Educational Resources Packaging Standards SCORM and IMS Common Cartridge – The Users Point of View

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Abstract. This paper reports on an exploratory study analyzing the Educational Resources' packaging standards SCORM and IMS Common Cartridge's (CC) regarding interoperability from the point of view of key users: teachers. The two specifications SCORM and CC to package Educational Resources have been developed to help the users to re-use Learning Objects from Learning Object Repositories (LORs) in Learning Management Systems (LMS) of schools. In our study, we found that teachers find packaging solutions highly useful, especially the interoperability between LORs and LMSs. Teachers also appreciated that they can modify packaged content after it has been uploaded to the LMS. The teachers also strongly appreciated the additional functionalities of CC packages while teaching courses online or giving home work/extra assignments to their students.

Keywords: Educational Resources, content packaging standards, Learning Object Repositories, SCORM, IMS Common Cartridge, teachers

1 Introduction

This paper shows the views of teachers on interoperability between Learning Object Repositories (LOR) and Learning Management Systems (LMS) supported by two content packaging standards: SCORM and IMS Common Cartridge (CC). We set up a testing experiment and survey to find out 1) whether teachers would get any additional value from using these standards and 2) whether tools used to support these standards are reasonable for teachers to use in their everyday teaching.

According to The IEEE Learning Technology Standards Committee, a Learning Object is defined as "any entity, digital or non-digital, that may be used for learning, education or training" [1]. Learning Objects in this paper are defined as digital objects which can be used, re-used or referenced during a technology-supported learning process [2]. Educational Resources can be defined as Learning Objects that can be employed in technology-supported learning [3]. Learning Object Repositories are collections of Learning Objects that are accessible to users via a network without prior knowledge of the structure of the collections [4]. Distribution of Educational Resources is most commonly done via LORs. This study investigates the views of teachers re-using and sharing Learning Objects from LORs with the help of interoperability standards SCORM and IMS Common Cartridge. In their everyday

lesson preparation, teachers use Educational Resources in LMS such as Moodle [5]. LMS help teachers to manage digital contents, to aggregate blended learning and give homework to their students.

Recent research involving packaging standards SCORM and IMS Common Cartridge has been focusing on the technical specifications [6],[7],[8], without investigating the teachers' point of view. The assumed benefits of SCORM and CC have not been verified by the end user group, leading to the questions of this study: Are the teachers willing to use SCORM and CC packages in their busy schedule of designing Educational Resources for their classes. Is the use of content packaging yet another technical problem which the teachers will not be able to handle with a reasonable amount of training?

This study aims to examine what the real users, the teachers, think of using these Learning Object packaging standards and ask if they can see the interoperability between LOR and LMS facilitating the work they are doing in their everyday lesson plan creation process.

When trying to evaluate the impact of a learning technology standard to the users, it is important to realize that specifications cannot be evaluated by users as users do not work with them directly. Rather, interoperability specifications are implemented in software tools offering a set of functionalities to the end user. End users can then make use of the tool in practice and that use can be evaluated. The evaluation results need to be analyzed in detail to assess whether problems are caused by the interoperability specifications or by the functionality provided by the tool, or the user interface through which the functionality is made available to the end user. [9] However, it can be evaluated whether the users have understood and used the key concepts of a specification (such as packaging or metadata categories). To avoid this problem, we look at the key concepts and functions enabled by the standards. As SCORM and CC are both standards which are widely implemented in tools, we can map the standards' concepts and the resulting functionalities in the tools, which are then assessed in practical experiments. Therefore we tested the standards by using the tools keeping in mind that the interfaces of these players could affect the minds of the users.

2 Open Educational Resources Packaging Standards

In the following, we discuss the content packaging specifications SCORM (Sharable Content Object Reference Model) and IMS Common Cartridge (CC).

