

Challenges Facing the Retrieval and Reuse of Learning Objects

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Abstract. This paper investigates organisational, cultural and technical challenges facing the retrieval and reuse of learning objects. Although there are many barriers to learning object reuse, large learning object repositories comprising objects such as web pages, images, documents and presentations are being built. While some of these resources have meaningful metadata associated with them, many do not. Academics are sometimes successful in reusing digital material, but the searching of repositories is a significant issue. Future work will investigate how to improve the effectiveness of learning object retrieval.

1 Introduction

Challenges facing the retrieval and reuse of learning objects can be divided into three broad categories: organisational, cultural and technical. There is substantial overlap and interaction between the three categories.

Organisational barriers are those that exist because of the structure of institutions. Examples of this include the difficulty in establishing a model of funding for resources that are created in one part of an institution and reused in another part, and the fact that different parts of an institution may be competing for students, and therefore not amenable to sharing resources.

Cultural barriers exist because of the past experiences or attitudes of academic staff. These barriers can either be to the contribution of material to a learning object repository (LOR) or to the reuse of material already contributed. The first may be as a result of insecurity about the quality of material, the feeling that others may take credit for one's hard work, or a fear of losing control. An illustration of the second, in a different context, is the difficulty in getting agreement on an appropriate textbook between academics teaching similar material, despite the obvious benefit in reducing the number of books that a student needs to buy. In general people want to put their own imprint on the material they teach, or approach it in a slightly different way. There are also difficulties associated with the pedagogical mismatch of learning objects.

Several technical problems also exist; these include design of appropriate user interfaces for both the submission and the retrieval of material; the choice of file formats appropriate for reuse; and the storage of the learning objects in a manner that allows for efficient access.

Some issues overlap these different types of barriers. For example, the management of access rights to material in a LOR can be seen as an organisational issue as a result of the need to track access across organisational units; as a cultural issue because academics want to retain control of material that they contribute to a LOR; and as a technical issue because of the difficulties of representing digital rights management requirements in a machine readable format.

In Section 2, we review findings of previous work on the barriers faced by university staff in reusing digital learning material. Section 3 analyses the types of resources currently available in LORs. We have begun to investigate how academics successfully reuse learning objects, including what their information needs are, and report on our preliminary findings in Section 4. The final section provides an overview of our proposed future research on effective retrieval techniques for learning objects.

2 Attitudes to reuse

In our previous work [3] we examined some of these barriers by conducting interviews and focus groups with people involved in projects supporting the reuse of material. Issues raised by interviewees and focus group participants included intellectual property considerations, loss of control of resources and the purposes for which they are used, distrust of the motivation of the institution, previous experience with poor user interfaces, and the importance of supporting academic staff to encourage commitment to cultural change. In addition, we conducted a survey that examined the attitudes of staff at an academic institution to the reuse of digital material for teaching and learning. The institution, RMIT University, is a dual-sector institution, and the 54 survey respondents were involved in teaching and learning in either a higher education (HE) setting, or a vocational education and training (VET) setting. The survey asked questions about how academics felt about using resources created by other staff, contributing their own resources for use by other staff, and the technical requirements of a system to support this reuse.

A high percentage of respondents said it was important to be able to reuse and adapt material without restriction. There was a difference in the attitudes between respondents from VET and HE. It was more important to HE respondents that they be acknowledged as the creator of a resource. On the other hand, it was more important to VET respondents that they be able to control the way that a resource is used.

In spite of these difficulties there is a strong desire among many academics to reuse material produced by others and to offer their own material for reuse. There are many drivers for this desire, including opportunities for the iterative improvement of resources, and the kudos associated with producing high-quality material that is reused by others. This kudos might be usefully compared to the prestige achieved by publishing research work. Leaving aside the relative funding models for research versus teaching, the distribution of research findings in research publications are the primary output of research practice. However,

File type	Collection 1		Collection 2	
	Number	Percentage	Number	Percentage
image	254 448	54.8%	8 777	33.1%
HTML	124 261	26.8%	6 072	22.9%
Flash	37 503	8.1%	3 389	12.8%
support	18 892	4.1%	3 225	12.2%
document	12 799	2.8%	3 055	11.5%
other	16 404	3.5%	2 018	7.6%

Table 1. Breakdown of collections by file type.

the primary use of learning objects is in the classroom, and any release of these materials for reuse by others is additional secondary work.

