

A model for online assessment in adaptive e-learning platform

H. Barbosa León^{*,1}, H. Rego¹, T. Moreira¹ and F. García Peñalvo¹

¹ Department of Computer Sciences, University of Salamanca, Plaza de los Caidos S/N 37008, Salamanca Spain

In this article, we present some general aspects of the on-line assessment activity. For the purpose of this paper, we want to focus ourselves in the activity of evaluation that takes place in the e-learning process and discuss the importance of this action for each participant of the process. After that, we profile the desirable characteristics of an adaptive system and we describe the importance of the assessment activity. Later we present a proposal model for an adaptive assessment tool for an educational platform now in development.

Keywords Adaptive learning environments; E-learning; Feedback; IMS QTI; Online assessment.

1. Introduction

Nowadays there are lot of works done and developments in progress in the area of e-learning. We can see Instructional and educational institutions have been incorporating information and communication technologies in learning a teaching process in order to increase the quality, efficiency, and dissemination of education. In this paper, we want to give emphasis to the activity of the assessment inside the e-learning process, focusing ourselves in this action, and to see how it can help to improve the learning process for all the participants: the students, teachers, the designers of contents, etc.

The rest of this paper is structured as follows. In section 2, we describe the general characteristics of the adaptive systems, focusing us in the description of the Learning Technologies Standards (LTS) and the specifications of IMS. In section 3, we want to define the importance of the activity of the assessment inside the e-learning process, separating the information for each actor that participates in this process. In section 4 we present our proposal for an Adaptive Assessment Tool, based on the HyCo (Hypertext Composer) platform [1], a development in process in the Department of Computer Science of the University of Salamanca (Spain). In section 5 we give our conclusions and future work.

2. Characteristics of adaptive systems

Today, it is necessary to produce educational systems based on Internet that allow us the dissemination of the education, covering the necessities of learning of students with diverse learning profiles. To achieve this, it is desirable that this systems perform the automatic task of adapting to each user, disconnecting the educational content of their final presentation using a semantic focus instead of one syntactic, defining a significant web.

In consequence, the learning systems should be flexible and effective, and a way to achieve that is to be an open and standardized system. We would like to focus ourselves in the Learning Technology Standards (LTS) and, inside these, in the IMS specifications, for wich, many areas require to be interoperable when the learning is distributed, therefore it details a set of specifications that build a reference mark for the exchange of educational elements. Among this, exist the IMS Question and Test Interoperability (IMS QTI) for the exchange of test elements and other assessment tools. It defines a data model for the presentation of questions, test and the correspondent results reports [2].

* Corresponding author: e-mail: barbosah@usal.es, Phone: +34 923614410

3. Importance of the assessment activity

In the educative process we could identify several factors that we should take into account like the style of the student's learning, the technical implications, the adaptive educational content, the learning and knowledge administration, the feedback, the motivation, etc. Traditionally, the activity of assessment has been seen apart from the e-learning process and there is a danger focusing the investigation in the assessment specifically, since this spreads to isolate the process of assessment from the learning and teaching activity [3].

But it is necessary to give emphasis to the assessment process because it can be seen as an activity that completes the cycle of the e-learning: allow the renovation of the information to the students (giving the results), to the instructor (giving the support for the feedback to the students) and the instructional designer (to update the contents of the learning system).

As Kendle and Northcote affirm, the valuation should be one of the first considerations when preparing an on-line course and it should be integrated in the course, and not to be considered as a later activity [4].

3.1 Importance for the Educative Content and the Adaptation Process

According to the Australian Flexible Learning Framework [5], the assessment, mainly when it is included inside a task of real learning or exercises can be an essential part of the learning experience giving to the whole Web site the characteristic to adapt to the necessities of the users. This could be an interesting feature of an educational Web site because the on-line instruction improves giving to the student:

- Convenient feedback: the web site shows the results of the valuation and it can give the feedback to the user to improve its results.
- When the lesson was taken and the valuation was carried out, the educational content can be re-adapted at the new level of the user's knowledge giving him/her new lessons to be studied, being based on the assessment scores.
- Starting from this last activity, we can offer the convenient, adapted, and significant information to the student, improving the educational experience.
- This process gives the flexibility, enables group work, it has the potential to be interactive, the students can make their exams in a remote way, and it can be easy to use. [3].

