Design and Development of Learning Objects by Library and Information Science Students

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Abstract: The concept of learning object has changed the way teaching materials are created, developed and distributed. This approach can contribute to an improvement in the quality of teaching/learning and data dissemination without the stakeholders needing to be technology experts. This paper aims to describe and evaluate learning objects created by students of the Digital Content, Documentation and Archiving module of the postgraduate course in Library and Information Science offered by the Polytechnic Institute of Tomar in 2011/2012. The paper also presents students’ feedback about the training provided, the use of eXeLearning, cataloguing of the learning object, its upload to a repository and its use in a professional context. The results show that students have welcomed this technology. They have considered the training provided as appropriate and found eXeLearning easy to use, as well as the cataloguing of the learning object with metadata and its upload to a repository. Most participants considered using learning objects in their own working contexts, considering it a useful tool to effectively respond to some day-to-day needs.

Key words: Learning objects; metadata; repository; learning; eXeLearning; library and information science.

Resumo: O conceito de objeto de aprendizagem veio alterar a forma de criação, desenvolvimento e distribuição dos materiais educativos. Esta abordagem pode contribuir fortemente para melhorar a qualidade de ensino e aprendizagem e a divulgação da informação sem obrigar os intervenientes a transformarem-se em especialistas em tecnologia. Nesta comunicação descrevemos e avaliamos os objetos de aprendizagem criados pelos alunos da unidade curricular de Conteúdos Digitais, Documentação e Arquivo da 1.ª edição da pós-graduação em Ciências Documentais lecionada no Instituto Politécnico de Tomar no ano letivo 2011/2012. Este artigo apresenta também a reação dos alunos à formação recebida, à utilização da ferramenta eXeLearning, à catalogação do objeto de aprendizagem, à sua disponibilização num repositório e ao seu uso na atividade profissional. Os resultados indicam que os alunos aceitaram bem esta tecnologia, considerando a formação recebida adequada e a ferramenta fácil de utilizar, assim como, a catalogação do objeto de aprendizagem com metadados e a sua disponibilização num repositório. A maioria dos sujeitos perspetiva utilizar objetos de aprendizagem na sua atividade profissional, considerando-a uma ferramenta útil para responder eficazmente a algumas necessidades do dia-a-dia.

Palavras-Chave: Objetos de aprendizagem; metadados; repositório; aprendizagem; eXeLearning; ciências documentais.
1. Introduction

Since the 90's of the last century, learning objects have aroused great enthusiasm among education providers [Nurmi & Jaakkola 06]. According to Wiley et al. [Wiley et al. 99], the ethos of learning objects is consistent with the work developed by Ted Nelson who has foreseen that in the future the operating unit of hypermedia systems would be the version and not the document.

According to Hodgins [Hodgins 00], learning objects are destined to revolutionise the way teaching materials are created, developed and delivered. Its applications are varied [Johnson 07] and its benefits are enormous, and therefore constitute an excellent option for teachers, particularly for librarian-teachers and for those who deal with documentation matters and need to transmit knowledge and skills to students and their peers as part of their professions.

The Online Learning Research Committee of EBSS developed a survey to collect information on librarian participation in online instruction and the responses from this survey are an important “indicator of the interest librarians have in creating online instruction and the need for more training venues, both in designing effective learning objects and in identifying the best pedagogically sound practices for teaching in an online environment” [Mestre et al. 11, p. 250].

Moro, Estabel and Nicoletti [Moro, Estabel & Nicoletti 08] refer that learning objects “are present in the educational environment as mediating tools of the teaching/learning process, through virtual learning environments, in the educational strategy where two or more individuals build their knowledge through discussion, reflection and decision-making. Those individuals are the actors involved in the educational scene: the librarians, the teachers and the students” (p. 1). The use of learning objects can even lead to new relationships between teachers, librarians and students through a new integrated communication network [Estabel, Moro & Santarosa 06].

Bell and Shank [Bell & Shank 04] introduce the concept of “blended librarian” as “an academic librarian who combines the traditional skill set of librarianship with the information technologist's hardware/software skills, and the instructional or educational designer's ability to apply technology appropriately in the teaching/learning process”. Learning objects play a leading role among these technologies.

When referring to librarians, Passarelli [Passarelli 05] shows the need to create closer theoretical-practical links with several areas of knowledge, particularly with Information and Communication Technologies (ICT), and even proposes new names for these professionals such as digital librarians, knowledge professionals or information architects.

