Learning objects in use

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Abstract

One of the really hot topics in the learning community at the moment is learning objects. Right now a lot of effort is put into developing and describing standards for learning objects – standards like SCORM, Ariadne or Dublin Core. These initiatives will definitely benefit the persons seeking information, but will be an extra burden on the persons supplying the information – the lecturers – since they have to add all the metadata.

In e-learning courses a lot of materials get developed – materials like discussions, essays, taped video sessions etc. – and all these materials are potential learning objects - something that others can reuse. It is therefore important, that it is easy for the lecturer to add metadata to the learning objects, so the objects can be easily found either by other lecturers or by the students attending the course.

In this article we will focus on balancing the need for metadata with the limited time the lecturers have. This is done in several steps: First we define what we think is a minimum amount of metadata and discuss this metadata description to see if it fits requirements of the lecturer, the students and the requirements for describing all the different types of materials. Secondly we propose and develop an open-source tool that can be used to store and retrieve the materials using metadata descriptions and be integrated in a lot of different e-learning systems. Thirdly we will describe how this approach can be expanded to give access to electronic materials like article databases. Finally we give some conclusions and remarks on how to make the creation of learning objects happen.

1 Introduction

In the past decade or so a lot of effort has been put into creating different descriptors for all kind of electronic learning materials. A lot of standards for describing learning materials have emerged like SCORM (SCORM [9]),



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ARIADNE [1] and Dublin Core [6] hand in hand with the development and spreading of e-learning systems. One example is the birth of the Dublin Core metadata standard [6]:*"Yuri Rubinsky of SoftQuad (who chaired panels regarding the future of HTML and Web authoring tools) along with Stuart Weibel and Eric Miller of OCLC (who were presenting papers about scholarly publishing on the Web and leading discussions on the delivery of Web-based library services) had a hallway conversation with Terry Noreault, then Director of the OCLC Office of Research, and Joseph Hardin, then Director of the National Center for Supercomputing Applications (NCSA). This discussion on semantics and the Web revolved around the difficulty of finding resources (difficult even then, with only about 500,000 addressable objects on the Web)"*

Describing materials have a much longer tradition in the libraries, where description and cataloguing have been done for a long time (in Hermann [8] an instruction for the library from 1797 is quoted) but the descriptors for learning materials - or learning objects – take into account the teaching and learning aspects.

All of these descriptors use metadata. Metadata (Day [5]) are traditionally defined as data about data, information about information, and are used to describe document contents and structure, relations to other data items, the properties of the corresponding data domains, legal rights etc. Metadata are also useful to provide textual descriptions for non-textual objects, for example, to enable the representation of multimedia document properties in a structured way, simplifying document management, search and retrieval (Yoon and Kim [12]). Today, most collections of articles and other learning objects worldwide have already adopted metadata as the basic tool for resource description. Following this trend, metadata recommendations for educational systems are one of the most productive activities in the standardization of computer-based learning systems (Anido et al [1]).

One of the advantages of e-learning is that all communication and materials are digital. This implies that it can be stored and retrieved at a later stage for the students to look at again; a property that adds a lot of flexibility to a course. In an e-learning course a lot of material gets created. In one example – an introductory programming course – over 100 video mediated materials, 50 program examples, 10 PowerPoint shows and a lot of relevant text based materials were created. For a more detailed description see (Bennedsen and Caspersen [3]). A lot of these materials have a broader usage than the limited usage in the concrete time of the course where they were created; it can be used to give alternative presentations for the topics in the course, as answers to questions etc. This naturally gives rise to the question: "How do the students find the relevant material"? If the e-learning system just uses text-based messages it is possible to do a text search using the search facility that is part of most e-learning systems (given that the search sentence is part of the text based material. If it is needed to add other information (e.g. keywords) metadata is needed for text based materials as well.) But what about the other types of material like videos, applications, images, program examples, etc? These are not searchable, so there is a need for metadata describing the content of these resources.



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If we look at the different metadata standards for learning objects, their goal is to add metadata making the materials reusable. One way of saying this is (SCORM [9], p. 21): "*It is intended to provide the technical means for content objects to be easily shared across multiple learning delivery environments*". SCORM as an example have four major goals: Accessibility, interoperability, durability and reusability – all goals related to the idea of creating learning objects that can be (re)used in many settings. One of the consequences for this reusability is a lot of fields in the description related to property rights; SCORM has nine categories: General, lifecycle, meta-metadata, technical, educational, rights, and relation to other objects, annotation and classification (SCORM [10]).

2 Minimum metadata definition

The approach here is to give the students a possibility of retrieving the different learning resources that is created during a course. Examples of these are streamed video lectures, slide shows with audio speech, solution to exercises etc. This use of the metadata implies that it is not so much reuse of the materials in other course setting that is the goal rather it is descriptions within one course. Therefore the different metadata fields related to lifecycle, meta-metadata, rights and relation to other objects are not needed. As a consequence we have developed a scaled down version of the SCORM metadata model. This metadata description has as its primary goal that the students can find the learning objects again.

