Collaborative knowledge generation and management for making didactic books

Clarice Gameiro da Fonseca Pachi [1]
clarice@dim.fm.usp.br

Jorge Futoshi Yamamoto [1,2]

Márcia Perez Resende Oliveros [1, 3]

1. FMUSP - Faculdade de Medicina da Universidade de Sao Paulo,
Av. Dr. Arnaldo, 455 - Cerqueira César CEP: 01246903 - Sao Paulo – SP – Brazil

2. NETI – Núcleo Especializado em Tecnologia da Informação-HCFMUSP - Sao Paulo - SP - Brazil
3. PMSP – Prefeitura do Município de São Paulo–DRE CL-Diretoria Regional de Educação do Campo Limpo – SP – Brazil

Abstract

The aim of this paper is to present a case study that allows measuring the participation of individuals in a social network involved in an editorial process to creating a work aimed at teaching high school students of Brazilian public education.

Through a platform of knowledge created from information stored on a mail server and the analysis of messages sent and received by the coordinator of mathematic edition, it has been possible to quantify the volume of didactical material created during four months of intensive work to build a book collection for teaching mathematics.

The procedure used in this research can fostered the quality of planning, designing and evaluating the editorial process and, mainly, help in decision making in managerial processes in companies involved in the process of creating books for government programs.

Background

Brasilian National Textbook Program - PNLD

The National Textbook Program (in portuguese: Programa Nacional do Livro Didático - PNLD) is considered the oldest of the programs to distribute textbooks to students of public schools in Brazil. Initially, it was targeted for public elementary education, including literacy classes for children. This program was created in 1929 and since there; it has improved its presentation and had different names and forms of execution. In 2004 it was deployed the National Book Program for High School (in Portuguese: Programa Nacional do Livro Didático para o Ensino Médio - PNLEM), for the universalization of textbooks also for students from public high schools across the country [FNDE, 2012].

Basically, both PNLD and PNLEM have the same form of execution and their major enforcement actions are, respectively:

- Inclusion of the publishers;
- Screening / assessment;
- Availability of guide book;
- Choice of books for schools;
- Application of book online or paper form by teachers and principals,
- Purchase from the publishers,
- Production under the supervision of FNDE (in Portuguese: Fundo Nacional de Desenvolvimento da Educação),
- Quality evaluation of the books by FNDE and IPT(in Portuguese: Instituto de Pesquisas Tecnológicas),
- Period of use by students switching to maintenance of uniformity of resource allocation,
- Distribution made by publishers to schools;
- Books distributed for schools throughout the country.

The role of publishing companies

High school is an intermediate stage between elementary school and college and it represents an important step in the education of young and teenagers in Brazil. Previous scholar experiences must be considered and aggregated into the educational curriculum for these young individuals who hope employability and social mobility and, therefore, improve their Quality-of-Life [PCNEM, 2000].

Therefore, production of learning material by the publisher companies of pedagogical materials must be in accordance with the expectations of the current Brazilian educational legislation. All requirements must be observed by these companies in conformity with intentions of the Ministry of Education and published and available in the Special Edict by FNDE site [Fig 1].

In order to provide public schools with high quality pedagogical textbooks, dictionaries and other pedagogical works, the Brazilian federal government runs the National Textbook Program. This program also serves students from the youth and adult

education (EJA - in portuguese: Ensino de Jovens e Adultos) of the public schools and partner organizations of the Literate Brazil Program.

Thus, each program runs on alternate three-year cycles and FNDE acquires and distributes not only books, but also, audio, Braille and MecDaisy versions to all students, in accordance of choosing made democratically by teachers and coordinators (FNDE, 2012).

Figure 1: FNDE site provides all information about Brazilian programs of didactic textbooks.

Introduction

This work analyzes the events that occurred in a publishing company, while creating a collection of didactic books for teaching mathematics for high school students to the National Textbook Program (PNLD), in Brazil.

We have analyzed data from routine of the authors of mathematic team since the first register made by the Special Edict of the PNLD until the Quality evaluation of the books delivered to FNDE and IPT.

Previous editorial projects showed that it is not enough to facilitate the access control and maintain a management of created information. Publishers also need to integrate and correlate such information to achieve success in this Knowledge Management Process.