2.1. SCORM

The Sharable Content Object Reference Model (SCORM) was created to help the re-usability, interoperability, portability, access, maintenance and adaptation of Learning Objects. [10] SCORM is a collection of standards and specifications that enable learning platforms to find, import and deliver learning content in a standardized way. SCORM specifies how Learning Objects must be created in order to ensure interoperability across different platforms and tools. [7]

SCORM was originally intended for use in self-study, computer-based training scenarios rather than in interactive scenarios between teachers and students. SCORM's crucial functionality 'sequencing' supports the learner by allowing him/her only to navigate into parts of the package based on the previous learning assignments fulfilled. However, it can be said that SCORM was created to help teachers when transferring collections of Learning Objects, typically from an LOR to an LMS.

To date, most popular Learning Management Systems support SCORM objects [11] among these the system of Moodle. SCORM packages can be uploaded as single, unmodifiable entries to Moodle.

2.2. IMS Common Cartridge

IMS Common Cartridge (CC) was supposed to enhance SCORM, offering more flexibility and support for assessments, web 2.0 standards, content authorization, collaborative forums and outcomes reporting [7]. The aim of IMS Common Cartridge was not to compete with SCORM but to support to blended learning rather than self learning. According to IMS [12] the IMS Common Cartridge specification's objectives for facilitating teaching include increasing flexibility, sharing and re-use. CC enables teachers to assemble lesson plans taking only parts of an CC package or integrating the whole package into their LMSs. This study aimed to find out how teachers saw the difference of interoperability when using IMS Common Cartridge packages integrated into a Moodle LMS.

IMS Common Cartridge is not as widely supported by different LMSs as SCORM perhaps because there are not yet as many tools to support it. However, LMS Platforms have gained growing interest towards IMS Common Cartridge support. It is still gathering momentum, which should increase by the announcement [13] from the popular open source platform Moodle to start supporting IMS Common Cartridge packages in the spring of 2010 on. Users can upload CC packages as a whole into the Moodle system much in the same way as uploading SCORM packages.

3 Test Setting

Adopting Standards and Specifications for Educational Content (ASPECT) is a Best Practice Network for educational content that aims at improving the adoption of learning technology standards and specifications [14]. Standards and interoperability experts produce recommendations that are implemented by tools and content providers before being tested by teachers during school pilots. Tests were carried out in order to demonstrate in which way the implementation of Standards and Specifications leads to greater interoperability and cross-border re-use of content [15]. The Learning Resource Exchange (LRE) is a pan-European federation of Learning Object Repositories [16]. The service is offered to stakeholders providing digital content, such as ministries of education, commercial publishers, broadcasters, cultural institutions, and other non-profit organizations offering online content to schools [17]. The LRE was used as the testing LOR in the ASPECT project and it provided the possibility to get the same package available in all the different formats (web page,

SCORM package, CC package, SCORM in Icodeon player and CC in Icodeon platform) in its metadata (see section 3.2 for further information).

Our main research aim is the validation of artifacts: the standards SCORM and CC as well as corresponding tools. As these standards are widely implemented in tools and rely upon them in practical experiments, the use of these tools can be considered a valid evaluation of the standards [9]. This paper mainly looks at the design evaluation [18] in an experimental setting [19] and essentially the usability aspects [20]. Both SCORM and IMS Common Cartridge have different versions which support different features. This study focuses on the key feature of compatibility and portability of resources as it can be seen as a critical feature for teachers when re-using learning objects from repositories.

3.1. Validation Group

A teacher workshop was organized for a group of 44 mathematics and science teachers equally split, from Portugal, Lithuania, Romania and Belgium. The four countries were chosen randomly among the participating countries to the ASPECT project. Teachers were selected to have the following characteristics: teachers of mathematics, science and/or technology, some experience with ICT and Learning Resources and currently teaching students aged 6 to 21. Before selecting teachers on the basis of these profiles, the strategy for finding volunteers varied from specifically contacting teachers who, in one way or another, had collaborated with the selection team before (e.g., Portugal) to publishing an open call for volunteers (e.g., Lithuania).