3.2 Importance for the User

For the student, the activity of assessment informs progress, it drives the learning, it is essential for the process of accreditation, and it measures the student's success. The tasks of valuation can be seen as the active components of the study, the results provide to the students with opportunities of discovering what they understand or not, if they can be competent, also to demonstrate what they have learned in their studies. Moreover, the feedback and the qualifications that the assessors communicate to the students are good to motivate and to teach [6]. It is necessary to mention that a quick, instantaneous, and effective feedback is very important for the students, also having access to multiple opportunities, to take control of its own learning and to control its advance.

3.3 Importance for the Teachers and Assessors

Most of the on-line learning systems are automated and bound to the learning management systems. This provide to the instructors the way to perceive the benefits of including a documented and consistent evaluation process where the technology allows the ease of monitoring the student's process and the provision of immediate feedback - all those features improve the quality of process of valuation [3].

A factor of importance is that the teachers can have a saving of time since the system can have the characteristic of evaluating in an automated way. The on-line valuation allows to improve the evaluation

process, allowing flexibility, saving time in the long term and it allows the quick feedback to the students, create consistent and standardized exams, the progress can be supervised, the activity of valuation can be documented, it is financially attractive and learners can be assessed equally [3].

4. Proposal

For our proposal, it is important to refer to the HyCo (Composer of the Hypertext) model [1], an ALE system in development, where we want to define and build an assessment tool that will be an integral element of this system. HyCo is an authoring tool to build semantic learning objects for web-based e-learning systems, by creating hypermedia educational resources and to access to that content.

This system uses open standards technologies such as Java, XML and the IMS specifications to ensure multiplatform adaptability, making their elements reusable, durable, and accessible. To acquire those characteristics, it is necessary to separate the educational content and their presentation, so the HyCo platform save the contents in XML files, allowing the introduction of LTS (Learning Technology Standard), particularly the IMS specification.

4.1 Technologies and concepts to be used

- **ALE** (Adaptive Learning System): conform its learning components to build the most suitable adaptive learning experience.
- **Learning designs**: Succession of educational activities that can tie several learning objects and definitions such objectives, prerequisites, and activities to complete or to fulfil the lesson. These designs are defined using the specification IMS LD
- **Metadata**: when using the metadata objects, we offer to the ATT the characteristics of inteoperatibility, reusability and exchange among different systems
- **SLO** (The Semantic Learning Objects): according to the IMS metadata, are stored as XML files in IMS metadata SLO repositories. When using the SLO's we can differ between the educational content and the learning processes.
- **XML** (eXtensive Mark-up Language): to assure an interchangeable tool that uses the metadata, building a well-documented and deployable tool.
- **IMS** specification: It defines a data model for the representation of educational objects for the learning systems. Among the specifications of IMS, we can find the IMS QTI (IMS Question and test Interoperability), for the representation of questions and tests and the corresponding report of results.

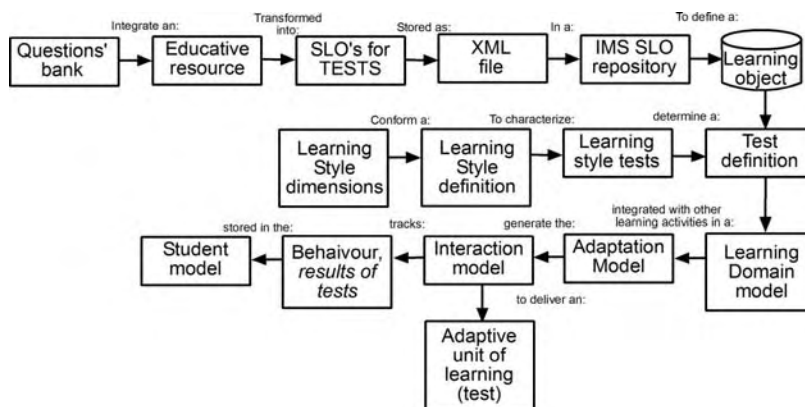


Fig. 1 Adaptive Assessment Tool (AAT) integrated into de HyCo [1] model.

