OAEditor - A FRAMEWORK FOR EDITING ADAPTIVE LEARNING OBJECTS

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ABSTRACT

Distance Learning supported by the WEB is a reality which is growing fast and, like any technological or empirical innovation, it reveals positive and negative aspects. An important aspect is in relation to the monitoring of the activities done by the students since an accurate online assessment of the knowledge acquired is an open and, therefore, worrying subject. A way of minimizing such situation is by using technology to monitor the general performance of the student in the virtual learning environment. This work invests on the construction of the OAEditor framework which allows teachers to create learning objects in the form of educational hyper documents representing conceptual graphs that can adapt to the interaction of the students according to their performance, besides enabling a pedagogical monitoring based on self-evaluative questionnaires which are automatically generated, pondering the navigation and performance obtained.

1. INTRODUCTION

This paper describes a framework to edit the Learning Objects (LOs) able to adapt to single characteristics of the students in the process of Distance Learning (DL). Most of the LOs produced nowadays do not provide feedback information supporting their efficiency in the teaching process, registering, for example, if the student is interacting in the right way with the object and if it is reaching the planned objectives Moodle (2012), BlackBoard (2012), Amorim (2005). Studies warn that the learning process is made easier when the teaching methods are in agreement with the learning style of the student Bohlen (1993, pp. 280-281), Graf (2008).

The solution proposed here is the OAEditor framework integrated to the AVA Moodle that performs the following functions:

- It enables the creation of learning objects in the format of educational hyper documents representing conceptual graphs;
- It allows the interaction between students and these learning objects;
- It generates logs in the interaction student-object;
- It stores a question bank;
- It automatically generates questionnaires to evaluate the level of learning of the students by choosing questions from a question bank that involve their navigation history and their development;
- It generates data reports of the logs and the students' assessments.

Moodle, the most popular Distance Learning Environment (DLE) among the eLearningGuild users Davis (2009), allows the aggregation of new blocks of functions – plugins – which broadens its functionalities. The OAEditor was designed as a plugin of Moodle and it was developed with the PHP language.

1.1 Structured Hyperdocuments as Conceptual Graphs

According to Bush (1945), the human mind operates by associations, following an intricate web of representations. For that reason there is a necessity of breaking with the conventional hierarchical structure

that we find in books, trying to adapt the didactic material to the nature of the human reasoning. The hypertexts allow the non-linear writing/reading where one can edit and manage the texts in a distributed environment. With the use of this facility the users have the possibility of interacting, creating new texts, introducing new documents or modifying the documents which are already there. The OAEditor uses this process in the creation of the LOs in which the professor creates fragments of information and also the connections among these fragments implementing Conceptual Graphs (CG), a concept proposed by Sowa (2004) to a graphic representation of knowledge, where the nodes represent the concepts and the edges represent the links among the concepts.

1.2 Applications Sensitive to Context

Medeiros (2010, pp. 15-16) presents a summary of some structures in the adaptive environments in relation to the following characteristics: data acquisition, storage, processing, characteristics of context use, patterns of the adopted content and communication infrastructure. The OAEditor has some characteristics of these structures, composing a new proposal, as shown in Table 1:

Table 1. Synthesis of structures and synthesis of the OAEditor

	Synthesis of adaptive structures by Medeiros (2010, pp. 15-16)				Synthesis of the OAEditor
	Semantic Learning Space	CTRL	GlobalEdu	Adaptation of Learning Scenarios	
Acquisition	Physical and Virtual sensors	Interactions with users, Model of the student and Curriculum	Learner Profile, Elements on social and Physical Context	Interactions with the user, Model of the student	Interactions with the user, Model of the student
Storage	Ontologies of content, context and domain	XML	Ontologies	Objects Repository	XML
Processing	First-order logic. Bayesian nets, Fuzzy logic and probabilistic logic	Logic Rules of IF THEN	Inference on the base of knowledge using the behavior rules WHEN IF THEN	Machine learning algorithm-(KNearestNeighbor)	Logic Rules IF THEN
Use of context	Recommendation of contents	Intelligent tutoring	Recommendation of learning objects and the support to the interaction of the learner	Adaptation of learning scenarios	Recommendations of learning objects and support to the learner´s interaction
Patterns of content	LOM, SCORM, IMS Learning Design, OKI, Ariadne and Dublin Core	Not applicable	SCORM	LOM (Learning objects) and IMS Learning Design (Learning Scenarios)	Conceptual graphs
Infrastructure of communication	Centralized	Distributed	Centralized	Centralized	Centralized

The great difference of the OAEditor is the proposal of structuring the hypertexts as conceptual graphs, providing the framework a big range of possibilities of implementation.

