

EVALUATING E-LEARNING PLATFORMS THROUGH SCORM SPECIFICATIONS

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ABSTRACT

E-learning platforms can be evaluated using multiple criteria and methods. This situation requires the elaboration of frameworks and models to drive such evaluation. There are some frameworks addressed to systematize the evaluation of e-learning platforms. However, a general problem in these evaluation frameworks is the lack of “benchmarks” to provide a formal reference in the analysis and comparison of e-learning platforms.

This paper provides a framework that is based on the use of SCORM standard specifications that allow instructors the elaboration of benchmark tests to evaluate e-learning platforms. The proposed framework is also based on a Learning Platform Evaluation Model that assumes three main areas of functionality of any learning platform: content, communications, and management. It has been applied to compare the functionalities of two popular LMS that support SCORM specifications. The paper describes some evaluation experiences that reveal the lack of integration of education standards into e-learning platforms.

KEYWORDS

E-learning platforms, evaluation framework, benchmark, standard specifications, SCORM.

1. INTRODUCTION

“E-learning platforms” is a generic term covering a variety of different products, all of which support learning in some way and using electronic media (Ferl, 2005). These products can be used to provide different ways of on-line education, and they address several learning contexts, ranging from conventional, classroom delivery to off-line, distance learning and on-line learning.

This variety of products and contexts makes difficult the evaluation of this kind of platforms. There are multiple criteria and methods to evaluate them, and frameworks and models are required to drive this evaluation. Britain & Liber propose a “Framework for Pedagogical Evaluation of Virtual Learning Environments” (Britain&Liber, 2004). This framework considers two models upon which an evaluation strategy may be based. The first one comes from the Conversation Framework (Laurillard, 1993) that addresses several ways the learning process is produced in an e-learning platform (e.g. discursive, adaptive, interactive or reflective). The second model is based on the Viable Systems Model (VSM), oriented to collaborative learning, which provides several steps to organize the learning process (e.g. Resource negotiation, Coordination, Monitoring, Individualization, Self-organisation or Adaptation). From each model, Britain & Liber propose different criteria to evaluate how e-learning platforms address the model learning characteristics. Subjective methods such as filling questionnaires or elaborating comparison grids are used to decide if a learning platform meets the selected criteria.

Another basic framework is proposed to distinguish between the many ways in which Virtual Learning Environments (VLEs) can be evaluated (Dyson&Barreto, 2003). This framework includes the purpose of the

evaluation, the type of methods that might be used and the measures employed. The authors describe the different roles for evaluation (e.g. formative, summative, integrative evaluations or quality assurance), the types of experiments to be performed (e.g. test or case studies) and criteria to evaluate the usability or the learning effectiveness. The proposed evaluation methods range from interpreting results, identifying processes and outcomes, and detecting the type of data (e.g. qualitative vs. quantitative or subjective vs. objective) or participants (e.g. expert vs. user). Additionally, several measures (e.g. usability heuristics, frequency of interactions or learning outcomes) are included in the framework.

There are other similar frameworks addressed to systematize the evaluation of e-learning platforms. However, a general problem in these evaluation frameworks is the lack of “benchmarks” to provide a formal reference in the analysis and comparison of e-learning platforms.

This paper provides an evaluation framework that is based on the use of educational standard specifications such as SCORM (ADL, 2004) and IMS LD (IMS, 2003) that allow instructors the elaboration of benchmark tests to evaluate e-learning platforms. The proposed framework is also based on the “Learning Platform Evaluation Model” (Ferl, 2005) that assumes three main areas of functionality of any learning platform: content, communications, and management. It has been applied to compare the functionalities of two popular LMS that support SCORM specifications: a commercial one, Blackboard (BB, 2004), and an open-source, Moodle (Douigamas & Taylor, 2003). The evaluation experiences deploy a prototype of benchmark developed under the SCORM version 1.2.

The rest of the paper is structured as follows. Section 2 describes the role of SCORM specifications in the context of e-learning platforms. Section 3 illustrates the proposed evaluation framework and section 4 reports the performed evaluation experiences. Finally, Section 5 gives some concluding remarks.

2. THE ROLE OF SCORM SPECIFICATIONS

SCORM (Sharable Content Object Reference Model) represents a “comprehensive picture of how a Learning Management System (LMS) might serve up Web-based learning content to learners in a standard way” (Mackenzie, 2004). In other words, it describes a specific way to deliver e-learning content in different platforms. Its importance lies in the ability to represent educational contents which can be shared but also in the interface between these contents and the e-learning platforms that use them. In fact, multiple platforms, either commercial or open-source, support this specification (ADL, 2004).