Initial observations showed that the ICT skills of this group of teachers ranged from little knowledge (a few even unsure of what Google was) to advanced (users of LaTeX). Up to 80% of the teachers had advanced ICT skills. The group of advanced teachers was strongly represented. The validation results must be seen in this light: Teachers participating in European projects tend to be more motivated towards ICT and improving their teaching methods. These teachers have clearly higher levels of motivation and are very eager to share their knowledge and expertise. As a consequence, it must be taken into account that if these teachers find the project tasks and concepts too difficult or uninteresting, one can be reasonably certain that this will apply even more so to teachers with average levels of ICT competence.

3.2. Tests Description

The workshop combined straight-forward assignments and direct feedback gathering from the teachers in the form of interviews and two surveys. The test session was organized in May 2010, concentrated on the integration of Resources into Learning Management Systems and content packaging. In preparation for the tests, teachers had already learned how to create basic courses on Moodle platform. They also had learned how to browse the Learning Object Repository, LRE.

In the tests, teachers were initially asked to create a normal lesson plan using the Moodle learning platform in a “traditional” way by combining different Resources. Then they were asked to repeat the same task using a Resource on the same topic that

had been ‘packaged’ by ASPECT content developers using both the SCORM and IMS Common Cartridge packages. The test task was to create a simple lesson plan made up of some text, an image, a quiz and a forum, on the topic of thermodynamics for Moodle, using four different approaches:

1) Using non-packaged content
2) Using the entire SCORM package (created from the non-packaged content)
3) Using an entire IMS Common Cartridge package (created from the non-packaged content, with a forum added)
4) Picking up parts from the IMS Common Cartridge package

The tests were designed to serve both as a basic training on the use of different types of packaged content and their features (necessary as the teachers had no previous experience with this kind of content) and at the same time obtain their reactions as rewards to usefulness in their everyday teaching, interest and facility to use. Each teacher had an empty Moodle course and editing rights. Each teacher designed the same lesson plan four times as described before. Teachers searched for the resource in question in the LRE, where it was provided in the 3 formats, both to view and download. For the non-packaged lesson plan, teachers had to use Moodle options to create the quiz and the forum themselves. Both the SCORM and Common Cartridge packages had the quiz included in the package, and the latter also contained a forum.

Additionally, teachers were presented with a dozen additional Resources packaged as SCORM and Common Cartridge to browse through and see their benefits, independently of the topic of the Resources. In all cases, to view the packaged content, Icodeon’s Common Cartridge Platform and SCORM player were used as the tools to show the packaged content.

4 Results Analysis

As the sample size of the survey (n=44) was small, the results of the statistical analysis can only give us some indication on the teachers’ attitudes. The survey results were backed up by a qualitative analysis of interviews of the teachers.

Generally, the teachers reacted to SCORM Resources in much the same way that they treated unpackaged content; for example, they did not see much difference between having a SCORM Resource and a PowerPoint presentation. While they saw that a SCORM package could include more than one resource, they did not use it any differently than PowerPoint; both types of content were integrated into an LMS as a single, unmodifiable entity. In comparison, the teachers were very enthusiastic about CC content packaging. After importing a CC package into Moodle, the teachers could remove parts that they did not need, edit the content and change the order of different resources. Many teachers requested instructions on how to adapt Moodle to use CC packages and even some teachers expressed an interest in using CC to package their own content in order to share it with other teachers.

Most teachers had little interest in simply viewing and playing SCORM or CC packages. On the other hand, apart from the option to upload the complete packages into an LMS and have the different parts of the package converted into Moodle format, the teachers liked the possibility of being able to embed only parts of a

Common Cartridge package in the LMS, or even blogs or websites, which is not possible to do with items from within SCORM packages. While this second option did not take advantage of the LMS's features, teachers liked to have the possibility to only integrate the parts of the cartridge into their courses that they liked or thought were relevant to their lesson. In the survey,

- 25% said that taking an entire course in SCORM format and using it in Moodle (or their school's own System) would be extremely helpful
- 39% said that taking an entire course in CC format and using it in Moodle (or their school's own System) would be extremely helpful
- 43% said that taking a piece of the Learning Resource from one of the CC packages and using it with their other teaching materials would be extremely helpful

Most of the teachers who did not see the approaches as extremely helpful, saw that the packages could be useful for them in limited cases like when giving homework or teaching an online course. The survey results indicate that teachers see the interoperability between LORs and LMSs created by the specifications SCORM and CC as useful for their everyday teaching – especially when the packaging allows them to alter the content after it was uploaded or selecting only bits of the package before uploading to LMS. IMS Common Cartridge specifies this interoperability.

