DELIVERING USER-CENTRIC ESYSTEMS

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ABSTRACT

This paper's mission is to highlight the importance for e-infrastuctures and technologies *(referred to in this document as eSystems)* to create value for the lifelong learner. From experience, solutions are often started from a technology first perspective, which is fundamentally the wrong way around when the goal of an eSystem is to create value for the user.
The paper is therefore driven from the user perspective covering: the User Value, User Experience and the importance of accessibility and the associated delivery methods.

Keywords: Educational Technology, User/computer interaction, Information System and User-Centered Design.

BACKGROUND

The world we live in is constantly changing. The main changes in the last decades have been: computers gaining omnipresence; a society diverse in culture, education, and socio-economic levels; a high skilled workforce needed in the majority of work places; a highly competitive business market; the appearance of new educational technologies; and decreasing students' interest to such traditionally prestigious subjects as physics, math, and engineering.

Learning is changing as well, especially the technologies of learning. e-Learning means that students and lecturers do not have to sit in the classroom but instead they learn from anywhere in the world and at anytime.

e-Learning is becoming very popular with Lifelong Learners allowing flexibility and choice. Thousands of modern companies, universities and colleges have online courses. It helps them distribute knowledge among learners in a broad and rapid way.

There has been also growth in what is commonly known as Web2 technologies especially in the area of social networking sites.

Adoption curves vary dramatically by region, but it is expected membership growth in all regions to peak by the end of 2009 and level out by 2012.

During 2008/09 there have been two extensive reports investigating the development of eSystems [5,6] within the LLNs in England, these have shown that there have been numerous duplication of systems, products and scope creep.

ISSUES, CONTROVERSIES AND PROBLEMS

User value (benefit-cost)

This is the value that an eSystem creates for the lifelong learner and how this relates to their needs. The needs of the lifelong learner are both those that are directly related to their learning journey and also their requirement for an environment that engenders confidence and enables the lifelong learners to focus on their own personal development goals.

To achieve this, it is important that the eSystem design process is started from the User first perspective. This will ensure solutions deliver true user value.

Therefore, fundamental knowledge of the user is important, along with possible learning styles. Those involved in the development of eSystems need to ask the question, who are the Learners and Users?

Through research within many of the established Lifelong Learning Networks within England, a user who sees learning as a lifelong journey will have some of these traits;

- Have positive self esteem
- Be accepting of others
- Perceptive and understanding
- Capable of interacting effectively
- Has problem finding & solving abilities
- Is creative & independent
- Discovers and develops personal passions
- Wants to impact the world in a positive way
- Good communication skills
- Personal reflection.

Types of learning: There is more than one type of learning that our lifelong learners will use. A committee of colleges, led by Benjamin Bloom (1956), identified three domains of educational activities: Cognitive: mental skills (Knowledge), Affective: growth in feelings or emotional areas (Attitude), and Psychomotor: manual or physical skills (Skills).

Trainers often refer to these three domains as KSA (Knowledge, Skills, and Attitude). This taxonomy of learning behaviors can be thought of as "the goals of the training process." That is, after the training session, the learner should have acquired new skills, knowledge, and/or attitudes.

Learning resources: Asynchronous learning resources (ALRs) developed as interactive courseware for the World Wide Web are receiving increasing attention because of the ease with which they can be accessed by Lifelong Learners at the time, place and pace of their choosing. Knowledge-based ALRs are critical for developing the knowledge base essential for problem solving. Problem-based ALRs are especially attractive because of their emphasis on the higher-order cognitive skills of analysis, synthesis and evaluation.

Computer-based interactive courseware can be developed to enable lifelong learners to acquire the entire range of cognitive skills contained in Bloom's taxonomy.

Graphic-intensive instructional modules sandwiched between an introductory statement and a formative quiz are used to constitute lessons designed to develop knowledge and comprehension. Practicums composed of problem statements and a series of questions for leading learners through a disciplined process of inquiry are designed to enable learners to acquire higher-order cognitive skills, including: application, analysis, synthesis and evaluation.

Digital Identity: The way a lifelong learner represents their identity changes according to circumstances. Different contexts require a different identity, each of which are expressed in a different way and provide different information. All of these contexts have ways for an individual to establish their identity and just like the physical world, they will have a variety of digital identities, expressed in different ways.

Today, however, there's no consistent way to 'model' the physical world and reflect this portfolio of digital identities.

Different kinds of digital identities will always be necessary—no single identity will suffice – and neither will any single identity provider. The solution is not to mandate a single system for digital identity, but find a coherent way to use multiple digital identity systems. Using these Web services technologies, it's possible to define a consistent way to work with any digital identity created by any source, using any identity technology.