The main SCORM components are:

- The CAM (Content Aggregation Model) that defines a model for packaging learning content.
- The RTE (Run Time Environment) that defines an interface for enabling communications between learning content and the system that launches it (e.g. a LMS).

The Content Aggregation Model component deals with *Assets*, *Sharable Content Objects (SCO)* and *Content Aggregation Packages*:

- *Assets* are single individual objects such as media or HTML pages, while *SCOs* are collections of *Assets*. They should be independent of learning context and intended to be subjectively small units, such that potential reuse across multiple learning objectives is feasible.

- *Content Aggregation Packages* comprise one or more *SCOs* or assets, that is, one or more learning objects. They should be structured in such a way that they are ready for delivery to a learner.

The Run-Time Environment component deals with an *API adapter* and a *Runtime service*.

- The *API* (Application Programming Interface) *adapter* enables communications between learning content and the LMS that launches it.

- The *Runtime service* is provided by the LMS and it is responsible for providing the user interface to the learner.

Figure 1 shows these main components and how they interact with e-learning platforms such as Web-based LMS. The basic operation is started by a client browser that requests a LMS server which stores SCORM packages. This LMS access triggers the *Runtime service* that enables the SCORM package display in the user Web browser (e.g. using a table of contents or a set of navigation buttons). Once the *Runtime service* is enabled, the user can navigate through the SCORM contents. Additionally, user applications can get or put information on the LMS server through the *API adapter* functions.

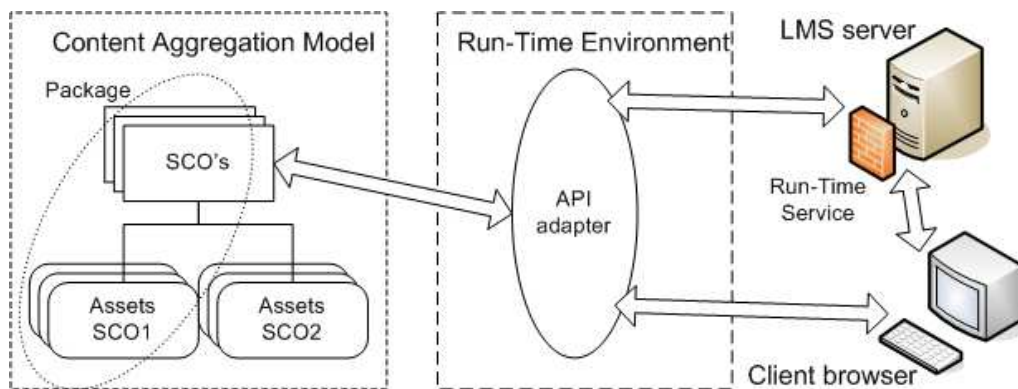


Figure 1. SCORM fundamentals.

ADL provides several test applications that allow instructors and developers to check the SCORM functionalities. The purpose of these tests is to verify that a specific SCO (content object) can be launched by an LMS or if it supports the Run-Time Environment Application Program Interface (API) functions defined in the SCORM. If the tests are correct the checked LMS can be stated as SCORM-conformant. These test applications are the basis for the elaboration of benchmarks, proposed in the current evaluation framework, which intend to add a pedagogical value in the evaluation of e-learning platforms.

3. EVALUATION FRAMEWORK

The proposed framework is based on the “Learning Platform Evaluation Model” (Ferl, 2005) that assumes three main areas of functionality of any learning platform: *Content*, *Communications*, and *Management*. A diagram that illustrates these functionalities is shown in Figure 2.

- The *Content* area includes tools and services that enable the authoring and delivery of electronic learning content, whether this content is written in-house, or imported from other sources.
- The *Communications* area covers those tools that support any type of interaction and group work (e.g. e-mail, discussion lists or bulletin boards)
- The *Management* area includes any tool or system that supports the management of the teaching and learning process.

This evaluation model allows the instructor to: (a) identify the needs and requirements in the learning process, (b) audit the available tools, and (c) detect if these tools meet the required needs. Figure 2 shows some examples of requirements in the previous functionality areas (e.g. the display of internal/external sources or the information organization in the *Content* area; the ability to send messages or the access to forums in the *Communications* area; or the user grading and tracking in the *Management* area).