Part of the objective of this research was not only to find out whether or not the teachers could see content packaging useful, but to find out if they could actually manage working with these standards with the ICT skills that they possess. Our initial hypothesis was that the tools supporting these standards have not yet developed enough to be easy enough for the teachers to use. However, according to the survey, normal web pages were unsurprisingly the easiest to use. 75% of the teachers found using entire SCORM packages really easy or reasonable, whereas they admitted having some problems when using CC packages, whether it was the package as a whole, or taking parts of it. However, interestingly none of the teachers evaluated that any of these methods as impossible to use in their every day teaching (see Fig. 1).

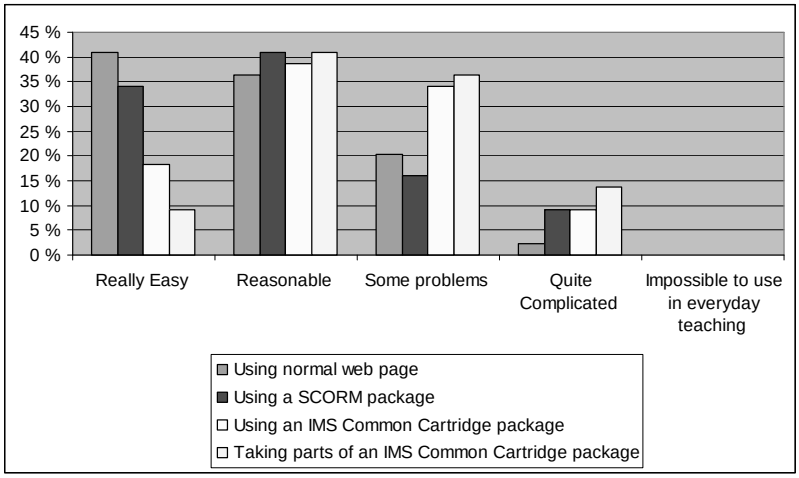

Fig.1. “How easy/difficult was it to create a lesson plan...”.

This study indicates that even though SCORM packages might not be the preferred solution for teachers, the longer period of development seems to have helped it to be easier to use than IMS Common Cartridge packages, which was not supported by Moodle before the spring of 2010. There seems to be a need to develop the tools for these standards to be more usable for teachers in the future. However this result would also indicate that the teachers did not like the easiest option best, which would suggest that they were able to look beyond the interfaces of the players into the ideas of interoperability and the standards.

Part of testing SCORM and IMS Common Cartridge with users, we looked at the opinions regarding the technical interfaces which show the contents of the packages. Teachers were asked to think of three typical use cases from their everyday teaching life:

A) Showing Educational Resources to students in their class rooms
B) Teaching an online course
C) Giving online homework/extra credit work to the students