In this case, Knowledge Management suggests the idea of a systematic process, dynamic and wide, in which the human capital formed by the team that developed the didactic work also received the responsibility for the success or failure of this project. [FONSECA PACHI et al., 2012; NEELY et al, 1997].

Thus, to conduct the design of the work for teaching mathematics, it was necessary to create a Knowledge Management System, in which the Human Capital, consisting by authors, coordinators, cooperator, publishers and service providers, was even more appreciated.

In addition, individuals also had the responsibility to understand and classify information and knowing the environment in which they could act and about their role in this process [FAPESP, 2001, SKIRME, 2011].

As a result, the company hired a coordinator for contents of mathematics who should interpret all involved information and understand its impact, analyzing the actions and decisions which were important in this process of organizational knowledge management for the construction of teaching material.

In this context emerged the role of Coordinator of Mathematics, whose role brought together her skills and specific knowledge about mathematics education and managing the editorial material wrote by the authors and ensuring the flow of information in the editorial process.

Therefore, recognizing the necessity to understand the processes of mapping Knowledge Management and the importance of individuals involved in this process, we showed a simple metric that helped to quantify the editorial work and analyzed the performance standards of those involved at each stage. [FONSECA PACHI et al, 2012; NEELY&BOURNE, 2000].

Paper is organized as follows: first, it summarizes data set and methodology. Finally, it presents and discusses the main results and some conclusions and suggestions for future work are showed.

Data and Methodology

There is an obvious difficulty for obtain a metric to assessing the contribution of each element involved in the creation of textbooks and it gets worse, if we consider that the rescue and preservation of existing information on these activities are lost during the process of work.

The main difficulty to analyze the management of knowledge is to find a model to assess the creation, the registration, the dissemination and shared knowledge. Usually, the solution for this problem is the proposal of indicators that are able to assess the tangible and intangible assets together; called "nontraditional" indicators [FONSECA PACHI et al, 2012; OECD,2011].

This paper discusses the problems arising from this process of Knowledge Management and we believe that this model contributed to an analysis of past events and can contribute to future projects in publishers companies.

Our method proposed a metrics based in communication performed by the Coordinator of Mathematics through her folders of e-mail messages.

These messages were stored on a server and represent an instrument for measuring the development of the tasks to build of the textbook. Fundamentally, these emails allowed quantify all stages of this work and therefore could be considered important for planning basis [Fig2]. In addition, these measures can establish compliance with the goals and objectives, and also signal the directions that were followed after each phase. [FONSECA PACHI et al, 2012; OECD,2011; FAPESP, 2001].

Table 1 below summarizes the folders that cluster the total of electronic messages (emails) and their respective size, measured in Megabytes (MB). Each folder contains several messages sent and received by coordinator of mathematics to the authors, editors and office staff. Subjects of those messages were carefully selected to compose properly the analyzed group and, thus, we ensured that each folder contains only pedagogical subjects to editing. Real names were to

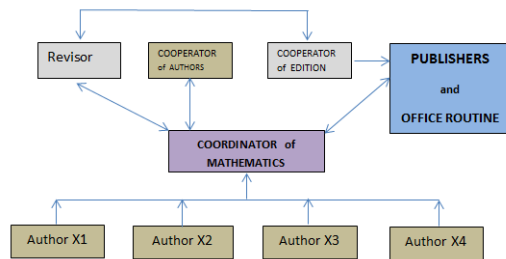maintain the confidentiality of the work and the publisher company.

Figure 2. Flow diagram of tasks for creating textbooks. Represents the set of tasks attributed to the coordinator of mathematic contents which had included the organization and technical review of manuscripts submitted from authors, the distribution of this production to the reviser of texts and cooperator of authors. Moreover, she still had maintained the relationship between the company and authors into the process of editorial development.

Measure model uses the e-mail as a platform of knowledge and getting quantitative indicators that could express the qualitative components as: collaboration, communication and organization of individuals involved in this process.

Comparing the total number of emails and size of each folder was possible to compare the working groups with the individual work to creating this collection of textbooks for teaching mathematics and analyses if goals were reached.

Ratio MB / e-mails can be considered an indicator of production to assess the contribution of each author in the process of construction of the original book. This written material was created specifically by each author about specific topics and was widely discussed with the coordinator of mathematics, Reviser and Publisher.

Reviser folder holds the files that contain the written material of authors, corrected and sent by Coordinator of Mathematics. Cooperator of Edition folder presents all answers for doubts of editing.