The big challenge in developing such a model is to include only the absolutely necessary fields. The main argument for this is that it normally will be the lecturer (or someone with knowledge of the field appointed to the job) who will have the obligation to create the metadata for the learning objects – an extra burden on top of the responsibility of preparing, holding, evaluating the course etc. It is therefore vital for the success to keep the metadata down to a minimum and create a simple and user friendly interface to enter the metadata.

On the other hand Forsyth (Forsyth [7]) asks the question "*Why do you want to deliver your course using the Internet*?" He argues that many institutions do it wrong because they just places translated paper-based materials on the Internet. His point is "*Where the Internet gains credibility in an educational context is the capability to be interactive and resource rich*". This implies that the metadata descriptions must be able to handle descriptions of many different kinds of material such as images, videos, audios, applications etc. This seems to imply that the metadata description must be very large; a problem when it is the lecturer that has to create the metadata.

The interesting question is therefore: "What are the necessary metadata elements that make it possible for the students to find the relevant learning resources?" The metadata elements should make it possible to describe the content of the resource. We have done this by having the following metadata elements:

- Title: A short sentence describing the resource as a hole.
- Author: The creator of the resource.

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- Description: A description of the content.
- Keyword(s): relevant keyword(s) within the course.
- Date: When is the resource created
- URL: The address of the resource

We have found these five metadata elements sufficient for the students. The only element that is not directly related to the possibility of searching the materials is the author. We have included this metadata element in order to give the students a possibility to judge the quality of the resource (i.e. is it created by the lecturer, other lecturers or another students in the course).

3 The system

We have created an open source system based on the XML standard (XML [11]). The metadata are stored as XML files. This way of storing the information gives great flexibility when we want to display the data since we can parse the XML files (for example show the title as a link to the material). By using folders to store the different metadata descriptions (i.e. XML files) the different materials can be categorized. The definition of the category is a special XML file placed in the folder.

The database stores only the metadata descriptions not the content of the material. The content is stored somewhere on the web and is referenced by a URL. This gives a great flexibility since it is possible to add materials that are not created in the course or materials that are accessible on other web-servers. If it is required that the material must be password protected, this is implemented on the web server storing the material.

This way of storing the metadata gives the possibility to use an open source XML database in order to make the metadata searchable. We therefore have the possibility to create a web interface for the material that shows the material in the chosen categories regardless of the actual placement of the material (this is shown in a web-browser):

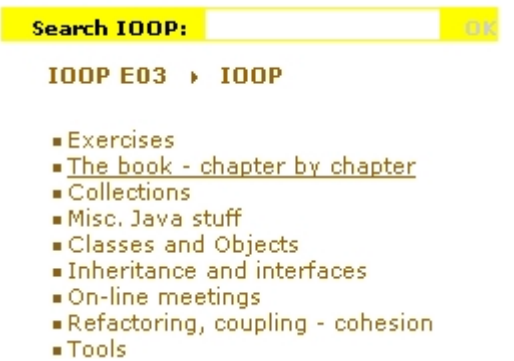


Figure 1: Categories of materials in an introductory programming course.

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The categories are defined by the lecturer. A resource can be in more than one category, but replication of the metadata is then needed.

When the user clicks on one of the categories, the metadata for the resources in that category is shown (notice that the resources in the example below are videos):



Figure 2: Some learning objects in the tools category.

The really big advantage is the possibility for searching. This implies that the students can find the relevant materials created in the course.

By using XML we have the possibility to create different metadata description by using different XML schemas. This implies that the lecturer (or other creators of metadata) can create their own metadata definition with metadata elements of their choosing.

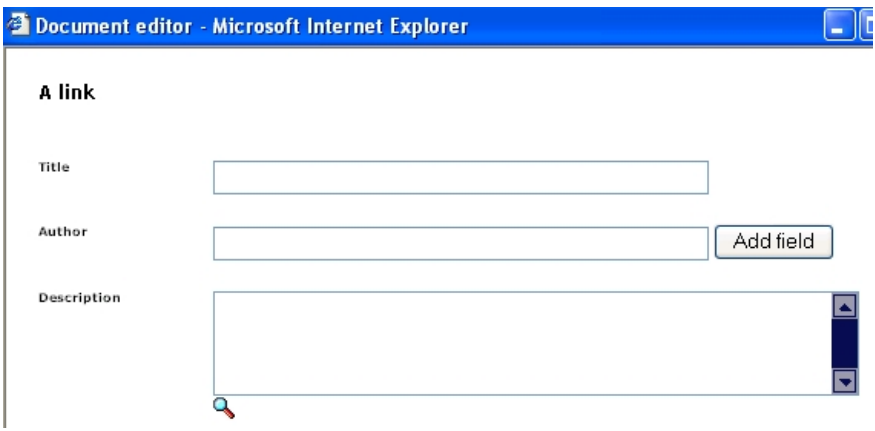


Figure 3: Form for describing metadata.

