ASK LDT 2.0: A WEB-BASED GRAPHICAL TOOL FOR AUTHORING LEARNING DESIGNS

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ABSTRACT

During the last decade, Open Educational Resources (OERs) have gained increased attention for their potential to support open access, sharing and reuse of digital educational resources. Therefore, a large amount of digital educational resources have become available worldwide through web-based open access repositories which are referred to as Learning Object Repositories (LORs). These resources have the potential to facilitate teachers to improve and enhance their day-to-day teaching activities. On the other hand, it has been identified that teachers could benefit from their participation in communities of best teaching practices by sharing, not only educational resources, but also learning designs that represent their pedagogical approach. As a result, there is an increased interest for the development of web-based repositories that facilitate open access to both educational resources and learning designs. However, the process of developing and sharing learning designs through web-based repositories requires authoring tools that can represent learning designs in a machine-readable way. A commonly accepted way that provides a standard notation language for the description of learning designs is the IMS Learning Design (LD) Specification. Consequently, a number of IMS LD compatible learning design authoring tools has already been developed. Nevertheless, most of these tools (a) are not supporting the process of importing and editing learning designs and (b) they are stand-alone tools restricting their widespread use. To this end, in this paper we present a web-based learning design authoring tool that aims to overcome the previous identified problems.

KEYWORDS

Learning design repositories, learning design tools, IMS learning design, graphical tool

1. INTRODUCTION

Over the past years, the term Open Educational Resources (OERs) has been emerged, aiming to promote open access to digital educational resources that are available online for everyone at a global level (Caswell, Henson, Jensen and Wiley, 2008). In response to this emerging trend, a large amount of digital educational resources have become available worldwide through web-based open access repositories which are referred to as Learning Object Repositories (LORs) (McGreal, 2008). These resources have the potential to facilitate teachers to enhance and improve their day-to-day teaching activities.

On the other hand, it has been recognized that teachers could improve the quality of their teaching and support their motivation for enriching their teaching practices through their participation in communities of best teaching practices, which facilitates them to share, not only digital educational resources, but also learning designs (LDs) that represent their pedagogical approach (Conole, 2008). More specifically, teachers are able through their participation to communities of teaching practices to: (a) search and download best teaching practices for share and re-use, (b) discuss and collaborate about best teaching practices and (c) provide their feedback about the actual use of a teaching practice via ratings and/or comments (Galley, Conole, Dalziel and Ghiglione, 2010). As a result, there is an increased interest for the development of web-based repositories that facilitate open access to both educational resources and learning designs (Sampson Zervas and Sotiriou, 2011; Paquette, Marino, Lundgren-Cayrol and Léonard, 2008).

Nevertheless, the process of developing and sharing LDs through web-based repositories requires authoring tools that can represent the pedagogical design that is followed in a typical classroom, that is, the structured flow of learning activities populated with resources and facilitated by certain tools and devices,

where teachers and students participate assuming certain roles (Griffiths and Blat, 2005; Wilson, 2005). A key specification that provides a standard notation language for the description of learning designs is the IMS Learning Design (LD) Specification (IMS Global Learning Consortium, 2003). Therefore, during the last years a number of IMS LD compatible learning design authoring tools have been developed (Griffiths and Liber, 2008. However, most of these tools: (a) are not supporting the process of importing and editing LDs, and (b) are stand-alone tools restricting their widespread use. To this end, in this paper we present a new learning design authoring tool, namely the ASK Learning Designer Toolkit 2.0 (ASK-LDT 2.0) that aims to overcome the previous identified problems.

The rest of the paper is structured as follows. In section 2, we introduce the IMS LD specification and we present its conceptual structure. Moreover, we present and compare existing LD authoring tools, so as to identify their weaknesses. In Section 3, we present the architectural components and the fundamental functionalities of the ASK-LDT 2.0. Section 4 presents users' satisfaction results from the use of ASK-LDT 2.0. Finally, we discuss our findings and we present our conclusions and suggestions for future work.