Significantly, without creating the right amount of value for the user then a system will not be well adopted no matter how good the communication strategy is. Before developing a system there needs to be a real clarity of purpose for the development and the development needs to be tested against this as it progresses.

A definition of value is benefit – cost. Understanding this is really key to developing a successful software solution for the lifelong learner.

Benefits of a system: The benefits of the system come through functions the software provides that enable the user to perform new tasks or old tasks better. This has often been defined as either a Decision Support System (providing information to support a decision) or an Online Transaction Processing System (A way of performing a basic transaction using a software system). This means identifying some functions that provide benefit to the user that is significant compared to other alternatives. The benefits can be due to:

- The individual functions
- The combination of functions available via this one tool (integrated functionality)
- The fact that so many functions are available in one place
- The stakeholders connected to the functionality
  - Peers
  - Customers (in the broadest sense)
  - Suppliers (in the broadest sense)
- Security, Speed and Stability compared to alternative solutions.

Costs of a system: The costs of a system, in addition to finance, really need to be examined. From experience, applications more often fail as a result of not considering the Total Cost of Ownership (TCO) of the system. The costs are generated from:

- Financial cost to the user (The Internet is now full of free software)
  - User Experience
  - Ease of use (based on their prior learning and experience, how much can a user just work out for their selves)
- The "look and feel" of the system (does it have an appropriate aesthetic to it?)
- Does it provide the user with confidence in both the technical fulfilment and the way that it communicates to the user?
  - Security (Is it secure, does it communicate security to the user)

- Stability (Is it stable and reliable, does the user feel this?).

In addition to the general position of any system there are particular benefits and costs that relate to the Lifelong Learner:

- Enabling them to find learning
- Supporting their individual learning (content through to self-reflection)
- Enabling them to find and develop accreditation and qualification.

The lifelong learner will need to do the first two above points during their life. Ironically, the third aspect is the one that often spawns the development of systems as they are nearly always developed by academic institutions. In reality, accreditation and qualification is not always a requirement for the lifelong learner unless they have specific professional requirements that drive them.

User experience

This is about the user interface: accessibility, ergonomics, and clarity (visual, oral, written communication).

Accessibility is massively important, as it is the only aspect of user experience that involves legal compliance. In addition to compliance there are extensive guidelines that suggest ways to support user's needs. There is a balance that needs to be considered in implementing an eSystem that it serves the needs of the whole user community and this involves making a compromise between different stakeholder requirements.

For a successful user experience it is vital that when designing a user interface (UI) the structure satisfies the levels of functionality and clarity required by the user. Information architecture addresses questions such as:

- What are users' primary goals, and how can they achieve them using the application?
- How do users get from place to place?
- What rules exist that users have to work around?
- What is the optimal scope of the application's feature set?
- What is the application's search mechanism?

Accessibility

Since September 2002 in the UK the 'The Special Educational Needs and Disability Act' (SENDA) has extended the Disability and Discrimination Act' (DDA) to include the education sector. As far as web based applications are concerned, you should not disadvantage any disabled visitor to your application by offering information or services that they cannot access. There is nothing in the SENDA or DDA legislation to say exactly what makes an accessible website, but the general consensus is that the (World Wide Web Consortium) 'W3C Guidelines' will be used as an industry standard.

The justification that web-based applications are accessible because they "follow standards" contains a serious fallacy. Specifically, the assumption that standards support accessibility. Using the recognised the current HTML or XHTML standards set by the W3C, is a fine practice, and certainly should be maintained. Using correct syntax and following a standardised method of communicating information is always a solid best practice. However, this should absolutely not be taken to mean that following these standards is the same as applying the principles of web accessibility.

Web standards only provide accessibility to the degree that they have been designed to do so and the guiding principle

behind standards development has not generally been to support accessibility. Web standards have been designed purely to establish a set, correct method of using the underlying code whether presentational (CSS), structural (XHTML) or behavioural (ECMAscript.)

In many (most) cases, web standards do not in any way require best practices they merely require conformance.

Does this necessarily mean that the standard is wrong or right? No, not as such. Different standards support different needs: it is important to keep distinct the purpose of the standard.

In the UK, the JISC TechDis Service aims to be the leading educational advisory service in the fields of accessibility and inclusion. Their mission is to support the education sector in achieving greater accessibility and inclusion by stimulating innovation and providing expert advice and guidance on disability and technology.

SOLUTIONS AND RECOMMENDATIONS

Simplicity

Around 1910, the German architecture and design school "Bauhaus" employed this simple creed: "Form follows function, ornament is a crime". Bauhaus didn't exactly teach web design, and they didn't deal with print ads, email campaigns, or flash based interfaces, but the basic principal will work for any area of design. Simple and functional design will essentially make things easier for the individuals who use, or are subjected to the design. When design is based on the required function, form comes along naturally.