Office routine folder refers to administrative documents such as letters, memorandums, press releases, discussions of processes and procedures, minutes of meetings, among others.

Table 1. Set of electronic messages (emails) and their respective size, measured in Megabytes (MB), in the period of January to May 2010*

	number of emails	size (MB)	MB/emails
Office Routine	134	29,28	0,219
Cooperator of edition	84	125,90	1,499
Author 1	495	243,10	0,491
Author 2	209	162,00	0,775
Author 3	55	47,00	0,855
Author 4	339	181,30	0,535
Cooperator of authors	396	257,40	0,650
Reviser	605	320,50	0,530
Publisers	369	205,60	0,557
total	2686	1572,08	0,585

Period of effectiveness of the Edictal of FNDE.

Cooperation of authors folder holds files containing lists of exercises and activities related to the contents of some issues of the collection. It was a support which made possible the fulfillment of the requirement for the resolution of the proposed activities in the student textbook and manual for teachers.

Results and Discussion

Information technologies such as the World Wide Web offer a potentially useful environment within which to build a multimedia repository for rich, explicit knowledge. Input is captured by forms for assigning various labels, categories, and indices to each unit of knowledge. The structure is flexible enough to create knowledge units, indexed and linked using categories that reflect the structure of the contextual knowledge and the content of factual knowledge of the organization, displayed as flexible subsets via dynamically customizable views [OECD,2012].

Effective use of information technology to communicate knowledge requires an organization to share an interpretive context. The more that communicators share similar knowledge, background and experience, the more effectively knowledge can be communicated via electronically mediated channels [WOLSKI et al., 2011].

In order to choose an appropriate measurement model, we seek to understand the development of each initiative focused on Knowledge Management between those involved in the process of building a didactic textbook.

Using e-mail folders as a platform of knowledge we built an indirect measure based on archived messages in a mail server which make easier evaluate all individuals involved in this work.

Figure 3, top, shows the behavior of variables message size and number of emails which we can observe a higher concentration of both variables in folder of the Reviewer. This has happened because he concentrated work editing texts and received all the written material created by the authors, after previous corrections of the Mathematics Coordinator.

We can also note that authors 1 and 4 had emphasis in both "message size and the number of emails". This actually happened, because these individuals had not produced their contents before. Although authors 2 and 3 also had produced textbook material, they already had more contents ready before.

Lower part of Figure 3 highlights the relationship between "size/number of emails". We realize that, as expected, Cooperator of edition is highlighted because made all management of edition before printing.
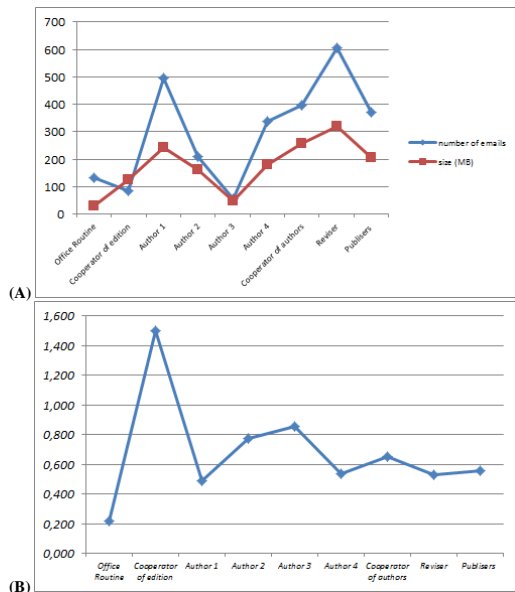
(A)

(B)

Figure 3: (A) Shows the behavior of variables message size (MB) and, (B) the number of emails and relationship between "size/number of emails"

We believe that our metric can show the processes of developing tasks and turned possible incorporate the development of the routine of each individual of the process and it can be considered a part of any decision-making process of the creation of didactic textbooks. In addition, both publishers and cooperators can take advantages from this repository of knowledge [FONSECA PACHI et al., 2012; NEELY, 2000].
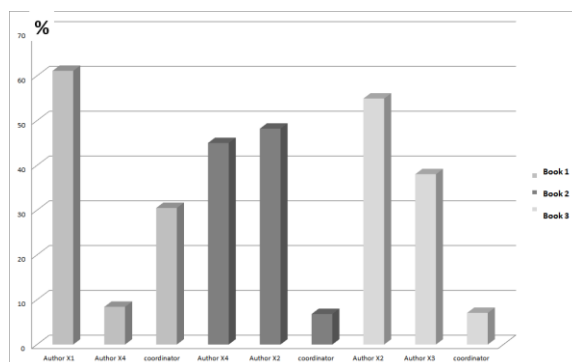

Figure 4: Shows the proportion of content created by each author in each pedagogical textbook.

