

Learning materials reusability in higher education: elements for designing digital collections from a knowledge management perspective.

Alma Rivera-Aguilera

José J. Téllez-Bertadillo

Victor M. Harari-Betancourt

Biblioteca Francisco Xavier Clavigero, Universidad Iberoamericana Ciudad de México

Prolongación Reforma 880, Lomas de Santa Fe

México D.F., México

Phone: 52 (55) 59504000, Fax: 52 (55) 59504248

alma.rivera@uia.mx, jose.tellez@uia.mx, victor.harari@uia.mx

ABSTRACT

This paper reports on an exploratory reusability study of digital learning material. Materials from eight university professors and the corresponding chat interviews were collected and analyzed from a qualitative inquiry perspective and using the grounded theory method. Sensitizing initial concepts from education, design, computer and information science were used in the initial approach to collect data, but the analysis results were rooted in actual material and chat texts. Interviews with university professors and the analysis of different digital learning materials led the research team to define eight categories or code families which are related to reusability. Such code families are: (1) learning promotion, (2) access, (3) emotional appeal, (4) technical suitability, (5) effective graphical and textual communication, (6) creativity, (7) collaboration, and (8) subject authority and they offer the structural elements for designing and implementing collections of digital learning material. The latter are the basis for knowledge management oriented systems aimed at sharing and preserving digital learning materials.

Keywords

Digital collections, digital learning materials, knowledge management.

INTRODUCTION

In college and universities, learning and research play the most important role for knowledge creation. Knowledge includes all the resources to interpret the environment and act appropriately to achieve goals. (Canals, 2003).

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Institutions need innovation and competitiveness in order to survive in global environments. Nidumolu, Subramani and Aldrich (2001) have indicated that knowledge management is crucial for keeping institutions competitive. One of the most traditional expressions of knowledge in higher education are learning materials that can be considered as knowledge artifacts.

Learning materials involve elements, structures and cycles which must be studied and coded with the purpose of systematization. This research focuses in reusability as the key element to approach systematization as a means for the design and implementation of better digital learning material collections.

The main objective of the research is to obtain valid information for designing a collection of digital learning materials that is useful for knowledge management in higher education institutions. The initial research question of this study was: which are the elements that influence reusability of digital learning materials in higher education? In order to resolve this issue, a research design was developed and implemented using a qualitative viewpoint which is briefly reported in this short paper.

In this study *digital learning materials are considered learning resources in digital format used in an educational setting to promote student learning, with one or more pedagogical methods recognizable in the material itself, or prone to be expressed through metadata. Reusability is considered the characteristic of a digital learning material that enables it to be used by the same or different professors more than once.*

BACKGROUND

Models and methodology for creating digital (and non digital) learning material, are reported by diverse authors (Gagné, 2005 y Heinich, et al, 2002).

Reusability of learning materials has been a recent topic in the last decade (López, Maestre Escalante, y Sanchez

Alonso, 2007), most of the time associated to learning objects. Learning objects (Wiley, 2000) were conceived from their onset for reuse, but this does not necessarily apply to learning materials in general.

Some authors have done studies in order to establish criteria for measuring reutilization (Cuadrado-Gallego, 2005), in some cases based on software reutilization similarities (Sicilia, 2005). In 2007, López, Maestre Escalante, and Sanchez Alonso reported an exploratory reutilization study at the Merlot collection. These findings concluded that of the 90% of 70 materials analyzed, only 50% complained about the established reutilization criteria. More qualitative research related to digital learning material reusability is required to find the essence of its elements and structure. This goal can only be achieved with careful analysis of material and author discourse.

METHODOLOGY

The qualitative inquiry was considered an adequate approach to this reusability study of digital learning materials, due to the novelty and complexity (Morin, 1995) of the research topic and the weight of significance attributed to the design, creation and use of learning material. (Rivera Aguilera, 2009b).

The research team was composed of three researchers and two assistants. Group discussions led to the collection and analysis of the data. Data gathering and analysis were done using the grounded theory method, in its contemporary proposal developed by Charmaz (2006). Charmaz complemented the symbolic interactionism (Mead, 1934/1993 and Blumer, 1969) that inspired original grounded theory proposal (Glaser and Strauss, 1967/2006) with constructivism. Both visions are concerned with the way in which action and meaning are built. Grounded theory is characterized by its flexibility, detailed analysis indications, substantive theory construction and the acknowledgement of research contributions to the analysis.