These requirements are specified into a “benchmark” test that is used to compare and to evaluate those tools that are part of a given e-learning platform. In the context of the proposed evaluation framework, benchmarks are implemented using educational standard specifications such as SCORM (ADL, 2004) and IMS LD (IMS, 2003). Currently, the benchmark experiments are based on the SCORM version 1.2 because most of the LMS platforms are conformant with such specification.

The benchmark prototype has been developed using authoring tools such as Macromedia Dreamweaver® and Reload (Reload, 2004). The first one has been used to implement the HTML pages that represent the SCORM contents (SCOs and assets). These HTML pages incorporate Javascript functions to access to SCORM runtime functionalities and Dynamic HTML code to display their results. The second one has been used to generate the SCORM package that integrates the HTML pages (Reload editor) and to check its correctness (Reload player).

However, the benchmark development reveals that SCORM is too restrictive for use in some kind of learning processes (e.g. constructivistic or social-based learning). Benchmarks can be extended to other standard specifications that enable new learning scenarios as long as these specifications are being

incorporated into e-learning platforms. Next section describes a benchmark example and the evaluation experiences performed on this benchmark.

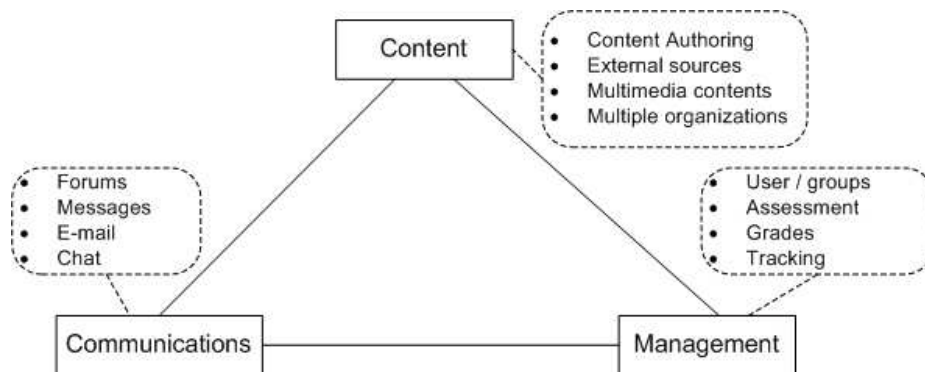


Figure 2. Learning Platform Evaluation Model.

4. EVALUATION EXPERIENCES

The selected example of benchmark, called *DemoScorm*, is based on a SCORM 1.2 package that includes three *organizations* to explain what SCORM means in the educational standards context. These organizations are mainly “discursive” since they address informative courses that differ in their detail level. There is a basic level that introduces the SCORM definition and its main components. A second level extends the basic one, by adding working aspects such as the edition of a SCORM package or its operation. In this level, interactive functions are introduced such as writing course comments or getting user information (e.g user identifier) from the LMS. The third level represents an advanced course that involves assessment tests and exercises (e.g. uploading an edited SCORM package).

This benchmark has been tested into two e-learning platform examples: a commercial one, Blackboard, and an open-source, Moodle. Figure 3 shows a screenshot that displays the initial SCO of this benchmark in a Blackboard platform (Blackboard Academic Suite™ 6.3.1.477).

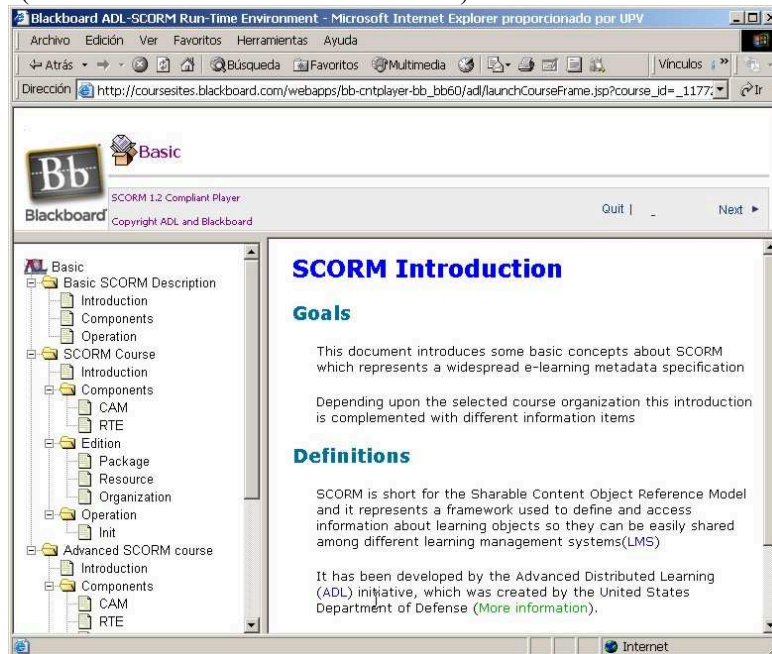


Figure 3. SCORM display in the Blackboard platform.