2. ARCHITECTURE/CHARACTERISTICS OF THE OAEDITOR

The Fig. 1 exposes the number of use cases in the specification of the OAEditor: maintaining learning objects, maintaining the question bank, logs, interacting with the learning objects, evaluating the learning process and Data evaluation.
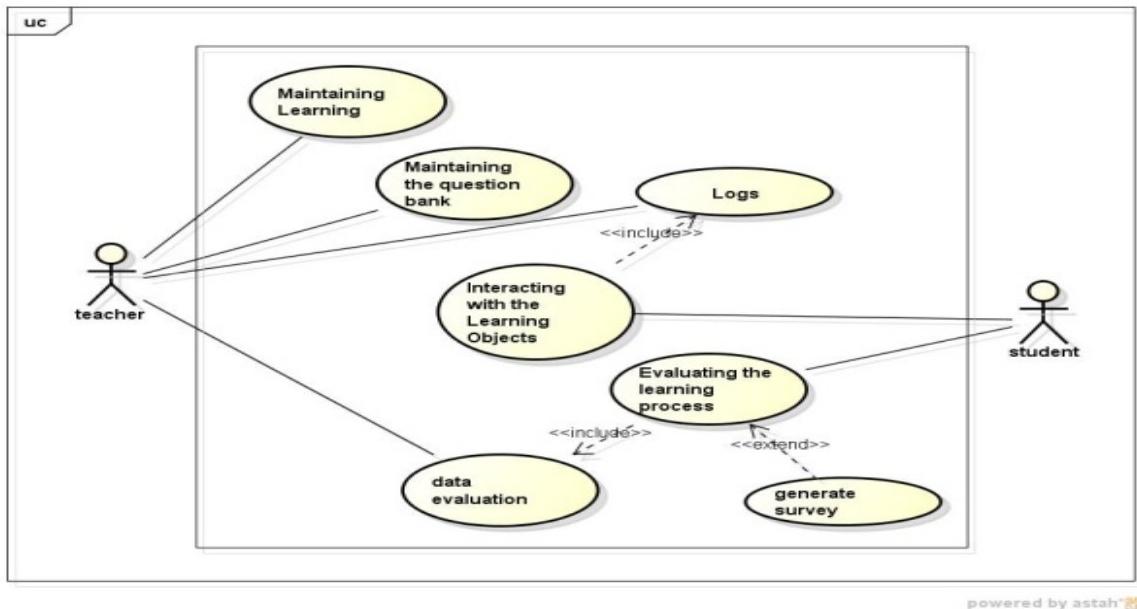
Figure 1. OAEditor Use Case Diagram

2.1 Use Case: Maintaining Learning Objects – Available to Teachers/Tutors

In the OAEditor the text is typed in a similar way to the editor of a regular text. One of the most important characteristics of the OAEditor is that it is adaptable to the student's profile, and its concepts are available in three levels: 'synthetic', 'detailed' and 'learn more', where each level presents the same concept, however, it is presented in different ways in a growing sequence of detailing.

2.2 Interacting with the Learning Objects – Available to Students

The OAEditor uses the authentication model of Moodle to get all the information about the user who is using the system, information such as login, profile, relationship discipline-student, section, and so on. Two users' profiles are considered: Teacher/Tutor and Student. The teachers can create/update/exclude LOs, feed the question bank and follow students individually. The students will be able to navigate through the LOs created by the teacher, answer questionnaires and see their personal records.

2.3 Logs

The interaction of the students with the LOs produces registers related to their navigation on the LO. With these logs many questions can be explored:
- Did the student really choose a satisfactory knowledge path?
- Which concepts were not chosen to be navigated?
- A certain concept was not chosen because the student already mastered it or because it was a lack of attention?

The great gain that it generates to the teacher is the possibility of knowing the individual profile of the students offering them more precise feedback.

2.4 Maintaining the Question Bank – Exclusive to Teachers

A question bank with good quality questions related to all concepts present in the LO is necessary to make the generation of questionnaires possible. The defined architecture suggests multiple choice questions with

five alternatives and only one possible answer, where each question is related to a specific concept present on the LO.

2.5 Evaluating the Learning Process

This evaluation is done when the student requests it. Each questionnaire has ten questions which are chosen in a way to have all the concepts of the lesson, favouring the concepts which were not navigated and the ones which obtained the lower results quantitatively. With this, the OAEditor breaks the conventional paradigm that the same questionnaire is applied to all students. When it is answered and submitted, the OAEditor sends the results back to the student's assessment, showing the mark and correct answers.

2.6 Data Evaluation

The pedagogical assessment will take place through an individual monitoring with each student. With the OAEditor the teacher has access to a monitoring area of the students attending the discipline where the way each student interacted of the learning object is shown. It is possible to visualize how many times each student accessed each concept, and there is also a table showing the number of questions about each concept and the number of right and wrong answers to each question together with all the tests taken by the student. All the tests can also be visualized.

On the page for monitoring the students you can see the tree of concepts of the unit on the left, and it shows how many times the student accessed each concept. There is also a table informing the number of questions related to each concept in all the tests done by the student as well as the number of right and wrong answers. And, lastly, the teacher can access the tests taken by the students.

3. CONCLUSION

The OAEditor framework implemented enables the creation of learning objects to the teacher in a transparent way. The teacher does not need to have specific knowledge in programming to create a high quality LO. The OAEditor transforms the act of creating an LO into a simple typing activity. From that moment, the system works in an automatic way, keeping the navigation logs of the students, automatically generating tests based on the navigation of the tests already solved, and also generating analytical reports to the teacher. The quality of the learning object created is directly associated with the expression of the conceptual graph in terms of completeness/coverage of concepts and established relationship among the concepts.

4. FUTURE WORKS

The main challenge that can be the motivation to a development of future studies is the incorporation resources of the artificial intelligence (AI) to the OAEditor. The use of the AI would help the development of a structure which permits:
- The programming of the LOs to suggest individual contents, based on cases, increasing the quantity of parameters to be considered;
- The creation of a mechanism of intelligent tutoring where the system itself can give the tutoring by suggesting contents, questions, external material among other things registering cases of success. Besides, it suggests paths the students should take based on these cases;
- The increase in the number of criteria which compose the generation of assessment questionnaires and establishing metrics able to detect if the questionnaires were enough to an evaluation criteria;
- The improvement of the reports in order to obtain more consistent data to take the decision, that is, establish more precise filters to build the reports.
  Other perceptions that can be applied latter on are:
- Making the system become collaborative so the students can insert contents in the LOs that could be assessed by the teacher and made available to the community, making it something similar to a wiki.

- Using the data mining techniques to obtain a better benefit from the information related to the students' logs;
- Making the system, without the intervention of the teacher, suggesting materials for studying, questions to solve, and so on;
- Identifying if there are patterns or tendencies in the navigation and answers of the students.

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