Designing Learning Services: From Content-based to Activity-based Learning Systems

Pythagoras Karampiperis and Demetrios Sampson

Advanced e-Services for the Knowledge Society Research Unit,
Informatics and Telematics Institute,
Centre for Research and Technology Hellas,
42, Arkadias Street, Athens, GR-15234 Greece

&

Department of Technology Education and Digital Systems,
University of Piraeus,
150, Androutsou Street, Piraeus,
GR-18534, Greece

{pythk, sampson}@iti.gr

ABSTRACT

The need for e-learning systems that support a diverse set of pedagogical requirements has been identified as an important 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. The most advanced of them are based on the IEEE Learning Technology Systems Architecture and use standardized content structuring based on the ADL Sharable Content Object Reference Model in order to enable sharing and reusability of the learning content. However, sharing of learning activities among different web-based educational systems still remains an open issue. The open question is how web-based educational systems should be designed in order to enable reusing and repurposing of learning activities. In this paper we propose an authoring system, refered to as ASK-LDT that utilizes the Learning Design principles to provide the means for designing activity-based learning services and systems.

Categories and Subject Descriptors

K.3.1 [**Computers and Education**]: Computer Uses in Education – *Distance Learning, Collaborative learning.*

D.2.11 [**Software Architectures**]: Domain-specific architectures.

General Terms: Management, Design, Standardization.

Keywords: Learning Design, Architectures, Learning Activities, Reusability, Authoring Tools.

1. INTRODUCTION

During the last years, several tools have been developed in order to support the process of web-based authoring and several learning systems have been implemented tailored to specific pedagogical approaches. Currently, there are several educational e-content repositories and networked infrastructures available ranging from federated or distributed learning repositories to brokerage platforms. Nevertheless, the level of learning content reusability remains relatively low, due to the fact that sharing of learning activities across systems has not been addressed yet. This limitation prevents systems from reusing the same learning scenarios, leading to significant extra pedagogical effort for reusing learning content in different contexts. On the other hand, existing Learning Management Systems (LMS) provide tools for web-based authoring that are tailored to the capabilities of the specific system in hand. As a result, reusing and repurposing of learning activities and content is not supported in a consistent manner [1].

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2. COURSEWARE AUTHORING TOOLS

Nowadays, there are several vendors that provide Learning Management Systems incorporating authoring tools that are based on the SCORM reference model.

The main limitation of the SCORM-based courseware authoring tools is that they are based on a "single learner model". This model assumes that a learner interacts only with content objects and that the learning activities are content-based activities engaging the learner in the learning process. Thus, the support provided by SCORM-based courseware authoring tools in the authoring process is limited in supporting the creation and sequencing of single learner, content-based learning activities. To this end, such authoring tools exclude the design of activities based on state-of-the-art pedagogical approaches such as constructive learning, collaborative learning etc. Moreover, since interactions between individual learners and/or between a learner and a tutor are abstracted in the SCORM reference model with no reference on how a learning system could support those interactions, SCORM-based authoring tools limit the interoperability between systems to only content interoperability.

On the other hand, a wide variety of non-SCORM conformant systems exist providing specific pedagogical approaches including active learning, constructive learning, collaborative learning, intentional learning, conversational learning, contextualized learning, reflective learning etc. (such as ActiveMath, MetaLinks, NetCoach, DCG, Interbook etc.). The main drawback of those systems [5] is that they are closed, self-contained systems that cannot be used as service components *(lack of reuse support*). Additionally, due to their close architecture they cannot support all the required functionalities in a learning process since they cannot use external services (*lack of integration*). On the other hand, even if an open and scalable environment has been implemented, 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.

3. THE PROPOSED AUTHORING TOOL

Reusing learning activities across different learning systems requires that all components of a learning activity can be modeled in

a commonly understandable form [2, 3, and 4] and that those platforms include the structural components required for the support of learning activities [5]. A first step is to agree on common ways for representing learning scenarios and describing the interactions between participating roles (learners, tutors, etc) and educational systems' services. To this end, standardization efforts on learning technologies have led to the IMS Learning Design specification which provides a standard notation language for the description of learning scenarios. Moreover, repurposing of learning activities in a consistent manner requires authoring tools that are capable of handling the machine understandable representation form of learning activities [3].

The ASK Learning Designer Toolkit (ASK-LDT) introduced in this paper, is a tool supporting the process of learning activities authoring (see figure 1).

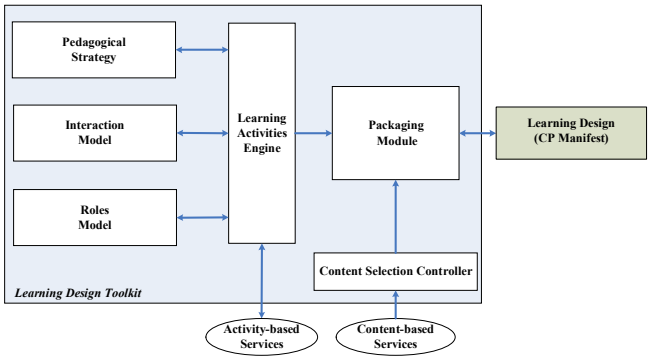

Figure 1: Internal Architecture of ASK-LDT

The ASK-LDT is based on the use of IMS Learning Design specification in order to provide to a pedagogical designer the environment for defining complex learning scenarios. The produced learning scenarios conform to the IMS Learning Design v1.0 Level B specification. The ASK-LDT, also, supports metadata for learning resources that conform to the IEEE Learning Object Metadata 1484.12.1-2002 standard.

Based on the Learning Design framework principles, the authoring process that the ASK-LDT supports consists of the following steps:

- *Definition of Pedagogical Elements*. At this step 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.
- *Definition of the Environmen*t. At this step a designer defines the participating roles in the desired learning scenario, as well as, the environments in which the activities are taking place. An environment can be a virtual environment such as a virtual laboratory, an on-line chat, a discussion forum etc., or a software tool exposed as a service such as an annotation tool, a search engine etc.
- *Learning Scenario Design*. During this step the designer specifies the activity sequence of a learning scenario using a graphical user interface. For each activity the designer defines the participating roles, the environment in which the specific activity is taken place, as well as, the method by which this activity will be completed and/or terminated (user choice or time limit).
- *Statistical Analysis*. At this step the ASK-LDT provides statistics of the use of each activity type and environment in the learning design specified, in order to visualize the designer's decisions.
- *Content Packaging*. This is the final step in the authoring process, in which the content components required to support the designed activities are specified. The output of this step is content packages conforming to the IMS Content Packaging v1.1.3 specification.

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 low-level notation language for the description of learning scenarios (so as to be able to inter-exchange 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.

4. CONCLUSION

In this paper we presented the limitations of the state-of-the-art of tools and discussed open issues and problems concerning the support of learning activities. Based on this discussion, we proposed an authoring system that utilizes the Learning Design principles to provide the means for designing activity-based learning services.

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