AUTHORING WEB-BASED LEARNING SCENARIOS BASED ON THE IMS LEARNING DESIGN: PRELIMINARY EVALUATION OF THE ASK LEARNING DESIGNER TOOLKIT

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Abstract

The need for e-learning systems that support a diverse set of pedagogical requirements has been identified as an interesting issue in web-based education. Until now, significant R&D effort has been devoted aiming towards web-based educational systems tailored to specific pedagogical approaches. As a response to pedagogical concerns towards standardization and interoperability needs, Educational Modeling Languages (EMLs) were introduced. These languages attempt to provide a formal way of representing the educational process in a commonly agreed manner. Nevertheless, still there exist very few web-based educational systems that support EMLs. One of the key issues to be considered when designing web-based educational systems to support EML is the adoption of easy-to-use tools for the definition of learning scenarios. In this paper we present the ASK Learning Designer Toolkit (ASK-LDT), a learning scenarios graphical authoring system that utilizes the IMS Learning Design specification and present preliminary evaluation results from its use.

Key Words

1. Introduction

e-Learning can be viewed as the process of delivering learning experiences to anyone, anyplace, anytime providing an open, flexible, and distributed learning environment [1, 2]. During the last years, several web-based educational systems have been proposed aiming to address specific pedagogical approaches. The main drawback of those systems is that they are closed, self-contained systems that cannot inter-exchange either educational content or activities. Additionally, the supported content and learning scenarios are a-priori designed to serve and support a specific pedagogical approach. As a result they are non-flexible in supporting different pedagogical approaches and they require extensive redesign effort in order to be used in different domains.

As a response to pedagogical concerns towards standardization and interoperability needs, Educational Modeling Languages were introduced, offering a standardized way to associate educational content, activities and actors in a learning scenario [3], enabling the inter-exchange of not only content, but also pedagogical scenarios [4]. Nevertheless, there exist only few web-based educational systems that support EMLs [5], due to the lack of EML-based graphical tools that provide easy-to-use authoring systems.
In this paper we present the ASK Learning Designer Toolkit (ASK-LDT), an authoring system that provides a graphical user interface for the definition of learning scenarios based on the use of IMS Learning Design Level B specification, the specification emerged from the OUNI/EML. The paper is structured as follows: In section 2, we discuss the evolution of Educational Modeling Languages focusing on the principles of the IMS Learning Design specification. In Section 3, we present the ASK-LDT, an authoring system developed to enable the definition of learning scenarios. Finally, we present preliminary evaluation results from its use.

2. Modeling Educational Processes

2.1. Educational Modeling Languages

The term “Educational Modeling Language (EML)” was first introduced in 1998 by researchers of the Open University of the Netherlands, as a pedagogical meta-model, that is, a model for describing pedagogical models, intending to express the learning process beyond content navigation and structuring [3]. The CEN/ISSS Learning Technologies Workshop defines an EML as “a semantic information model and binding, describing the content and process within a ‘unit of learning’ from a pedagogical perspective in order to support reuse and interoperability” [6].

Educational Modeling Languages are intended for describing, reproducing and reusing not only educational resources, but also events and roles associated with teaching and learning processes. This objective has been based on the fact that learning occurs not only through interaction with knowledge resources, but also through interactions within learners’ social and working environment [7]. In literature, a number of EMLs have been proposed including:

- PALO: An Educational Modeling Language developed at the Department of Languages and Computer Systems of UNED (Universidad Nacional de Educación a Distancia), Spain. PALO is structured using a five level information model that describes content, activities, structure, scheduling and management processes [8].

- LMML: A Learning Material Markup Language developed at the University of Passau, Germany, based on a meta modeling architecture for knowledge management [9].

Despite the variety of EML languages and approaches, the EML that has attracted by far the most attention is the "Educational Modeling Language" developed by the Open University of the Netherlands (OUN-EML) [3].

Recently, the OUN-EML converged to an international specification for modeling educational processes, namely, the IMS Learning Design (IMS LD) [10] adopted by the IMS Global Consortium. The rational and the principles of the IMS Learning Design specification are presented in the next section.

2.2. The IMS Learning Design Specification

The key assumption of the IMS Learning Design specification is that regardless of the adopted pedagogical strategy, learners attain learning objectives by performing a series of activities in the context of an educational environment.

Within this context, an activity can be formally defined as a triple containing the content that is delivered by an educational system, the actors participating in the learning activity (such as the learner or a group of learners, the tutor etc.) and their corresponding interactions. These interactions include three types, namely, interactions with the learning content, interactions with the educational environment and interactions between the participating actors.