2. BACKGROUND

2.1 IMS Learning Design Specification

IMS LD Specification was developed by IMS Global Learning Consortium (IMS GLC) in 2003, with the aim of providing a standard notation language for describing LDs (IMS Global Learning Consortium, 2003). A learning design (LD) is defined as: "*the description of the teaching-learning process, which follows a specific pedagogical strategy or practice that takes place in a unit of learning (e.g., an educational course, a learning activity or any other designed learning event) towards addressing specific learning objectives, for a specific target group in a specific context or subject domain*" (Koper and Olivier, 2004, p. 98). IMS LD specification consists of the following core elements (Koper and Olivier, 2004):

- **Activity:** Activities are one of the core structural elements of the LD and they are used to express actions that learners or teachers perform during learning and teaching. They also specify their termination conditions and the actions to be taken upon termination. There are two basic types of activities: Learning Activities and Support Activities. A Learning Activity is directed at attaining a learning objective per individual actor. A support activity is meant to facilitate a role performing one or more learning activities.
- **Role:** specifies the participating roles in a learning/support activity. There are two basic Role types: the Learner Role and the Support Role. These roles can be sub-typed to allow learners to play different roles in certain types of learning/support activities. Similarly, support role can be sub-typed and given more specialized roles, such as tutor, teaching Assistant, mentor, etc. Thus, roles set the basis for multi-user models of learning and teaching. The name that a certain role is given depends on the underlying teaching approach and the setting in use.
- **Environment:** Environments are elements which hold educational resources and/or tools/services (such as a chat, a forum, etc.)
- **Property**: Properties are elements that store different kinds of data, which can be displayed and updated/changed during the teaching/learning process. Properties can be used for building conditions of IF-THEN-ELSE statements that control the visibility of elements such as activities and environments, as well as for updating of existing properties.

The IMS LD specification follows the metaphor of a theatrical play. This means that the learning process is represented as a play including a sequence of acts, with each act containing a number of role parts that connect the roles to the learning activities they perform and to the educational resources they use (Koper and Olivier, 2004). In IMS LD, a learning design can be built at three (3) different levels, as follows (Koper and Olivier, 2004):

- **Level A:** contains a series of learning activities, performed by one or more actors/roles, in an environment consisting of educational resources and/or tools/services.
- **Level B:** adds properties (storing information about a person or a group), and conditions (placing constraints with rules upon learning flow).
- **Level C:** adds notifications that can facilitate reconfiguring design based on run-time events.

2.2 Learning Design Authoring Tools

During the last years, a number of IMS LD authoring tools have been developed, which could be summarized below:

- **LAMS (Learning Activity Management System)** (Dalziel, 2003) is an open-source web-based graphical authoring tool, which enables its users to graphically design LDs of pre-defined learning/support activities (users can not define new types of learning/support activities). LAMS supports (a) pre-defined role types and (b) pre-defined environments integrated with specific specific tools/services, whereas it can not support definition of properties and conditions. Finally, LAMS enables export of LDs in IMS LD level A compatible format.
- **ASK Learning Designer Toolkit (ASK-LDT)** (Sampson, Karampiperis and Zervas, 2005) is a stand-alone graphical authoring tool, which enables its users to graphically design LDs based on the interconnection of user defined learning/support activities. ASK-LDT supports (a) user-defined role types, (b) user-defined environments and (c) definition of properties and conditions. Finally, ASK-LDT enables export of LDs in IMS LD level A, B compatible format
- **ReCourse** (Griffiths, Beauvoir, Liber and Barrett-Baxendale, 2009) is an open source stand-alone authoring tool, which combines form-based and graphical-based authoring of LDs based on the interconnection of user defined learning/support activities. However, the dominant approach for authoring LDs within the tool is based on filling forms. ReCourse supports (a) user-defined role types, (b) user-defined environments and (c) definition of properties and conditions. Finally, ReCourse supports import and export of LDs in IMS LD level A, B and C compatible format.
- **OpenGLM** (Neumann and Oberhuemer, 2008) is an open source stand-alone graphical authoring tool, which enables its users to graphically design LDs based on the interconnection of user defined learning/support activities. OpenGLM supports (a) user-defined role types, (b) user-defined environments and (c) definition of properties and conditions. Finally, OpenGLM enables export of LDs in IMS LD level A and B compatible format.
- **CADMOS** (Katsamani, Retalis and Boloudakis, 2012) is a stand-alone graphical authoring tool, which enables its users to graphically design LDs based on the interconnection of user defined learning/support activities. CADMOS supports (a) user-defined role types, (b) user-defined environments and (c) definition of properties and conditions. Finally, CADMOS enables export of LDs in IMS LD level A, B compatible format.

Table 1 compares existing LD authoring tools according to their functionalities. As we can notice from Table 1, most of the existing LD tools are stand alone and they are not accessible via a web-browser. On the other hand, most of them can support the definition of the main IMS LD elements as identified in section 2.1 and only LAMS come short into supporting all main IMS LD elements. Nevertheless, it seems that only ReCourse can support the process of importing LDs in IMS LD compatible format. This creates an extra barrier to the interoperability between different existing LD authoring tools. Therefore, in this paper we propose a new tool namely, ASK-LDT 2.0, which is a web-based graphical authoring tool that fully supports the (a) process of authoring LDs by utilizing the main IMS LD elements, as well as (b) the process of importing and exporting LDs in IMS LD compatible format.