Figure 4 above, we observe the proportion of content created by each author and t-tests showed significant differences between the volume of text created for each book in this collection (p <0.05). It is also possible to highlight the participation of the coordinator of mathematics in the productivity of

written content of mathematics for each book, going beyond her planned activities in this project.

These findings are important for a better understand of the individual productivity and they can help the publishers to making a fairest remuneration in the future.

Effective use of information technology to communicate knowledge requires an organization to share an interpretive context. The more that communicators share similar knowledge, background and experience, the more effectively knowledge can be communicated via electronically [GAMBER et al., 2008].

Coordinator of Mathematics has realized this work of organization and using her pedagogical and management experience it was possible to measure this implicit contextual Knowledge.

Furthermore, we believe that the study of this metric can give subsidies for the development of actions that can improve the activities of creation of textbooks in Brazil.

References

EARL, M 'Knowledge Management Strategies: Toward a Taxonomy', Journal of Management Information Systems, Vol 18 No.1, p. 215-233; 2001.

DTI 'Our Competitive Future – Building the Knowledge Driven Economy', [online], DTI, http://www.dti.gov.uk/comp/competitive/main.htm (1998) [setembro 2007].

FAPESP. Indicadores de Ciência, Tecnologia e Inovação em São Paulo – 2001. Anexos Metodológicos, anexo 4, p A 16; 2001.

FNDE- Fundo Nacional de Desenvolvimento da Educação, 2012. Available in: http://www.fnde.gov.br/index.php/programas-livro-didatico

FONSECA PACHI, C. G.; YAMAMOTO, J. F.; COSTA, A. P. A.; LOPEZ, L. F. Relationship between connectivity and academic productivity. Scientometrics (Print), v. 90, p. 1-14, 2012.

GAMBER,T; FRIEDRICH-NISHIO,M; GRUPP,H. Science and technology in standardization:
A statistical analysis of merging knowledge structures. Scientometrics, Vol. 74, No. 1; p.89–108, 2008.

MALHOTRA, Y. Measuring Knowledge assets of a nation: Knowledge system development, set. 2003 Available: < http://www.kmnetwork.com/> [Acesso em setembro de 2007].

NATIONAL ECONOMIC AND SOCIAL FORUM. The policy implications of social capital. Dublin, 2003. 157 p. (Forum report , n.28).

NEELY, A. et al. Designing performance measures: a structured approach. International Journal of Operations & Production Management. Bradford, v.17, n.11, p.1131-1152; 1997.

NEELY, A.; BOURNE, M. Why measurement initiatives fail. Measuring Business Excellence. V.4, n.4, p.3-6; 2000.

OECD 'Knowledge Management Learning by Comparing Experiences from Private Firms and Public Organisations', [online], OECD, http://www.olis.oecd.org/olis/2001doc.nsf/LinkTo/PUMA- [access dez 2011].

OECD 'Impact of the Emerging Information Society on the Policy Development Process and Democratic Quality', [online], OECD, http://www.olis.oecd.org/olis/1998doc.nsf/LinkTo/PUMA(98)15 (1998) – [access jan 2012].

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD)- http://www.oecd.org/bookshop/ - [acesso em abril 2007].

PCNEM- Parâmetros Curriculares Nacionais para o Ensino Médio – MEC – Brazil, 2000.
Available in: http://portal.mec.gov.br/seb/arquivos/pdf/blegais.pdf

SKIRME, D. J. Measuring the value of the knowledge: metrics for the knowledge-based business.2003.Disponível em http://www.skyrme.com/. [Access jan 2012].

WOLSKI,M;RICHARDSON,J;FALLU,M;REBOLLO,R;MORRIS,J. Developing the Discovery Layer in the University Research e-Infrastructure.Proceedings of KGCM Summer 2011.
http://www.iiis.org/CDs2011/CD2011SCI/KGCM_2011/PapersPdf/GA919ET.pdf (access: mar 2012)