration of the users who are higher education students in this study. The aim of this longititudial study is to identify the perceptions of the learners about using the internet for interaction purposes.

2. THEORETICAL FRAMEWORK OF THE STUDY

Collaborative and Cooperative Learning and the Use of Internet for Interaction purposes are the form the theoretical background of the study.

Collaborative and Cooperative Learning

Graham & Scarborough (1999) describe collaborative learning as the acquisition of knowledge, skills, or attitudes, that takes place as a result of people working together to create meaning, explore a topic, or improve skills. Therefore, there is a need for an instructional method that seeks to promote learning through collaborative efforts among students working on a given learning task. The environment should be designed in such a way that it would enliven and enrich the learning process.

Collaborative learning is also seen as an outgrowth of cooperative learning where learners have to develop their cooperative skills to use them in self-directed, high performing teams that conduct free inquiries and solve problems jointly.

Meanwhile cooperation is working together in small groups to enhance the participants learning. The activities are designed in such a way that outcomes are not only beneficial for the individuals but also for the group. Members of the group are to provide support, encouragement and assistance to each other for better academic progress so they meet even after school. It also enhances positive interdependence, taking responsibility and sense of belonging (Smith, 2000). This in return is expected to result in facilitation of learners to actively construct their own body of knowledge than the teacher producing it. Learning is described as a sharing process which is enriched when shared more and become a valuable tool to other learners. So, it can be said that learning has moved from individual basis to collaborative.

This is where the internet or the virtual setting is highly needed since learning is no longer limited to classroom environments and collaboration and cooperation is needed for optimal learning. Moreover, they need a user-friendly mean which is the personal computer. In order for the learners to reach information easily they need to access the internet by determining on the best key words and means to create their pen-friend like interaction program.

3. METHODOLOGY

Students of Arts and Science Faculties and students studying at an English-medium university can register for courses leading to English Language Teaching Certificate which consists of 10 courses. There were two sections for each course. Section 1 was offered to undergraduate students studying at the university where this study was carried out during the day-time while section 2 was carried out in the evenings with undergraduate students from other universities or graduates. The study had twofold purpose. The first one was to enable students to interact easily with their group member(s) and with the groups in the other section. Secondly, there are various programs that can be used for interaction purposes. However, the instructors wanted to enhance cooperation by having them design their interaction means from the scratch with a joint effort.

Participants

Fifty-seven (57) students attended the courses. Of the 22 undergraduate students of section 1 three of them were studying at the Computer Engineering department while the other students were studying at English Language and Literature department. As for the section two students they were from various departments such as computer programming, history, English language and literature, sociology, business management, political science, etc.

Procedures

This study was carried out at the Instructional Technology and Material Development and Methodology courses. The courses duration is one semester, 14 weeks. The focus of the Instructional Technology and Material Development course was on the improvement of learners PC use skills and making use of the internet resources to prepare materials. The chat system was designed in this course. The focus of the other course was on English language teaching and learning methods.

Data Collection and Analysis Procedures

The data were collected via journals kept by the students to reflect their experience in the mentioned aspects. The self-evaluation consisted of identifying their strengths and weaknesses of their experience and their frustrations or satisfactions if any.

The data gathered pertaining to that particular week was categorized under the interview topics. Then, each topic was further categorized usually as negative and positive perceptions and the reasons. The same procedure was carried out for the analysis of the compiled data.

4. RESULTS and DISCUSSION

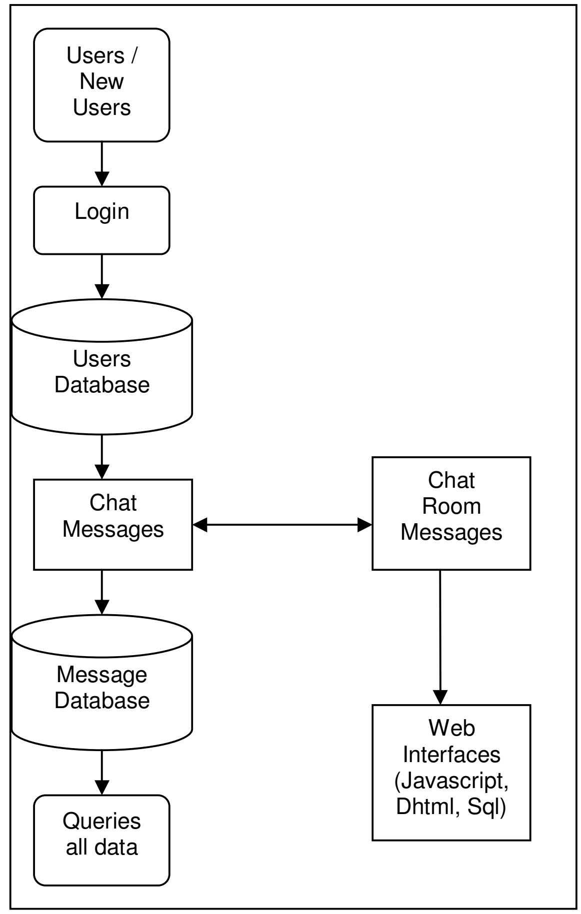
The analysis of the data collected revealed the need to regard this study as a pilot-study and redesign the study for two purposes. First of all, the two mentioned courses were offered at the two sections at two different semesters. Secondly, the participants did not have the same educational background. Some students for example, had already taken the methodology course prior to taking the other course. Next, some students did not have a personal computer and some did not have the internet connection. Finally, some of them were not able to use the internet effectively.