We have created a web-based interface for the metadata suppliers. We have created two types of interfaces for metadata suppliers: one where it is possible to

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create categories and one where you just select the category and then add the metadata. The metadata entry interface passes the XML schema and creates input fields for the relevant metadata elements.

4 Evaluation

The system has been in use in one course and is currently being used in two other courses. The one course where it was used was the introductory programming course mentioned above. There were 32 students participating in the course. We have evaluated the usefulness of the system by qualitative interviews with a representative selection of the students from the course (nine students all in all). Furthermore we have interviewed the lecturer and the teaching assistant involved in the course.

4.1 The main results of the evaluation

- Only 50% of the students have used the resource database. The rest of the students did not know that they could search the materials. If they had known, they indicated that they think it would have been very useful.
- The students had hardly any use the system during the course but used it during their preparation for the exam. They explained that the course design (one topic pr. week) implied that they had very little need for extra materials. But at the exam period they needed to understand all the topics and could not only focus on materials for one topic.
- The students found the interface simple to use and the descriptions for the materials useful.
- The lecturer and teaching assistant found the interface for creating metadata a little difficult to use. They would have preferred integration with a web browser.
- The teaching assistant supplied the videos with indexes (the time a given topic starts in the video). This serves both as a description of the video and as a guide for the student showing him what part of the video is relevant.

We will evaluate the use of the system for the two courses in this semester. The use of the system in one of the courses is a little different: The course is based on materials available on the Internet. The system is here used for describing the already available materials (i.e. adding metadata like description, reading depth, mandatory text etc) and making these metadata searchable.

5 Integration of library resources

Particularly in distance education settings we have observed that the students do not use academic articles or other academic materials. Neither do they use the databases available at the library for searching relevant information. At the most they use Google or other search engines, but this approach has many drawbacks. One is the quality of the materials they find. Another is that they probably do not hit any academic articles since they are not freely accessible on the Internet.



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The Danish Electronic Research Library was founded in 1996 with the aim of providing electronic access to many articles etc. They have negotiated rights for all students and staff of the Danish Universities to search and read many of the article databases and full text articles. These articles are accessible within the network on the campus or by different solutions (like proxy-servers and passwords) to the students outside the campus.

The solution created here uses the Z39.50 standard for accessing library databases. It is possible to include a database in the search (and which fields in the metadata description) if this database is Z39.50 compliant. This part is work in progress but we believe that this integration of library materials in the e-learning platform will have the effect that the students will use the library materials much more.

The XML database used is also compliant with the Z39.50 standard. It is therefore possible to make all the materials created in a particular course accessible for other than the students participating in the course.

6 Related work

In [4] Collis they noticed five outcomes from practice. "*Of the hundreds of thousands of objects in the TeleTOP database for the University of Twente, the large majority are submissions by learners, many of which are re-used by other learners as study resources. The system has not replaced the book but extended it, so that resources from many different origins, often located by the participants, form a dynamic and growing resource collection"*. In their setting this is done as part of a commercial system, not as an open-source component the course designer can add to an existing course web site. As described above we are also working on integrating library resources as part of the system

7 Conclusion

We have described an approach to learning objects where the main purpose for the learning object not so much is reuse by others but reuse within a course. This is relevant in e-learning settings where all the materials are digital. When e-learning uses richer types of materials than merely text based materials, metadata is needed. We have proposed a minimal metadata description and developed an open source system based on the Z39.50 standard in order to make the metadata descriptions available and searchable for the students. Furthermore we have evaluated the use of the system by students and lecturers.

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References

[1] Anido, L.E. et al, Educational metadata and brokerage for learning resources, *Computers and Education*, **38(4)**, pp. 351 – 374, 2002

[2] Ariadne, www.ariadne-eu.org/en/publications/metadata/ams_v32.html, last visited December 4, 2003

[3] Bennedsen, J and Caspersen, M., The Rationale for Designing a Programming Course for Adults, Proc. of International Conference on Open & Online Learning, 2003

[4] Collis, B. The TeleTOP initiative: new learning, new technology, *Industrial and Commercial Training*, **34(6)**, p 216 – 222, 2002

[5] Day, M., Metadata in a nutshell. *Information Europe*, **6(2).** 2001

[6] Dublin Core Metadata Initiative, www.dublincore.org/, last visited 27 November 2003Forsyth, I. *Teaching and Learning Materials and the Internet*, Kogan Page, 2001

[7] Forsyth, I., *Teaching and Learning Materials and the Internet*, Kogan Page, 2001

[8] Hermann, Else, Mod fælles standarder (towards common standards) (in Danish), Biblioteksstyrelsen, 1999

[9] The SCORM overview, version 1.2, available at www.adlnet.org, last visited December 4, 2003

[10] The SCORM content aggregation model, version 1.2, available at www.adlnet.org, last visited December 4, 2003 [SCORM2]

[11] XML reference, www.w3.org/TR/REC-xml, last visited December 4. 2003

[12] Yoon, J. P., & Kim, S., Schema extraction for multimedia xml document retrieval. *Procs. of the 1st International Conference on Web Information Systems Engineering (WISE'00)*. IEEE Press. 2000



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