Table 1. Comparison of Existing LD Authoring Tools

Functionalities	LAMS	ASK-LDT	ReCourse	OpenGLM	CADMOS
Stand-alone/Web Based	Web-based	Stand-alone	Stand-alone	Stand-alone	Stand-alone
Form-based/Graphical-based	Graphical-based	Graphical-based	Form-based	Graphical-based	Graphical-based
User-defined Roles	Pre-defined	✓	✓	✓	✓
User-defined Learning/Support Activities	Pre-defined	✓	✓	✓	✓
User-defined Environments	Pre-defined	✓	✓	✓	✓
Create/Edit Properties/Conditions	-	✓	✓	✓	✓

IMS LD Level Compatibility	A	A, B	A, B, C	A, B	A, B
Import IMS LD Package	-	-	✓	-	-
Export IMS LD Package	✓	✓	✓	✓	✓

3. THE ASK LEARNING DESIGNER TOOLKIT 2.0 (ASK-LDT 2.0)

ASK-LDT 2.0 is an open source web-based graphical tool fully supporting the process of authoring learning designs that are compatible with IMS LD. ASK-LDT 2.0 can be used by teachers and/or educational practitioners, so as to graphically design LDs based on the interconnection of user-defined learning/support activities. Moreover, ASK-LDT 2.0 supports (a) user-defined role types, (b) user-defined environments and (c) definition of properties and conditions. Finally, ASK LDT 2.0 enables import and export of LDs in IMS LD level A, B compatible format. Figure 1 presents an overview of ASK-LDT 2.0 architecture.

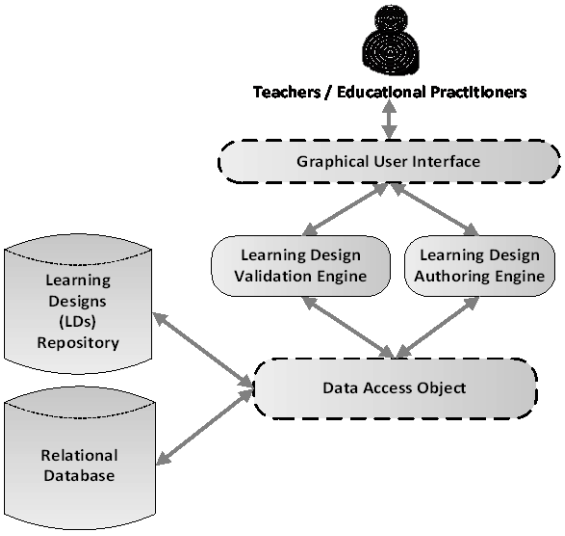

Figure 1. ASK-LDT 2.0 Architecture

As shown in Figure 1, the lowest level includes a repository where the LDs that are created or imported to the tool by its users are stored. This level includes also a relational database where information about the users of the tool, as well as information about the graphical representation of the LDs is stored. The lower level module (namely, the Data Access Object) provides access to the LDs repository, as well as to the relational database and includes all the necessary procedures for reading and writing to them. The next level includes the following modules:

- *The Learning Design (LD) Validation Engine*, which includes all functionalities relating to (a) validating and importing LDs to the tool compatible with IMS LD and (b) validating and exporting the LDs that are developed by the users of the tool based on the IMS LD specification.
- *The Learning Design Authoring Engine*, which includes all functionalities for authoring LDs based on the main IMS LD elements as described in section 2.1

Finally, the top level of the tool is the Graphical User Interface Module, which is responsible for the graphical representation and visualization of the LDs and the interface with the users.

The main functionalities of ASK-LDT 2.0 can be summarized as follows:

- **Create/Edit/Import a LD:** The user has the capability to create a new LD from scratch or open and edit an existing LD (Figure 2). Another option for the user is to import to the tool an existing LD package, which is conformant with IMS LD specification (Figure 3). This import functionality is a unique feature not supported by other similar tools and it can highly facilitate the interoperability with other similar tools.