Setting: Universidad Iberoamericana Ciudad de México

The research scenario was the Universidad Iberoamericana Ciudad de México (UIACM)¹, which is one of the most recognized universities in México². UIACM has an enrollment of approximately 10,000 undergraduate students and more than 1000 graduate students. The institution offers 36 undergraduate, 22 master's and 7 doctorate programs in 19 different departments.

Data

In order to collect data, some professors were selected and asked to contribute with digital learning materials and

participate in corresponding chat interviews. Collaborators were chosen for this study according to the following criteria: academic program coordinator recommendations, high scores obtained by professors in institutional academic evaluations specifically in the use of technologies and personal selections made by members of the research team.

Chat interviews were considered in this study adequate means to record the professor's discourse (Mann and Stuart, 2002), because of its helpful automatic text registration and the convenience of online appointments. Furthermore, the acceptance of a chat interview provided information regarding the digital culture habits of the professors interviewed. If some of them would have preferred personal or phone interviews, the research team would have been willing to accept, but none rejected the chat interviews.

Gathering of materials and chat interviews

In the Fall of 2008, members of the team collected the digital materials from all 19 departments of the University and its Reflection Program. Twenty three professors, who met the established criteria voluntarily participated, among them, 7 women and 16 men. A total of 282 materials were collected.

A closed digital collection was designed and implemented with the shared materials, using the Greenstone³ digital collection management software. A metadata application profile was defined using Dublin Core, Learning Object Metadata and some local metadata tags (Rivera-Aguilera, 2009a).

The first phase of the analysis reported in this paper was carried out in 2009. Eight materials were chosen from the digital learning collection to be analyzed by the research group. This batch was composed by materials authored by four female professors from the departments of Architecture, Political Sciences, Business Studies and the Reflection Program; and, four male teachers from Religious Sciences, Law, Design and Engineering.

Only one learning material for each selected professor was analyzed. The following questions were asked during the chat interviews.

1. How do you use this particular learning material? (previously selected material) [questions related to access, learning and design]
 - a. Do your students have problems to access this particular material?
 - b. Does this particular learning material help your students in class?
 - c. Is this particular learning material easy to use?
2. Why did you decide to create learning materials in a digital format? [questions related to digital culture].

¹ www.uia.mx

² The Universidad Iberoamericana recently received the 2009 SEP-ANUIES Prize for being the best private university in Mexico. SEP is the Ministry of Public Education and ANUIES is the National Association of Universities and Higher Education Institutions.

³ www.greenstone.org

- Did you consider that this material can be used by other professors? [questions related to usability].

Five of the chat interviews were conducted by one researcher with one professor, two by two researchers interacting in a group chat with the corresponding professors, and one by the whole research team with one professor. The chat interface used was the library chat in two cases, one was performed by Gmail and the other five were made using Microsoft Messenger.

Analysis

The data analysis was done by associating free codes to the learning materials and chat interview texts. The initial code assignment was made during the research team sessions. The basic operation of code assignment was reviewed and agreed on by the team. The materials were distributed for the purposes of individual coding, taking into account the researchers' discipline (education, technology and design in our case) and the topics of the material.

Code lists and data quotations were reviewed by members of the research team and an integrated free code list was prepared. Afterwards, free codes were associated as a result of group discussions with the idea of building families around the concept of reusability.

RESULTS

Findings were grouped in two types:

Digital learning materials used in higher education

The teaching materials analyzed were:

- Tutorial for Computer Aided Design (CAD) using Power Point.
- Set of files for a machine design engineering class using Word and Flash.
- Presentation about the anti-global movement using Power Point.
- Marketing tutorial in Word.
- Movie analysis guide for an ethical analysis of a case in Word.
- Web site for graphic design projects.
- Presentation about Saint James's Letter for Biblical Studies in Power Point
- Islamic Human Rights Declaration on PDF

Elements influencing reusability of learning materials

From the analysis of the materials and the chat interviews, an initial list of 11 code families or categories were identified as an influence to our main category: reusability. Seven categories were derived from initial theoretical concepts, and the other four originally emerged from the data (in bold type). (Figure 1).

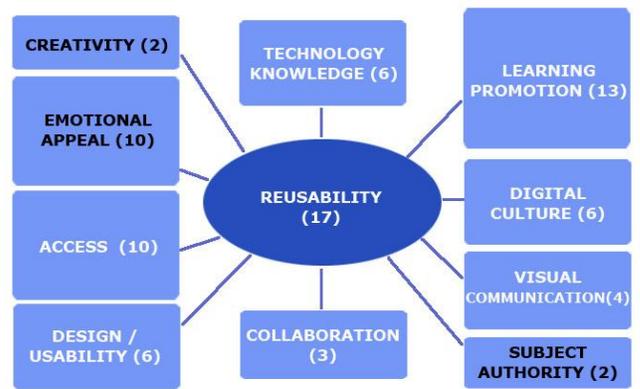


Figure 1. First conformation of categories related to the reusability of digital learning materials indicating the number of quotations associated (groundedness).