Several authors have examined the impact of relative rewards given to teaching versus research on the development and reuse of learning objects [4, 5]. Taylor and Richardson [7] attempt to address the issue by describing a peer review scheme for information communication technology based material for teaching and learning.

3 Examination of learning object collections

The debate about the definition of a learning object has been vigorous, and a number of authors have discussed the arguments [2, 6, 8]. To understand the nature of existing LORs, we have looked at two collections of learning objects. Rather than attempting to define a learning object as an abstract concept, we have examined the types of resources that are being stored for reuse.

Collection 1 consists of 26 536 files that have been used as part of a number of business related subjects. These files have not been developed to comply with any learning object standards. While descriptive metadata has not been added to the resources, there is a certain amount of metadata associated with them, such as the name, size and modification time of the files. The files are currently being reused in the same context over time, though it is not clear if they are being used in different contexts.

Collection 2 consists of 4.3GB of compressed material comprising almost 1 000 SCORM-compliant composite learning objects. This collection is managed by an organisation that oversees the development and maintenance of significant numbers of learning objects targeted at VET across Australia. In total there are 464 307 unique files.

The breakdown of file types for each collection is shown in Table 1. Files have been grouped according to their file extensions, and similar file types have been merged. In both collections image and HTML files account for a large proportion of the total files, and there are significant numbers of Flash files, support files (XML Schema documents, JavaScript, Cascading Style Sheets and Macromedia notes) and documents (Microsoft Word, RichText, PDF and PostScript).

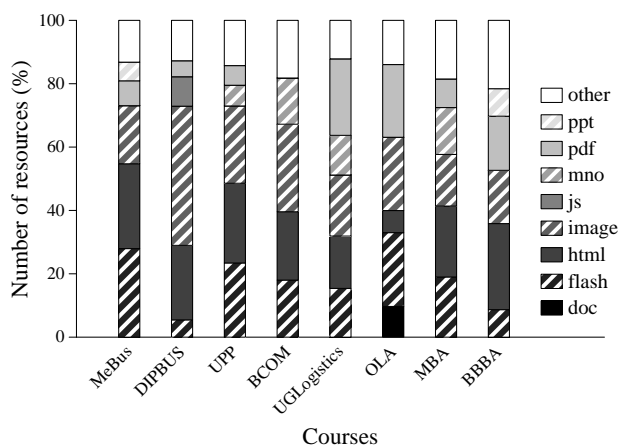


Fig. 1. File types by course

A cursory examination of the links in Collection 1 reveals that many files have been combined for presentation. As there are many HTML files, which generally include hyperlinks, this is not surprising. There are 29 872 link anchors and 17 961 links to images in the HTML. Of the anchors, 5 456 link to the target **top** within the document. Of the links to images, 3 216 link to files with “icon” in the file name and 234 of them are called `rmitlog.gif`. While these are being reused, it seems likely that these images add only presentational value rather than educational value.

Figure 1 shows the percentages of different file types in Collection 1 by course. The courses are sorted by the average modification time of the files within the course. The course with the average oldest files appears on the leftmost side of the graph.

We are also extending our examination of learning object collections, and hope to reach agreement with the maintainers of additional LORs to use the resources for research purposes.

4 How academics successfully reuse learning objects

We are currently interviewing academics who have successfully reused material to examine the problems that they faced in their reuse, but also to look at the things that helped them. We are also investigating the types of material that people are able to successfully reuse, and hope to establish appropriate information needs that can be used to construct queries to test various retrieval and ranking techniques.

Subjects being interviewed are RMIT University academic staff teaching in either VET or HE. Potential interviewees were identified through discussions with members of groups involved in the production, use, reuse and management of reusable learning objects. Three groups were asked to nominate staff

for interview; one at university level, one at academic faculty level and one at school level. These groups were identified as being involved in the production, use, reuse and management of learning objects in the first stage of our research. Participation of interviewees is voluntary and confidential.