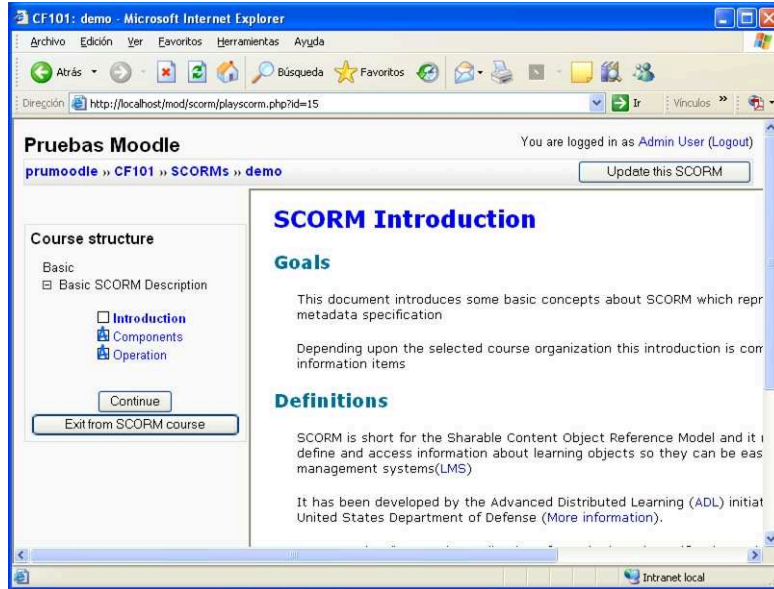


Figure 4. SCORM display in the Moodle platform.

Figure 4 shows the SCO display of the *DemoScorm* benchmark in a Moodle platform (Moodle version 1.5). Both platforms, Blackboard and Moodle are SCORM conformant but each one displays benchmark tests in a different way. For example, the BlackBoard platform represents all the available *organization* structures in a sequential way while the Moodle platform allows the selection of a specific *organization* to be displayed.

Table 1. *DemoScorm* Evaluation results.

Evaluation framework	Criteria		Platforms	
			BB	Moodle
	Content	SCORM authoring /edition is allowed		
		External sources can be viewed	✓	✓
		Multimedia contents can be displayed	✓	✓
		Organization structures can be selected		✓
		Content navigation is enabled	✓	✓
	Communication	Announcements or discussion boards are available		
		Assignments can be delivered		
		Collaboration tools can be used		
	Management	E-mail service is linked		
		SCORM packages can be imported	✓	✓
		Navigation options can be configured	✓	
		Assessment facilities are provided		
		Gradebook items are allowed	✓	✓
SCO grading is displayed			✓	
Gradebook items are updated				
	Tracking items are allowed	✓		
	Tracking results are updated			

Table 1 shows some evaluation results based on the proposed benchmark. These evaluation criteria are focused on the functionalities which can be accessed from the SCORM services in the target e-learning platform. The Content area functionalities are mostly provided by the evaluated platforms. However, those that address the Communication and Management areas are poorly supported as it is shown in Table 1. Overall, communication services are not available from SCORM players and management facilities are offered by both platforms (e.g. grading or user tracking) but they are not effectively used in most cases. This situation is a consequence of the SCORM content-based orientation but it invites to think about the relative benefits of interoperability and an unanswered question arises: *are standard specifications (e.g. SCORM) really integrated into e-learning platforms?*

5. CONCLUSIONS

This paper describes an evaluation framework that is based on SCORM specifications that allow instructors the elaboration of benchmark tests to evaluate e-learning platforms. These benchmarks provide a formal reference in the analysis and comparison of e-learning platforms. The proposed framework is also based on an evaluation model that organizes the functionalities of any learning platform into three areas: Content, Communications, and Management. This organization contributes to facilitate the evaluation process and the decision making about the e-learning platform selection. In order to check this evaluation framework, a benchmark prototype has been developed and it has been used to test two examples of widespread e-learning platforms. The obtained results show that current platforms have still lacks in the integration of standard specifications. Future works plan to extend the evaluation of platforms to other products such as .LRN, Sakai, or WebCT. These works will consider the development of new benchmarks and the application of new specifications such as IMS QTI or IMS Learning Design.

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