Also Cohen [Cohen 06], in its “Librarian's 2.0 Manifesto” refers the need for librarians to keep the pace with societal evolution starting by saying: “I will recognize that the universe of information culture is changing fast and that libraries need to respond positively to these changes to provide resources and services that users need and want”.

The need to provide libraries, archives and documentation centres with skilled staff who are prepared to deal with paper-based but mainly with digital documents, prompted the Polytechnic Institute of Tomar to initiate the 2011/2012 postgraduate course in Library and Information Science. The course is aimed mainly at:

1. “Delivering professionals in the library and information science sector who are capable of ensuring a quality work considering the civilisational changes in this new millennium and
2. “Meeting the demands of School Libraries as established by Decree No.756/2009 dated 14 July concerning the creation of the Librarian Teacher career” [Instituto Politécnico de Tomar 12].

The curriculum of this postgraduate course includes an ICT module called “Digital Content, Documentation and Archiving” in which the students are expected to become familiar with the standards concerning the treatment and handling of digital documentation and to gain skills that will enable them to use digital content repositories on the Internet, implement systems for the electronic management of documentation, create and catalogue digital content and use Web 2.0 tools. In the context of the module, the students have been challenged to create learning objects in their area of activity, catalogue them and upload them to a repository.
2. Learning Objects

According to Wiley [Wiley 02], a learning object is any digital resource which may be reused to support learning. Its main characteristics are reusability, interoperability, durability and accessibility [Marques & Carvalho 08]. According to Shepherd [Shepherd 00], there are three types of learning objects: integrated, informational and practice.

The development of learning objects must be based upon a model that describes the individual's or the institution's strategy in this matter [Marques 12]. In this work, we have explored the model proposed by Ally [Ally 04] and the Multiple Perspectives Model to Structure Learning Objects [Carvalho 06]. Once created, learning objects are catalogued with metadata and deposited in repositories.

Metadata are used to help identify, describe, manage and locate learning objects. This is information that can be embedded in the code of the learning object (embedded metadata), stored in a file that accompanies the learning object (associated metadata) or in separate databases (third-party metadata) [Duval et al. 02].

Metadata can include generic information such as the name of the author of the learning object, the date of creation and the language; technical information such as the file format and the requirements in terms of operating system; educational information such as the level of learning and the results; information about copyright; among other relevant information [Rehak & Mason 03].

Currently, several metadata standards and specifications co-exist. The Dublin Core Metadata Element Set (DCMES) is one of the benchmarks of documentation sciences in the digital context having received the contribution from professionals in a wide range of areas from librarians to computer professionals [Hillmann 05].

Storage and management of learning objects make use of repositories that are either stand-alone or are included in other services such as a Learning Content Management System (LCMS) [Downes 04]. Lehman [Lehman 07] class them into generalist, thematic and commercial. Among the most popular are Agrega, ARIADNE, the International Database of Educational Objects, Connexions, HEAL, Ilumina, MERLOT and SMETE Digital Library. In Portugal, the e-Learning Repository from TecMinho is the main reference.

The use of standards and specifications in the creation of learning objects facilitates its sharing and according to ADL [ADL 06] it can reduce related development costs between 50 and 80 percent which justifies the extensive work done in this field during recent years [González & Marin 10].

The SCORM model - the main reference in this field - includes a series of guidelines, specifications and rules developed by several organisations in order to establish a standardised way of sharing learning content between different systems and technologies (LMS, repositories, edition tools, etc). Creation of learning objects according to the SCORM model can be done through authoring and packaging tools such as Adobe Captivate, eXeLearning, KnowledgePresenter, Lectora, Sculptoris, Trident or Xyleme Studio [Marques 12].

This research made use of eXeLearning - a tool developed by the University of Auckland, the Auckland University of Technology and Tairawhiti Polytechnic with the financial support of the New Zealand Government Tertiary Education Commission.

This tool enables us to easily and quickly create standard learning objects making use of text, audio, video, animation, Adobe Flash films, Java applications and PDF files among others, as well as Web 2.0 content. Files are stored in ELP format and can be exported in various formats: SCORM 1.2, IMS Content Package, website, single page, text file and iPod notes.

The eXeLearning allows the insertion of metadata according to DCMES structure; however, it may use specific software such as DC-dot to do it.

Although the content of learning objects may be free and open, copyright and intellectual property must be ensured and in this regard the Creative Commons licences are an excellent option. In Portugal, the current version is 2.5 and includes six user licences [Creative Commons Portugal 10].
3. Study

Political and administrative developments have caused significant changes in the public administration paradigm in general and particularly in library and information science.