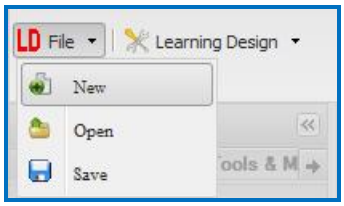

Figure 2. Creating/Editing an Existing LD

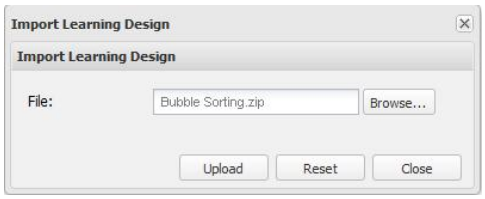

Figure 3. Importing an IMS LD Package

- **Define Roles/Environments:** The user has the capability to create/edit different roles for a LD (learner and/or support roles as defined in IMS LD specification) (Figure 4). Moreover, the user has the capability to create/edit environments (as well as tools and educational resources that support this environment), where learning/support activities of a LD can take place. It should be noted that the tool supports the creation of environments that are supported by educational resources and pre-defined tools/services as defined in IMS LD specification, namely a forum, an announcement service, a chat and a send mail service (Figure 5).

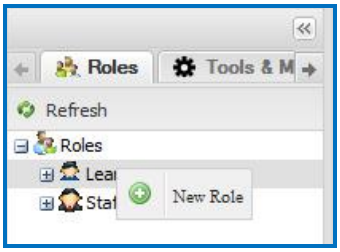

Figure 4. Create Learner and/or Support Roles

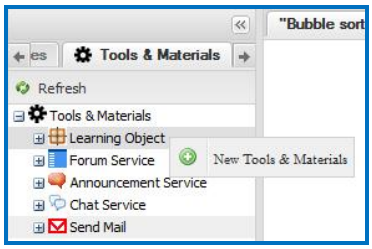

Figure 5. Define an Environment, as well as Tools and Educational Resources that support this Environment

- **Graphically Design Activities:** The user has the capability to graphically design by using the drag and drop functionality the flow of the learning/support activities of a LD (Figure 6). Moreover, for each learning/support activity the user can add description and educational resources, assign roles and assign environments where the learning/support activity will take place. Finally, for each activity the user can define properties and conditions for the completion of a learning/support activity or for skipping/showing the next learning/support activity of a LD.

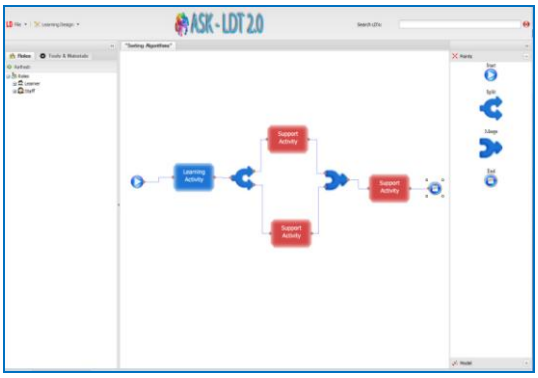

Figure 6. Designing the Learning Flow o a Learning Design

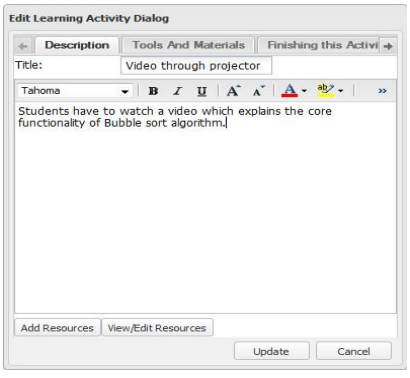

Figure 7. Defining the Properties of an Activity (Educational Resources, Participating Roles, Environments, Properties And Conditions)

- **Validate/Save/Export a LD:** The user has the capability to validate a LD before saving it and exporting it as IMS LD file package (Figure 8). Finally, the LDs are stored to a local repository and they can be retrieved by using an auto complete paginated search mechanism (Figure 9).

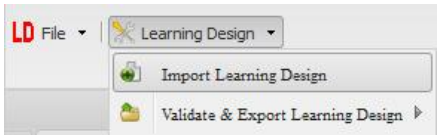

Figure 8. Validate and Export a LD as an IMS LD Package

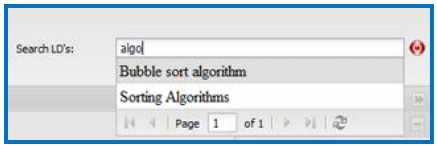

Figure 9. Search LDs from ASK-LDT 2.0 Local Repository

4. PRELIMINARY EVALUATION

In this section, we present an experiment of using ASK-LDT 2.0 for the development of a LD. The main objective that we aim to address through this experiment is to measure users' satisfaction for authoring LDs by using the functionalities that were identified in Section 2.2. The evaluation method we have used is the method of survey (Cohen, Manion and Morrison, 2007). Surveys are appropriate evaluation methods for measuring the attitudes and the opinions of users (Rosier, 2002). Thus, we consider this evaluation method suitable for our evaluation objective.