Following the notation of the IMS LD, the different participating actors are called roles and they are divided in two main classes, namely the Learner Role and the Support Role. These roles can be sub-typed allowing the definition of refined learner and support roles. For example a learner can be a task leader or a group participant and the support roles can be a tutor or a task reviewer in a collaborative problem-solving activity.

Furthermore, the IMS LD formulation provides a notation schema for the description of activities taken place in a specific Environment. These activities can be Learning or Support Activities. A Learning Activity is attaining a learning objective per individual actor and a Support Activity is meant to facilitate a role performing one or more learning activities.

The IMS LD specification is implemented at three Levels. Learning Design Level A includes the following elements: a series of activities (for example assessment, discussion, simulation), performed by one or more actors (learners, teachers etc.) - roles, in an environment consisting of learning objects or services. Level B introduces properties about participating roles and conditions upon flow of activities. Level C introduces notifications to participating roles (triggered events - e.g., if a student asks a question, the teacher needs to be notified that a response is needed). From the above description, it is obvious that Level B provides the means to describe the adaptive functionality in a learning scenario through the use of conditions [11].

3. The ASK Learning Designer Toolkit
The ASK Learning Designer Toolkit (ASK-LDT) [12] is an authoring tool based on the use of IMS LD Level 2 specification that provides the environment for a pedagogical designer to define learning scenarios. Earlier versions of ASK-LDT have been presented elsewhere [12].

The core design concept of the ASK-LDT is to provide a graphical user interface for the design and sequencing of learning activities, which, on one hand uses a standard XML-based low-level notation language for the description of learning scenarios (so as to be able to inter-change learning activities between different systems), and on the other hand enables pedagogical designers to use their own design notation (high-level notation) for the definition of learning scenarios. Furthermore, ASK-LDT supports the use of content objects that conform to Sharable Content Object Reference Model v1.2 [13] and IMS Content Packaging v1.1.3 [14].

**Figure 1. ASK-LDT authoring process**

The authoring process supported by ASK-LDT consists of the following steps (Fig. 1):

- **Definition of Activity Types.** At this step (Fig. 2) the ASK-LDT supports the pedagogical designer in defining the activity types he/she wants to support in a learning scenario, as well as, in defining a notation schema for each activity type specified. During this step the designer has the ability to characterize each activity type as "learning" or "support" activity, following the IMS LD Notation (Fig. 3).

**Figure 3. Defining Activity Types**

For each activity type defined the designer specifies the preferred design notation (schema and color) that will be used for the graphical representation of the pedagogical scenario (Fig. 4).

**Figure 4. Specifying Graphical Design Notation**

- **Definition of Environments.** At this step (Fig. 2) the designer defines the environments in which the activities are taking place. An environment can be a web-based environment such as an on-line chat, a discussion forum etc., or a stand alone software tool such as an annotation tool, a search engine etc. For each environment specified the designer can provide a set of learning objects required from an end user to interact with the corresponding environment (Fig. 5).

**Figure 5. Defining Environment Characteristics**
- **Definition of Participating Roles.** At this step (Fig. 6), the designer defines the participating roles in the desired learning scenario.

  ![Figure 6. Defining Participating Roles and Groups](image)

  **Figure 6. Defining Participating Roles and Groups**

Each role can be defined based on specific attributes of a user model (Fig. 7), enabling the definition of refined roles and groups (Fig. 8). For example, the designer can specify that Group A consists of learners with good knowledge of the subject and another group, Group B, consisting of learners with medium knowledge.

![Figure 7. User Model Definition](image)

**Figure 7. User Model Definition**

As described in section 2, such functionality cannot be supported by systems that implement IMS Learning Design Level A, since elements of the User Model can be modeled in the IMS LD schema only as global properties, available in IMS LD Level B (Fig. 9).

![Figure 9. Supporting User Model elements in IMS LD](image)

**Figure 9. Supporting User Model elements in IMS LD**

- **Learning Scenario Design.** During this step (Fig. 10), the designer specifies the activity sequence of a scenario using a graphical user interface.

![Figure 10. Designing a Pedagogical Scenario](image)

**Figure 10. Designing a Pedagogical Scenario**
For each activity the designer defines the participating roles (Fig. 11), the environment in which the specific activity takes place (Fig. 12), as well as, the method by which this activity will be completed and/or terminated (for example user choice or time limit) (Fig. 13).

The time limit is often used in testing activities where a learner is required to finish a test in a specific time frame. Alternatively, this functionality can be used for associating a sequence of activities within a time schedule.