It is crucial that those engaged in this activity keep up with these changes and have the tools to face the new challenges of modern society.

This need led us to the following question: Can learning objects become a useful tool for library and information science professionals?

Therefore, in the 2011/2012 academic year, we have undertaken a study within the module Digital Content, Documentation and Archiving of the first edition of the postgraduate programme in Library and Information Science taught at IPT intended to:

- Check the students’ feedback about learning objects;
- Analyse the students’ ability to create learning objects with the eXeLearning software, catalogue them with metadata and make them available in open digital repositories;
- Assess the potential of learning objects for library and information science.

3.1. Characterisation of Participants

Of the 39 students enrolled in the postgraduate course, only 6 did not attend the module Digital Content, Documentation and Archiving. Most of he students who participated in the module activities are women (84.8%). In what concerns age, it ranged from 32 to 50 years, and the mean is about 39 years.

Most of the students are teachers and librarians (Table 1).

<table>
<thead>
<tr>
<th>Professional occupation</th>
<th>f</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Librarian teacher</td>
<td>10</td>
<td>30.3</td>
</tr>
<tr>
<td>Librarian</td>
<td>6</td>
<td>18.2</td>
</tr>
<tr>
<td>Teacher</td>
<td>5</td>
<td>15.2</td>
</tr>
<tr>
<td>Library officer</td>
<td>3</td>
<td>9.1</td>
</tr>
<tr>
<td>Library technician</td>
<td>3</td>
<td>9.1</td>
</tr>
</tbody>
</table>

When questioned about their familiarity with the creation of educational content with the support of computer tools, 48.5 per cent of the respondents reported having "little" familiarity, 39.4 per cent "reasonable" familiarity while the remaining participants reported having "none".

3.2. The Learning Objects Developed

The 33 students were divided into ten working groups and each group developed a different learning object (Table 2). Most learning objects are informative. Stimulating the interest in reading and promoting reading and writing skills as well as creating a read/write repository are further goals of the learning objects.

<table>
<thead>
<tr>
<th>Title</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>José Régio Repository</td>
<td>Disseminate José Régio’s works.</td>
</tr>
<tr>
<td>On-line Readings</td>
<td>Stimulate interest in reading and develop reading, writing and information literacy skills.</td>
</tr>
<tr>
<td>Integrated Risk Management</td>
<td>Show how the conservator-restorer profession articulates with documentation science and its significance in the safeguard of cultural property contained in libraries and public archives.</td>
</tr>
<tr>
<td>Next Stop is the Best Stop</td>
<td>Create a repository containing digital content related to reading.</td>
</tr>
<tr>
<td>A Tour through Regional Literature</td>
<td>Promote regional literature namely José Poças (father and son).</td>
</tr>
<tr>
<td>School Library of Atouguia</td>
<td>Promote interest in reading.</td>
</tr>
<tr>
<td>IPT Documentation Centre and Archives</td>
<td>Presentation and dissemination of IPT’s Documentation Centre and Archives.</td>
</tr>
</tbody>
</table>
**Table 2. Learning objects created within the module Digital Content, Documentation and Archiving**

<table>
<thead>
<tr>
<th>Title</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Mubliando&quot;</td>
<td>Disseminate activities and events targeted at children in a non-school context.</td>
</tr>
<tr>
<td>Carlos de Almeida Museum House</td>
<td>Disseminate the Carlos de Almeida Museum House.</td>
</tr>
</tbody>
</table>

All learning objects have been created with the eXeLearning software, catalogued according to DCMES, and they are in compliance with the SCORM standard. Copyright has been ensured through the Creative Commons Licence.

![Image 1. Learning object “Next Stop is the Best Stop”](image)

None of the students knew the DCMES structure, although some of them had extensive experience in data processing and cataloguing. This experience would, however, reveal to be useful in the completion of the fields and in the usage of international thesaurus.

The evaluation of the objects’ potential has been done by the lecturers in charge of the module using the evaluation grid proposed by Bennett and Metros [Bennett & Metros 02] that are based on the MERLOT Tasting Room Peer Review Process. The grid includes three dimensions: content quality, usability and potential effectiveness as a teaching tool. Every dimension includes a set of items that are evaluated based on a Likert scale where 5 corresponds to "strongly agree" and 1 corresponds to "strongly disagree".

The two lecturers assessed the learning objects individually and the results represent the mean (see Tables 3-5).