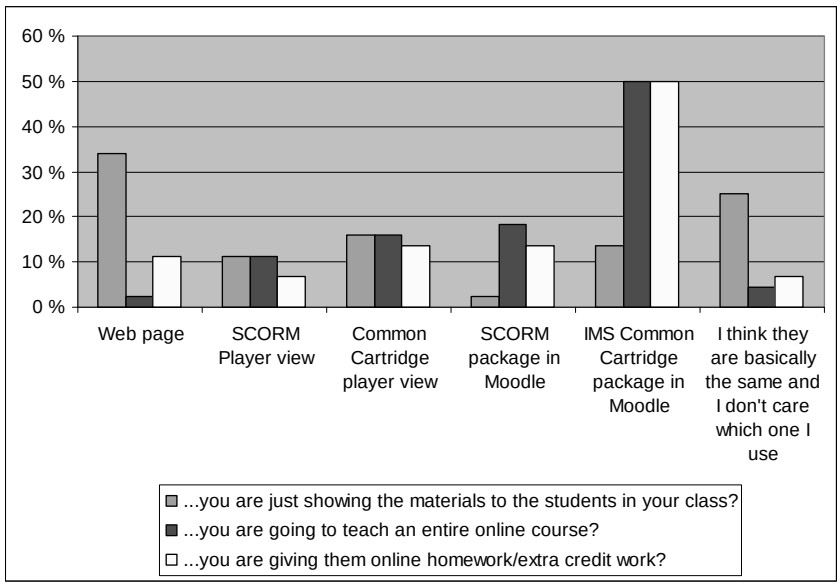

Fig. 2. Interface preferences of teachers in three use scenarios.

Overall, Fig. 2 shows that when it comes to just showing Resources in the classroom, that is easiest to do from a normal webpage, or even that it does not matter so much what the interface is. However, when you are creating an online course or giving homework to students, normal web page is no longer enough. Half of the teachers thought that using IMS Common Cartridge packages in Moodle would be the ideal way to teach online or give assignments in the form of homework or extra credit to the students. In the interviews with teachers it became obvious that Learning Management Systems like Moodle are widely used in schools and therefore standards

that create interoperability between content and these LMSs, have additional value for teachers.

If we want students to study independently, you can give them a SCORM package that they unzip and then use. But if you want, for example, to integrate a package in Moodle, because in Portugal we use Moodle a lot, probably Common Cartridge is good, because we can prepare everything and import it into Moodle." (ICT Teacher from Portugal) “

After the workshop, teachers were asked, what would they prefer to use after learning about the functionalities of SCORM and IMS Common Cartridge packages and interoperability between LORs and LMSs. Most of the teachers ended up preferring IMS Common Cartridge packages (87%), leaving only 7% to prefer normal web pages and 9% to prefer SCORM packages. This result supports the finding that teachers were genuinely excited about the prospects of IMS Common Cartridge after one day of training and lesson plan making. The teachers also seemed to support the solution that was the most adaptable to their own needs rather than the solution that was easiest to use.

5 Conclusions

Open educational materials and other web-based resources lead to new opportunities for sharing and re-using content. [21] European teachers are seldom aware of the content packaging standards SCORM and IMS Common Cartridge but understand the added value of re-using Educational Resources in their everyday teaching.

In this paper, we have presented the teachers’ view on the interoperability between LORs and LMSs while using SCORM and CC standards. Teachers showed special interest towards CC packages and in particular their use in Moodle system. In detail, the teachers enjoyed the possibility of editing a package, taking some elements and mixing them with their own teaching Resources very much in the same way as they do in with the non-digital Resources in their classrooms. CC supports this kind of interoperability, which is the key finding of this research as it aims to solve one of the biggest problems in the field [22]. In this study, the teachers said that they were more willing to use a solution that would be suitable for them than the solution which seemed the easiest to use. Also no teacher believes that packaging standards are impossible to use in everyday teaching, even though they can see some problems and complications in the process. After a standard is finalized, it takes a long time before tools are developed that actually deliver the functionality to end users in a way that is useful and usable [23]. Hence, for the success of the standard among users, it is crucial to develop CC tools and improve their usability.

We also need to recognize that many teachers still struggle to obtain the basic IT skills which are more essential for their day-to-day work even if these teachers were optimistic about content packaging – teachers with lower ICT skills might have a different point of view. In our opinion, training in content packaging standards may be something that remains of interest to a fairly small number of European teachers. However, it is not imperative for the teachers to know that these standards exist. What is vital for them is that the process of lesson preparation using Educational Resources

will be smooth and quick. Further development of these standards and the tools around them is the way of assuring re-use of Educational Resources.

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