For example, have you ever used or visited a website where there is so much art and motion that you can't tell what is going on, or what you should even be clicking or navigating on? One can encounter sites like this quite frequently. Sometimes the sites are actually quite aesthetically pleasing, but they've missed the point of why they even wanted to make it "pretty" in the first place. By following the rule "Form follows function, ornament is a crime", we can start to break down what is necessary, and what is not.

Establish the "function": First off, one has to determine what the function is. If one does not know what the function is we are trying to serve for the user, then it will be difficult if not impossible to make it easier and simply to use.

It is vital to analyse the functions required by our lifelong learner, produce the case, prioritise, then focus on making those functions easily usable and accessible.

Establish the "ornament": Determining what is superfluous to your design is simpler than you think. Ask yourself this question about every element of your design. "Does this compliment, or complicate my function".

There is often a desire to fill in every "whitespace" or "hole" in your user interface. This does not mean you can't use all the space you're provided with, but give it some breathing room. Areas where the eye can rest and linger. By allowing your layout to be evenly and moderately spread out, content and navigation will be much easier to view and use for your users.

Examine all your content and ask the question is it really needed? Where should it be placed that would make the most sense? Is it helping you or hurting you? Too much verbiage or call to action can clutter and confuse users. Make your content and actions clear and concise.

Is the design layout logical? Really think about how a user is going to navigate through the user interface. Even though you may think what you're doing is logical, YOU aren't your users. Test, test, test.

Quality

Quality is achieved by evaluating the whole e-system against all of the areas and requirements to be considered as part of evaluation and continuous improvement in delivery.

Quality doesn't cost money. It's poor-quality products and services that pile up extra costs for a provider.

The "cost of quality" isn't the price of creating a quality product or service. It is the cost of NOT creating a quality eSystem. This could heavily impact on the user confidence in the solution developed, losing adoption and integration and would lead to costs to regain confidence.

In short, any cost that would not have been expended if quality were perfect contributes to the cost of quality.

Don't assume you know what the learner wants. There are many examples of errors in this area, such as "new Coke" and car models that didn't sell. Many organisations expend considerable time, money and effort determining the "voice" of the customer, using tools such as customer surveys, focus groups and polling.

Satisfying the learner includes providing what is needed when it's needed. In many situations, it's up to the learner to provide the provider with some of the requirements.

Generation perspective

A solution will be aimed at a particular market. It is important to consider an approach that will be well suited to the target demographic and possibly utilise the ability to provide different approaches, devices and interfaces to meet the different demographics. There needs to be some consideration of those who have access to technology and those who don't. In addition the skill levels, geographic locations and generational perspectives need to be considered.

Economic growth is increasingly driven by the skill of the local workforce and, more specifically, confidence and competence in using digital technologies.

As the middle class and articulate are relative early adopters of new services and emerging knowledge, they tend to make full use early of web-based systems.

Likewise, if we do not begin to develop applications of digital technology designed to address inequality we shall reinforce the digital divide by default.

A key challenge is that access to technology will become necessary within Maslow's hierarchy of needs as individuals progress. Increasingly, digital technology will become key to them, starting with wealth, or at least work.

But there is still a considerable overlap between social exclusion and digital exclusion. So we need to be creative in developing targeted digital applications in health if they are to help bring people into the digital age rather than act as a further barrier to use.

Our providers need to commit investment in the use of digital technologies to tackle inequality, including partnerships with those more skilled in adapting digital to new markets than we are.

The new barrier is basic ICT skills, now being addressed through voice technology, increasingly intuitive technology and assertive investment in schools, with 90 per cent of 16 to 24-year-olds now ICT familiar if not fully literate.

The key barrier now is attitude and interest. Our most disadvantaged communities are often our most disappointed,

with learned low expectations and limited appetite for new experiences. We really need to understand what the added value of new technology might need to be, for people to wish to use it. While digital technology has a huge amount to offer everyone, paradoxically it could have disproportionate benefit for the currently disadvantaged.

Ownership

In addition to the individual lifelong learner adopting the e-System it is essential for sustainability that someone takes ownership of the delivery (It could even be owned by lifelong learners in a wiki environment). Intellectual Property might be considered also.

Recently there have been debates concerning the capacity of a lifelong learner to source learning from a range of providers, allowing the learner to be in control of their own learning accessing possibly the best resources and content from around the world.

Social networking sites could, in their next generation, facilitate this allows inividuals to create a personalised learning environment accessing learning from numerous locations.

Delivery Methods: Technology needs to be subservient to the needs of the lifelong learners and appropriate to a number of different factors. There is not one way of providing a solution that is perfect and the "best" solution is not just about the selection process but about responding and developing once the solution is deployed. The solution selected needs to consider the technologies, people and other resources available to meet the user's requirements.