4.1 Participants and Workshop Setup

The study was conducted with MSc students (N=35) during their third semester of studies as a workshop, which was presented in the MSc Course on e-Learning at the Department of Digital Systems of the University of Piraeus, Greece. The workshop lasted three (3) hours and participants were asked to develop a LD by using the ASK-LDT 2.0. The LD was the same for all participants and it was provided to the participants as a document describing in details: (a) the learning flow of the learning/support activities of the LD and their interconnection, (b) the participating roles to each learning/support activity, (c) the environments where each activity should take place and (d) the properties and the conditions for completing each activity of the LD.

The procedure that was followed for the evaluation workshop was the following:

- **ASK-LDT 2.0 Introduction:** the workshop started with a demonstration about ASK-LDT 2.0 to be used by the participants. The main objective of the demonstration was to familiarize participants with the functionalities of the tool, and to provide guidance for the subsequent hands-on LD task.

The demonstration took the form of a one (1) hour presentation supported with slides including (a) a brief introduction of the ASK-LDT 2.0 functionalities and guidelines for using them during the LD task and (b) an example of developing a pre-defined LD.

- **LD Authoring Task:** each participant was assigned the task of developing the pre-defined LD using the ASK-LDT 2.0 and without any further assistance. Our intention was to ask the participants to develop a rather complex LD, so as to ensure that the participants had to perform more than a simple transfer of identical actions from the previously presented example to the task.
- **Post task questionnaire:** after the LD development task was completed, participants were asked to fill out a post-task questionnaire, which aimed to collect information about participants' satisfaction concerning the use of ASK-LDT 2.0 during the LD authoring process. For each one of the questions presented in the questionnaire, a five-point likert scale was used where 5 denotes "very satisfied" and 1 denotes "not at all satisfied".

4.2 Results

This section presents quantitative data analysis results for participants' satisfaction related with the use of ASK-LDT 2.0 functionalities for authoring LDs based on their responses to the post-task questionnaire. Table 2 presents the mean and the standard deviation for each question of the questionnaire that was filled by the participants of our study (N=35).

Table 2. Users' Satisfaction per Functionality

Nr	Questions	Mean (N=35)	Standard Deviation (N=35)
1	Was it easy to create learning and/or support activities?	4.60	0.28
2	Was it easy to graphically design the flow of the learning/support activities of the pre-defined LD?	4.48	0.29
3	Was it easy to define roles and assign them to learning and/or support activities?	4.61	0.27
4	Was it easy to define environments and assign which learning and/or support activities will take place in these environments?	4.53	0.30
5	Was it easy to define properties and conditions of for showing/hiding learning and/or support activities of the pre-defined LD?	4. 43	0.30

As we can notice from Table 2, participants' satisfaction has achieved very high mean score for the examined functionalities. Additionally, the standard deviation indicated that individual participants' responses are close to the participants' satisfaction mean proving their validity for the functionalities that were examined via the post-task questionnaire. These results provided us with indications that ASK-LDT 2.0 can strongly support the process of authoring learning designs and it can highly satisfy its users during this process.

5. CONCLUSIONS AND FUTURE WORK

In this paper, it was argued that there is a growing trend for the development of web-based repositories that facilitate open access not only to educational resources but also to LDs. It was also identified that existing LD authoring tools that could be used for developing and sharing LDs through web-based repositories (a) are not supporting the process of importing and editing LDs and (b) they are stand-alone tools restricting their widespread use. Therefore, we presented ASK-LDT 2.0 a web based LD authoring tool, which is based on IMS LD specification and it aims to overcome the limitations of existing LD authoring tools. Preliminary evaluation results from the use of ASK-LDT 2.0 provided us with indications that ASK-LDT 2.0 can strongly support the process of authoring LD and it can highly satisfy its users during this process.

Future work includes further development of the ASK-LDT 2.0 to support: (a) Level C of the IMS LD specification, (b) integration for searching/sharing the developed LDs from/to existing web-based repositories of LDs, (c) integration for searching/retrieving educational resources from existing LORs, so as to be used to LDs developed by the tool and (d) incorporation of new tools (in the form of widgets) to the environments that are defined for supporting the learning/support activities of a LD.

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