4.2 The Adaptive Assessment Tool Model.

In the figure 1, we profile the main components and the process to develop an Adaptive Assessment Tool (AAT), based on the HyCo model [1], taking into account the most important modules to configure our model of AAT. The idea is to show the prospective flow to develop an adaptive unit of learning according to the products made by the platform of HyCo, but, in this case we will talk about an adaptive assessment as the adaptive unit of learning.

- **Learning Objects:** The teacher or the instruction designer makes a series of test questions that will integrate an educational resource. In this process, all the IMS metadata that can be inferred from the original resource are defined, becoming a SLO. After that, a XML file is generated, specifically for each SLO, designed exclusively for assessing purposes. This file is stored in an IMS Metadata SLO repository, allowing us to have learning objects in form of assessment questions that fulfill the IMS QTI specification and that can be attached to learning activities of learning designs, being compatible with specific learning style tests, defined below.
- **Learning Style Tests:** In the other side, we have to take into account the learning styles of the students. Felder and Silverman Learning Style Model and the Kolb's Experiential Learning Theory [7] are two well-know examples, the idea is not to prescribe any learning style, but provide authors with a flexible structure where different learning style approaches can be described and used to characterize the learning styles and the activities of the students. Once the learning style approach is selected, a learning style test could be defined. Each one of those tests assembles a series of assessment items into a specific test for a specific learning style definition.
- **Test Definition:** When the learning objects (assessment items) and the learning style tests are defined, a test definition could be made in agreement with a learning style definition. We want to remember that, as it is described in the HyCo model, there are four kind of test: learning style test, current knowledge and initial and final knowledge. The formers are included in a unit of study. The initial and final knowledge tests are linked to a unit of learning, while the current knowledge test has to be related to a learning activity or activity sequence. The results of these tests set the values of the learning style, initial and final knowledge of each student, these values are stored into a student model in order to use them to describe adaptive rules.
- **Delivery:** To complete the release of the AAT we should encapsulate it into a frame that integrates other elements to complete the adaptation for the student:
 - **Learning Design:** To integrate objectives and prerequisites for the test.
 - **Learning style:** When the learning style of the student is identified, we can select a learning style test definition in concordance with the learning style of the student.
 - **Adaptation Rules:** they categorize the student stereotypes, defining adaptive statements and techniques.
- **Interaction Model:** Delivers an adaptive unit of learning, including mainly the learning material and the test, also this module tracks the student behaviour during the interaction with the system when the learning activities are visited, delivering the results of the test as well.
- **Updating the Student Model:** Integrates the results of the interaction model, storing the learning style and the acquired knowledge for each the student.

5. Conclusions and further work

The on-line valuation is an important step inside the process of the on-line learning because it offers a convenient regeneration to all the participants in the process, helping improve the learning and the experience in the instruction.

1 In this article, we wanted to give emphasis to the paper of the valuation putting it at the middle of
2 the process of the on-line learning and defining the factors of importance of the main elements that
3 participate in this process: the educational content and process of adaptation, the users or students and
4 the teachers. Referring to the assessment activity we can think that it should be interoperable, because it
5 is an element of the process of the on-line learning and it plays an important paper inside this experience.

6 Inside this conceptualization, we want to create an Adaptive Assessment Tool (AAT) that can take
7 into account the specific characteristic of the system of HyCo and could be intrinsically part of him. To
8 do this we want to develop an application where the professor or the instructional designer can integrate
9 the questions of the test, following the same two phases that in the process of HyCo, conforming a file of
10 XML as output, associated with a warehouse of learning objects in metadata format, following the
11 specifications of IMS.

12 On the other hand, we assure that the assessment tool takes into account the pedagogic aspects to
13 conform the adaptive systems considering the styles of each student's learning, integrating this style with
14 a game of questions to create a Learning Test definition. After that, following the integration with the
15 HyCo system, the test is tied up with other learning activities in the Learning Domain Model, integrated
16 in the Adaptation Model generating an IMS file containing deliverable learning design to the next
17 module, the Interaction Module which gives an adaptive unit of learning the student - a IMS CP file-, it
18 follows the student's behaviour in the visited learning activities and the result of the test carried out by
19 them. At the end, this module updates the Student Model.

20 Among the specifications of IMS, are those of IMS QTI, dedicated completely to the area of the as-
21 sessment that we will analyze and evaluate for development of the AAT for the HyCo, developed in the
22 Institute of Educational Sciences in the University of Salamanca, Spain.

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