Table 3 shows good results for the quality of learning objects contents. They have obtained the maximum score regarding objectivity and conciseness, relevance, accurate information and adequate amount of material.

![Table 3. Evaluation of the content quality of learning objects](table)

Table 4 reports the results for the usability. The learning objects have obtained the maximum score in most items.

![Table 4. Evaluation of the usability of learning objects](table)

Table 5 shows the potential effectiveness of learning objects as a teaching tool. Some groups identified learning objectives and knowledge prerequisites only in the metadata, which has negatively influenced these two items.
Potential effectiveness as a teaching tool | Assessment
--- | ---
A | Identifies learning objectives | 3
B | Identifies prerequisite knowledge | 3
C | Reinforces concepts progressively | 4
D | Builds on prior concepts | 4
E | Demonstrates relationships between concepts | 5
F | It is very efficient (one can learn a lot in a short period of time) | 5
G | Overall rating | 4

Table 5. Evaluation of the potential effectiveness as a teaching tool of the learning objects

In general, the evaluation results have been very satisfactory, both in terms of content and usability as well as in terms of effectiveness as a teaching tool.

4. Students’ Opinions

We questioned the students about the creation of learning objects and their potential use in their own working contexts. To collect the data a questionnaire was prepared in the SurveyMonkey tool. The questionnaire included mostly multiple-choice questions and some open-ended questions. The instrument of data collection was validated by an expert in the area.

As far as training with eXeLearning is concerned, 93.9% of the respondents consider it appropriate and only 6.1% reported that some questions remained unanswered. None of these respondents justified his/her answer.

For 12.1% of the respondents eXeLearning was very easy to use, 66.7% found it easy to use and 21.2% neither easy nor difficult (Table 6).

<table>
<thead>
<tr>
<th>Using the eXeLearning was:</th>
<th>f</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very easy</td>
<td>4</td>
<td>12.1</td>
</tr>
<tr>
<td>Easy</td>
<td>22</td>
<td>66.7</td>
</tr>
<tr>
<td>Neither easy nor difficult</td>
<td>7</td>
<td>21.2</td>
</tr>
<tr>
<td>Difficult</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Very difficult</td>
<td>0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Table 6. Use of eXeLearning (N=33)

Most respondents found it easy to catalogue learning objects with metadata (57.6% answered “easy” and 9.1% "very easy") and 30.3% answered "neither easy nor difficult". One respondent however, found the cataloguing of learning objects difficult (Table 7).

<table>
<thead>
<tr>
<th>Cataloguing the learning object was:</th>
<th>f</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very easy</td>
<td>3</td>
<td>9.1</td>
</tr>
<tr>
<td>Easy</td>
<td>19</td>
<td>57.6</td>
</tr>
<tr>
<td>Neither easy nor difficult</td>
<td>10</td>
<td>30.3</td>
</tr>
<tr>
<td>Difficult</td>
<td>1</td>
<td>3.0</td>
</tr>
<tr>
<td>Very difficult</td>
<td>0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Table 7. Cataloguing the learning object (N=33)

More than half of the students found it easy to upload a learning object to a repository (15.2% found it very easy and 39.4% found it easy), 33.3% answered “neither easy nor difficult” and only 12.1% found this task difficult (Table 8).

<table>
<thead>
<tr>
<th>Uploading the learning object to a repository was:</th>
<th>f</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very easy</td>
<td>5</td>
<td>15.2</td>
</tr>
<tr>
<td>Easy</td>
<td>13</td>
<td>39.4</td>
</tr>
<tr>
<td>Neither easy nor difficult</td>
<td>11</td>
<td>33.3</td>
</tr>
<tr>
<td>Difficult</td>
<td>4</td>
<td>12.1</td>
</tr>
<tr>
<td>Very difficult</td>
<td>0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Table 8. Uploading the learning object to a repository (N=33)

When questioned about their prospects of using learning objects in their own working contexts, 84.8% answered that they intended to use them and the remaining respondents answered that perhaps they will use them.

Those who intend to use learning objects in their own working contexts mentioned that the learning objects are very interesting for promoting learning (21.3%), constitute an innovative way of presenting educational content (17.9%) and are an attractive way of disseminating information (14.3%) (Table 9).