Interviewees were first asked questions about the sorts of resources that they have reused, including the characteristics, file types and granularity of the resources. They reported the reuse of a wide range of resources, from the text of a single web page to a set of lecture slides appropriate for the lectures of an entire subject, and file types including HTML, Macromedia Flash and Microsoft Powerpoint.

We then discussed how the resources were reused, including the offerings they were reused in, what contextualisation was necessary, and what difficulties they encountered and support they received when attempting to reuse.

Material was reused in a number of different ways. First, academics gained permission to use third-party material, which was then manipulated or contextualised. Second, academics had the material developed specifically for them. Respondents reused material in offerings of the same subject targeted at different student cohorts or in offerings of the same subject at a different time. Some reuse also involved the conversion of the material to different formats.

Interviewees were questioned about how they searched for resources for reuse, and what types of information needs they were trying to satisfy. Several different types information needs were revealed. While some interviewees were content to find material to build upon and contextualise into existing material, some interviewees want to reuse material with no or minor adaptation and are not concerned with the contextualisation of the resource. Further, the granularity of desired results ranged from a single resource on a single topic to an entire semester's material, as well as much in between.

The level of support varied between respondents. Departments exist within some academic units whose sole purpose is to assist academics develop and reuse digital material. Suggestions for the reuse of material often came through these departments, and difficulties in reuse were absorbed by them rather than passed on to the individual academic. In another case, while appropriate content was suggested by a central university source, the interviewee was left to manage the conversion of the material to an appropriate format.

Finally, participants were asked to reflect on their experiences and discuss how they would like to reuse resources in the future.

While this is a work in progress and detailed analysis has yet to be carried out, preliminary findings support our previous findings that there are differences in attitude between those involved in HE and those involved in VET. VET interviewees seem to take reuse as a given, with much ad hoc sharing going on in their departments already. For example, most departments provide a shared network drive where teachers can store their material, with the understanding that resources should be used in different subjects where possible. There also seemed to be a tendency to reuse material of a larger granularity in VET. Some HE staff expressed exasperation at the unwillingness of their colleagues to share

material, or to reuse material that others have made available. We surmise that the greater acceptance of sharing may be a result of the high number of contact hours and extensive use of sessional employees as VET teaching staff. Additionally, VET teaches competency-based material where the competencies are mandated by government agencies.

In general the interviewees have a positive attitude to reuse, and most have stated that they are willing to keep trying to reuse material, despite the difficulties they have faced.

5 Conclusions and future work

We have observed that in spite of many barriers large LORs are being built and academics are sometimes successful in retrieving and reusing digital resources from these repositories.

Our upcoming work will use the information needs and queries that we have established to examine methods for the effective retrieval of learning objects from LORs. The dominant technique for learning object retrieval is through searching metadata assigned to a resource when it is submitted to a LOR. There are a number of problems associated with the use of descriptive metadata for learning object retrieval. Who is responsible for producing the metadata and associating it with a learning object? Should it be the producer of the material, who is an expert in the field, or an expert cataloguer? There is a mismatch between the person doing the indexing, who has the resource in front of them and is basically engaged in a descriptive exercise, and the searcher, who is unlikely to have a particular resource in mind but is trying to fulfil an information need and may use a wide variety of search terms. The process of assigning metadata is time consuming and expensive. The assigning of metadata is secondary to the use of the learning object in a teaching and learning context, and is often treated as less important. Many of the difficulties associated with the use of descriptive metadata to aid retrieval have been discussed in the field of information science [1].

We will be examining various techniques for retrieving and ranking learning objects, with a focus on using the primary resource and information about the uses of that resource to enable effective retrieval. All retrieval and ranking exercises use characteristics of the collections they are searching to develop heuristics to aid the ranking of search results. We will examine the resources in various LORs and collections to investigate what characteristics of learning objects might be useful for the development of ranking heuristics. These techniques include full-text search on text extracted from learning objects, analysis of links between hypertext resources, analysis of the structure of composite learning objects, and analysis of the usage patterns of resources.

Following on from the different types of information need required by searchers, further work hopes to address issues of what is the appropriate information to return to a searcher. For example, if a resource is a composite resource, comprised of a number of HTML pages that are designed to be traversed or navigated

through in a certain order, is it appropriate to return a page from the middle of a path or is it better to return the entry page.

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