Moreover, during this step the designer has the ability to define properties about the activities or the participating roles of the scenario (Fig. 14), as well as, define the updating of their values when a specific activity takes place (Fig. 15).

Such functionality provides the flexibility to control the flow of activities depending on the property values (feedback) during the run-time execution of the scenario.

- **Content Packaging.** This is the final step (Fig. 16) in the authoring process, in which the content components required to support the designed activities are specified. The intended user of this step is the subject expert, who is responsible for populating the pedagogical design with the required content objects. After the design of the pedagogical scenario (previous step), the ASK-LDT automatically generates the XML coding of IMS LD Level B that corresponds to the...
designed scenario. After the XML coding generation, the subject expert is requested to associate for each resource defined, the required content objects that support the designed scenario. For each resource, additional required components (e.g. images that are used within an html page) can be specified using a drag and drop interface (Fig. 17).

![Figure 17. Associating Content Objects with Activities](image)

4. Preliminary Evaluation

4.1. System Implementation

The ASK LDT is already available for public use, and is available online from: `www.ask.iti.gr/demos/ASK-LDT_vUF_rel1.1_Setup.exe`. This version of the tool has been tested for compatibility with the CopperCore LD runtime engine. To this end, scenarios designed with the ASK LDT tool can be run through the CopperCore runtime player. Intensive interoperability tests between ASK-LDT, Reload Editor and CopperCore are planned to take place in the Advancing Learning Technology Interoperability 2005 (alt-i-lab2005) event (www.imsglobal.org/alti-lab/).

Next, we discuss preliminary evaluation results of the ASK Learning Designer Toolkit.

4.2. Preliminary Evaluation

In this section we present preliminary evaluation results for the ASK-LDT tool, recorded in the UNFOLD Communities of Practice meeting (www.unfold-project.net) at Barcelona April 2005. During this meeting the ASK-LDT tool was presented to a sample of 9 participants and they were requested to design their own pedagogical scenario using the tool. The outcome of this process, that was, the pedagogical scenarios populated with sample content objects were presented using the CopperCore run-time player. Fig. 18 presents the distribution of the participants in this meeting.

![Figure 18. Distribution of evaluation participants](image)

Fig. 19 presents the feedback on how friendly to the designer the ASK-LDT tool is. In the context of our work, the friendliness of the tool was examined against the functionalities that the tool provides for the definition of a pedagogical scenario. From this figure, the evidence about the tool is that most participants of the experiment found that the tool is moderate friendly to the designer of a pedagogical scenario.

![Figure 19. Evaluation Distribution](image)

In order to analyze deeper the reflections on the ASK-LDT tool, we have classified the participants of this experiment in two classes based on their experience level on the details of the IMS Learning Design specification (Fig. 20).

![Figure 20. Participants’ IMS LD Experience Level Distribution](image)

Fig. 21 presents the evaluation results for well experienced participants, whereas Fig. 22 presents evaluation results with less experience with the IMS Learning Design specification.
Figure 21. Opinion of well experienced users with the IMS Learning Design specification

Figure 22. Opinion of less experienced users with the IMS Learning Design specification

Additionally, we have classified the participants of this experiment in two other classes based on their experience level with IMS Learning Design based authoring tools (Fig. 23).

Figure 23. Participants' Authoring Tools Experience Level Distribution

Fig. 24 presents the evaluation results for well experienced participants, whereas Fig. 25 presents evaluation results with less experience with IMS Learning Design authoring tools. As we can observe from these figures, the ASK-LDT is more preferable for less experienced people with IMS LD based authoring tools, as well as, for those users who are quite familiar with IMS LD based authoring tools but are not exposed to the details of the IMS Learning Design specification. This is due to the fact that ASK-LDT automatically generates the IMS LD coding without requiring the user to know and handle the details of the specification. On the other hand, more experienced users want to have more control on the details of the IMS LD representation and thus they prefer tools with direct control of the XML coding. The experiments showed that the automatic generation of the XML code is perceived by more advanced users as a limitation introduced by the ASK-LDT.

Figure 24. Opinion of well experienced users with IMS LD authoring tools

Figure 25. Opinion of less experienced users with IMS LD authoring tools

5. Conclusions

In this paper we discussed the evolution of Educational Modeling Languages and presented the ASK Learning Designer Toolkit (ASK-LDT), an authoring tool based on the use of IMS LD Level B specification that provides the environment for a pedagogical designer to define learning scenarios. Finally, we reported initial evaluation results of the tool from the UNFOLD Communities of Practice meeting held at Barcelona April 2005.

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7. References


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