However, the students who were able to communicate via internet believed that it was effective since it not only improved their computer usage skills but also helped them save time.

The following is the interaction program designed by the students.

The LINUX as the system, APACHE as the web-server were utilized. PHP web language was used to set up the system and MYSQL was used as the data base. However, since the system's aim was to enhance collaboration and cooperation via communication via internet DHTM and JAVASCRIPT were also employed. The twofold reason for using the additional languages were as follows: First of all, the page would open as a new window

Scheme 1: Chat System



Secondly, and more importantly, without any action taken by the "other" users the page renews itself and result in appearance in the other users screen.

As can be seen from Scheme 1 and the brief explanation provided above it has a very simple structure. The first step taken by the learners was to make use of the MYSQL database to form the system. Carry out the refinement process via "mysql.php" file and run the "install.php" file. Once the system starts to run the necessary data is uploaded to the database. The address of the system is "http://ccs.cankaya.edu.tr/chat"

Meanwhile as a user the first step to take is to type in the user name and ID and sign in. Once the user is in the system just like in the "MSN Messenger" model the user can see the other logged in users. Likewise the user will receive a notice when one of the other user logs off (scheme 2 & 3).

Although there are other programs that do serve the same purpose for the following three reasons the learners were asked to design such a system. The first aim was to make the PC more user friendly to the learners from social studies. Secondly, to emphasize collaboration and cooperation among learners via a project that has a real-life impact, something concrete. Finally, to make the learning climate more entertaining and show the learners that learning is a continuous process.

The system enabled the instructors to obtain feedback since the "log in data record" was inbuilt to the system. Therefore, the instructors were able to analyze data in terms of log in duration, frequency, and content. (Table 1).Based on the data collected it could be said that in order to enhance collaboration and cooperation among learners a small-scale project can be utilized. However, the project needs to be real rather than simulated.

Scheme 2: Chat System – Login Page

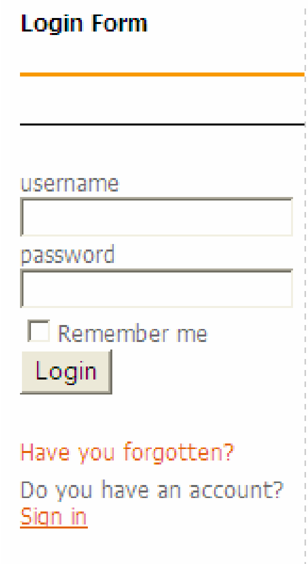


Table 1a: p4_salle in database chatphpmysql (Sample data about login-logout period of the learner)

ID	user	user_ID	dt	dt_first
17	ali	ali	2007-06-19 13:47:40	2007-06-19 13:14:01

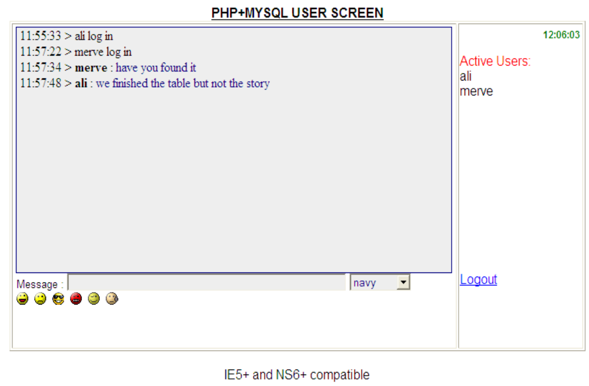
Table 1b: p4_admin in database chatphpmysql (Sample data about previous)

ID	dt_last_liste	dt_last_chat	dt_last_p4	dt_last_admin
1	2007-06-19 13:14:01	2007-06-19 13:32:59	2001-01-01 01:01:01	2007-06-19 13:47:34

Table 1c: p4_msg in database chatphpmysql (Sample data about the contents of interaction)

ID	user	text	dt
40	system	ali is login	2007-06-19 13:14:01
41	system	merve is login	2007-06-19 13:32:59
42	merve	merve :hello	2007-06-19 13:33:09
43	ali	ali: hello	2007-06-19 13:35:01
44	system	ali is logout	2007-06-19 13:39:23
45	system	merve is logout	2007-06-19 13:45:07

Scheme 3: Chat System - User Page



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