Further analysis and group discussion of families and corresponding quotes led the team to integrate digital culture and technology knowledge in one family named *technical suitability*. Likewise, code families named design/usability and visual communication were merged in *effective graphical and textual communication*. (Figure 2).

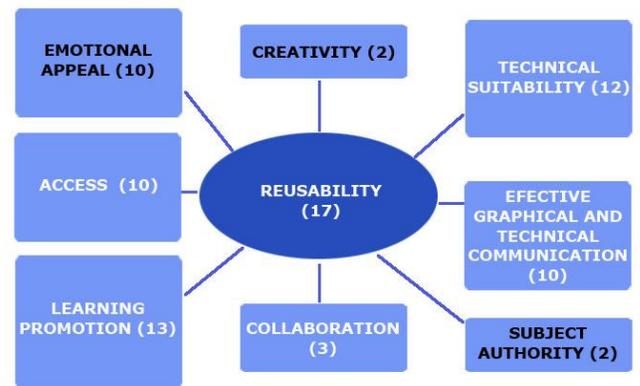


Figure 2. Second conformation of categories related to the reusability of digital learning materials indicating the number of quotations associated (groundedness).

The resulting eight categories and supporting quotes are described below. Saturation of these categories will be pursued in the future through focused coding.

Learning promotion

This category is related to each professor's effort to develop effective learning materials.

- Materials include learning objectives, bibliography, self-evaluation questions, etc.

Technical suitability

This category refers to the technical ability of the professor and the technological adequacy of the learning material.

- A web site design project was developed by the professor himself who masters html language, clear navigation structure, the adequate use of color, etc.

- “This material is very convenient for students, because they have the material in print and digital format. They can do their homework at home or wherever they are and then send me their papers by mail”.

Effective graphical and textual communication

This category refers to a successful choice of graphics and clarity of the textual instructions.

- CAD tutorial presents an elegant use of color and clear textual indications, which make it satisfactory for self-learning.

Access

This category states the possibility that students have to access the materials.

- “No, they don’t need specialized software to open files”.
- “It’s done in Word, is like a text book, with exercises at the end of each topic”.

Emotional appeal

This category refers to the emotional response generated by the material and the emotional manifestations expressed by the professors during the chat interviews related to the material.

- Selection of controversial content, like the Islamic Human Rights Declaration
- “Students appreciate, and even one gave a presentation prompter as a grateful expression for the clear and detailed explanation in the material”.

Collaboration

This category is related to the group activities or the collaborative creation mentioned by the professors in the interview.

- “I use the movie guide to help the groups to resolve a case study of persons and humanism”.

Creativity

This category is related to innovation in the use of technological and educational methods for learning improvement.

- The Religious Sciences presentation achieved simplicity using a combination of graphic, text and color, maybe not elegant, but effective for transmitting complex contents.

Subject authority

Up to date use of disciplinary theories, methods and recognized authors.

- “Yes I use theories of books like Stanton and Kotler, these are course text books, also Internet materials and recent research from ABI [Proquest Academic Business Information], including success and failure cases from marketing specialized magazines”.

CONCLUSIONS AND FURTHER RESEARCH

A deeper knowledge of digital learning materials in universities was achieved as a result of analyzing the data collected. The findings suggest that: (1) learning promotion, (2) access, (3) emotional appeal, (4) technical suitability, (5) effective graphic and textual communication, (6) creativity, (7) collaboration, and (8) subject authority are related to reusability. Reusability is highly grounded in the data. We stress that the data refer to the sample described previously and the results are only applicable to the case analyzed here.

Taking into account these research results, digital collection design will include pedagogical knowledge metadata recollection useful for evaluating the potential reutilization of the learning materials.

Reusability elements reported here and further analysis will be the base for developing a theoretical construction. The described findings also offer initial structural elements for designing and implementing knowledge management oriented systems used for sharing and preserving digital learning material.

This research will continue with focused coding of more digital learning materials and its corresponding chat interviews, the development of a reusability index based in a quantitative methodology and the implementation of an open access and open content digital learning system for preserving and sharing the didactic knowledge of university professors.

Further interviews with students would round out the data sample and will be considered for future research.

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