<table>
<thead>
<tr>
<th>Motives given for using learning objects</th>
<th>f</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are very interesting for promoting learning</td>
<td>6</td>
<td>21.3</td>
</tr>
<tr>
<td>Constitute an innovative way of presenting</td>
<td>5</td>
<td>17.9</td>
</tr>
</tbody>
</table>

Table 9. Motives for using learning objects (N=33)
Motives given for using learning objects | f | %
--- | --- | ---
educational content | | |
Constitute an attractive way of disseminating information | 4 | 14.3
Allow a positive strategy to achieve learning objectives | 3 | 10.7
Improve students' motivation | 3 | 10.7
Stimulate research | 2 | 7.1
Make learning more effective | 1 | 3.6
Allow easy creation, edition and dissemination of educational content | 1 | 3.6
Allow the use of information in multiple contexts | 1 | 3.6
ICT technologies are crucial to create high-quality teaching content | 1 | 3.6
Created content can be used in several "platforms": websites, repositories, LMS, etc. | 1 | 3.6

Table 9. Students' prospects of using learning objects in their own jobs (N=28)

Of the five respondents who answered "perhaps", only two justified their option. One of them said that the usage of learning objects in his working contexts is dependent upon the will of his employers and the other that it is dependent on future needs.

The purpose of the learning objects are teaching support (21.2%), delivery of subject content (18.3%), information dissemination (18.3%) and advertisement of institutional activities and resources (12.1%) (Table 10). Two respondents have not answered the question.

| Purpose of the learning objects | f | % |
--- | --- | ---
Creation of a digital repository to host a database of a document collection | 1 | 3.0
Library promotion | 1 | 3.0

Table 10. Purposes of learning objects that are to be created by participants (N=31)

5. Conclusions

Learning objects can be used in any field of study and at any educational level from primary to higher education [Sosteric & Hesemeier 04]. Among other benefits, this approach enables lecturers to quickly prepare high-quality learning materials and activities [Marques 12]; makes full use of virtual learning contexts [Marques 12] and is an excellent medium to promote and disseminate online information [Bettio & Martins 04].

In the context of the Digital Content, Documentation and Archiving module of the first edition of the postgraduate course in Library and Information Science, the students have created learning objects to be used in their own working contexts. Most participants found eXeLearning easy to use. This may be related to the usability and simplicity of the software and the appropriateness of the training (93.9% found training appropriate) because almost half of the participants (48.5%) had little familiarity with the creation of educational content making use of computer tools, and some of them even reported having none (12.1%). eXeLearning has revealed to be an effective, user-friendly software and a free-of-charge solution for designing and developing learning objects.

Most participants also found it easy to catalogue learning objects with metadata and deposit them in a repository. However, at cataloguing level, several issues have arisen such as the interoperability between the DCMES structure and the UNIMARC format used in most libraries, an aspect that is difficult to solve but nonetheless technically possible [Chudamani & Nagarathna 06] [Day 97]. From the analysis of fields we observed that the most experienced participants have used well-known thesaurus such as Eurovoc and DeCS. Therefore, we consider it important that individuals who have never
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worked with cataloguing be provided with specific training in DCMES in order to produce more effective and efficient metadata.

Although digital repositories have been seen as a very good solution to share learning objects, it was found that some students have also made them available at the LMS and LCMS of their institutions.

The learning objects created by the participants have quality content and a good usability and potential effectiveness as teaching tools.

The vast majority of participants (84.8%) consider using learning objects in their own working contexts and the remaining participants perhaps will use them. The fact that the tools are an attractive, innovative way of promoting learning (21.3%), of presenting educational content (17.9%) and of disseminating information (14.3%) are the main reasons cited. The main purposes mentioned are support for classes (21.2%), delivery of subject content (18.3%), information dissemination (18.3%) and advertisement of institutional activities and resources (12.1%).

The results show that it is easy to create quality learning objects and reflect the participants' enthusiasm for the prospect of using them in their own working contexts. The maximisation of these teaching materials will depend on their use in multiple contexts and the validation of its development model will depend on the results of the evaluation of that use.

Other issues should be the object of future research such as to investigate how to encourage Library and Information Science professionals to convert their contents into learning objects; How to promote a collaborative and sharing environment among them; How to encourage reuse; and How to develop training activities on tools for the production of learning objects and metadata without considerable financial charges for the institutions.

Acknowledgement

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References


[Carvalho 06] A. A. A. Carvalho. “Learning objects structured according to Cognitive Flexibility Theory”. 22nd International Council for Open and Distance Education (ICDE) World Conference on Distance Education. Rio de Janeiro, Brasil: ICDE, 2006.


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1 Educational & Behavioral Sciences Section of the Association of College and Research Libraries, a division of the American Library Association.