Many researchers have documented the increases in potential learners worldwide drawing attention to the social imbalance in access to higher levels of education. There was/is a perceived need to development much more comprehensive, flexible, innovative and radical solutions and strategies to engage with these new learners. These strategies will/have needed a 'radical change' in conventional educational thinking, methods, organisations, structures and practices. In other words, a new approach has been needed touching on all aspects of the educational process.

- Changes in learning needs (more people wanting to learn different things)
- Problems of financing (reduced funding, demands of more effective use of resources (staff etc.,))

- Increased concern about democratisation and fairness (social equality, elimination of socioeconomic; gender and geographic inequities)
- A perceived need for closer ties to day to day life (lifestyles) harmony between education and culture, relating education to work, lifestyle, ecosystem, common values
- A need to change teaching and learning stragies..
  - There has been a realisation that educational providers need to review their teaching and learning strategies, to enable the flexibility required for the lifelong learner. Providers are encouraged to allow individual customisation of learning, allowing reactive solutions to training and personal development needs. At present funding and reporting requirements often contrive to discourage and hinder this type of flexibility especially when eSystems are utilised.
- New emerging forms of communication (other that the written printed word)
- New methods of educational delivery
- Changing demands of work - retraining
- New career patterns
- Home-based work
- Changing clientele for education - increasing numbers especially in mature-age students resulting in both work and career changes.

Adoption: By starting with User Value then we have a good basis for the future adoption of the solution. It is really important to make sure that the value hypothesis originally generated has been tested out on lifelong learners at the beginning and is reviewed as the solution develops. If the solution provides value then it is important to find a way to market/communicate the existence to potential new users. Adoption is often the result of:
- The user seeing the potential of something 'new'
- Popularity with peers
- Additional functionality
- A portal to other places allowing a seamless experience to the user
- Personal skills and requirements

CONCLUSIONS		
Define scope		
Action	**Question**	**Factors**

1.
Develop an understanding of the user
	What are the problems/needs of the Lifelong Learner (User)?
	
	What is the current provision of services (electronic and other) to the user?
		Lifelong Learner (User)
		• Personal development
		• Reflection
		• Finding learning
		• Engaging with:
		  • learning support
		  • peers
		  • professional bodies
		• Accessing multiple sources of information
		• Personal presentation

2. Clarify the purpose	What services could be improved? (increasing benefit or reducing cost) What gaps exist in provision of services? (less likely) What problem does the application solve?	• Current eSystems • Current manual systems

CONCLUSIONS

Plan Benefits

Action	Question	Factors
3. Define functionality	What functions will provide the benefit the user needs? What other special benefits come from the solution?	• Individual functions • New integrated functionality • Speed of transaction or reporting • Interaction with peers • Interaction with customers • Interaction with suppliers
4. Identify functionality from existing provision that can be incorporated into the e-system	What is already in existence that provides the required benefits?	• Access to external related functionality • Portability of data

Avoiding costs

Action	Question	Factors
5. Identify security require-ment	What are the legal requirements? What are the personal requirements?	
6. Design Stability	Where will the eSystem be hosted, is it stable enough and supported for the required life of the solution?	
7. Evaluate Affordability	How does the price of the solution compare to current provision?	

Planning the User experience

Action	Question	Factors
8. Design Logical Function	What are the logical steps involved in performing the function(s)? What alternative logical path(s) could be provided	
9. Design Intuitivenes	What interfaces will the user be familiar with? How can the application be designed to make the user feel at home?	• User's prior experience with software (e.g. MS Word, Google, Amazon) • User's experience with non-IT interfaces (e.g. cash machines, TVs, traffic lights)
10. Design Clarity of Communication	How clear is it where "clickable items are"? How clear is it what the impact of using a certain part of the interface is? How cluttered is the interface with different messages?	• Use of language • Written clarification of steps • Tool tips appearing on hover • Simplicity
11. Design Navigation	How easy is it to move from one part of the system to another? How easy is it to retrace steps? How is data maintained between screen changes?	Multiple Intelligences
12. Design Visual Appearance	How does it look? What feelings will the look of the system generate for the user?	• Colours • Font size • Graphic design • Simplicity • "Form follows function"
13. Create Accessibility	What provision is there for disabled users with accessibility needs? What are the legal requirements for accessibility?	

CONCLUSIONS		
Plan User Support		
Action	**Question**	**Factor**
14. Provide Training	What training will the user require? How will training be provided for the user?	• Help • eLearning • Trainers
15. Provide Support	What will happen if an error occurs on the system? Who is responsible for maintaining the application?	• Error handling • Clear error messages
16. Provide Feedback Opportunity	How can a user feedback problems?	

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