

e-LD : A Collaborative and Online e-Learning Design Authoring Tool Based on IMS-LD Specification

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Abstract— Nowadays, with the evolution of e-learning technologies, there is an urgent need for the design, development, reuse and sharing of online courses and contents as standard learning objects. To build this courses, this requires the use of creation tools, called “authoring tools”, which manifest, in most cases, a complexity of use for teachers authors. The aim of this work is to develop an authoring tool for constructing learning objects, tool targeted at supporting teachers instructors in implementing educational contents. The authoring environment, called “e-LD (e-Learning Design) Authoring Tool” is based on the methods of Instructional Design and Learning Design, particularly the IMS-LD specification that offers an explicit separation of "activities" and "resources" by specifying the semantic relations linking them. In addition, e-LD tools introduces an aspect of online and collaborative Learning Design : the process of e-Learning Design is done collaboratively by integrating interaction tools inspired from collaboration on Web 2.0 applications. Firstly, the paper justify the choice of IMS-LD as basic model to construct learning objects. Then, this work presents the design and development process of learning objects and describes the steps of the development process. Finally, the paper exposes the adopted technical choices and a first prototype is set up to provide a subjective evaluation of the new framework.

Keywords— e-LD; e-Learning; Learning Design; IMS-LD; Authoring tool; Collaboration

I. INTRODUCTION

Today, e-learning technology offers a wide range of new opportunities for development of education [1]. The pedagogical possibilities made possible by digital technologies constituting a main lever for the modernization of practices of e-learning [2]. In this sense, with the diversity of solutions made possible by educational technologies, the important movement to establish norms and pedagogical standards for online learning and training has changed the way that we exercise the practices of learning design [3]. In this context, a number of e-learning standards as LOM (Learning Object Metadata), SCORM (Sharable Content Object Reference Model), IMS-LD (Instructional Management Systems-Learning Design), etc. have been established for the modeling and diffusion of educational contents as learning objects. The use of these standards requires authoring tools environments compatible with each standard. In this sense, several existing tools and editors can be used to design and create learning objects.

However, the process of mediatization of pedagogical contents for online learning raises many questions. Various studies show that, from a technical point of view, many standards of pedagogical modeling give little of place to pedagogical aspects or show a complexity of use because they have a strong interest in standardization and issues of

reuse [4][5][6].

This work is in the light of these issues. It relates of the work on Learning Design (LD) process and is focuses mainly on the process of implementation of e-learning courses as standard Learning Objects (LO). The main objective is to help teachers authors, at the technical level, to collaboratively develop learning objects compatible with the IMS-LD standard. It comes to implement an online authoring tools of online and collaborative development of learning objects, based on the IMS-LD specification. Learning objects developed are reusable and interoperable. The authoring tool proposes an educational development process upstream of IMS-LD specification and addressing himself to non-expert end-teachers authors.

This paper is organized as follows: firstly, the paper presents an literature review about the main characteristics of the Learning Design process. The paper goes on to presents the main characteristics of the IMS-LD specification, standard on which is based the proposed model. In the next section, this paper describes generally the process of design and development of the proposed authoring tool. The paper then proceeds to describe the technological choices adopted to implement the framework. Finally, the article presents the main interface of the implemented prototype and concludes with future work of this research.

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II. RESEARCH BACKGROUND

A. Learning design (LD)

Learning Design is defined as a process that consists to the description of the teaching process following a specific pedagogical approach that addresses specific learning objectives for a particular audience in a particular discipline [7]. Fig. 1 illustrates the relations among the Unit of Learning or Learning Object (concepts increasingly used in the field of the Learning Design), learning model, domain model, and theories of learning and instruction. The Unit of Learning or Learning Object is the result of the LD process.

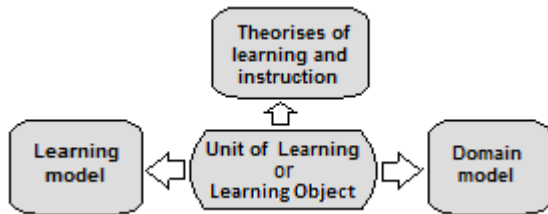


Fig. 1. The context of learning design

The learning model describes how students learn based on various learning theories. The domain model describes the content and its organization, for example, software engineering or data on the Web. The theories of learning and instruction describe the instruction principles and models based on the literature or the experience of practitioners [8]. In the field of e-learning, to enable the design of the dynamics of teaching and learning and their standardization,

the IMS Global Learning Consortium established a new specification for online learning. This specification, named IMS Learning Design (IMS-LD), provides a framework of elements that can describe any design of a teaching-learning process in a formal way. In the following, we describe in detail this specification.

B. Instructional Management Systems-Learning Design (IMS-LD)

IMS-LD is an open standard that is used to code a wide variety of digital courses, known as Units of Learning or Learning Objects, in a formal, semantic, interoperable and machine-readable fashion. It is a specification to represent and encode learning structures and methods [9]. The IMS-LD supports a wide range of modern pedagogical approaches such as active learning, collaborative learning and adaptive learning [7].

IMS-LD is focused on the design of pedagogical methods able to manage learning activities linked to learning objects within a learning flow. This learning flow consists of plays, acts, activities, activity structures and environments and it is flexible enough to provide several personalized itineraries depending on the role assigned or on a set of rules. The usual life-cycle starts with a lesson plan modeled according to the IMS-LD, defining roles, learning activities, services and several other elements inside a XML document [10]. IMS-LD consists of three levels (Fig. 2).

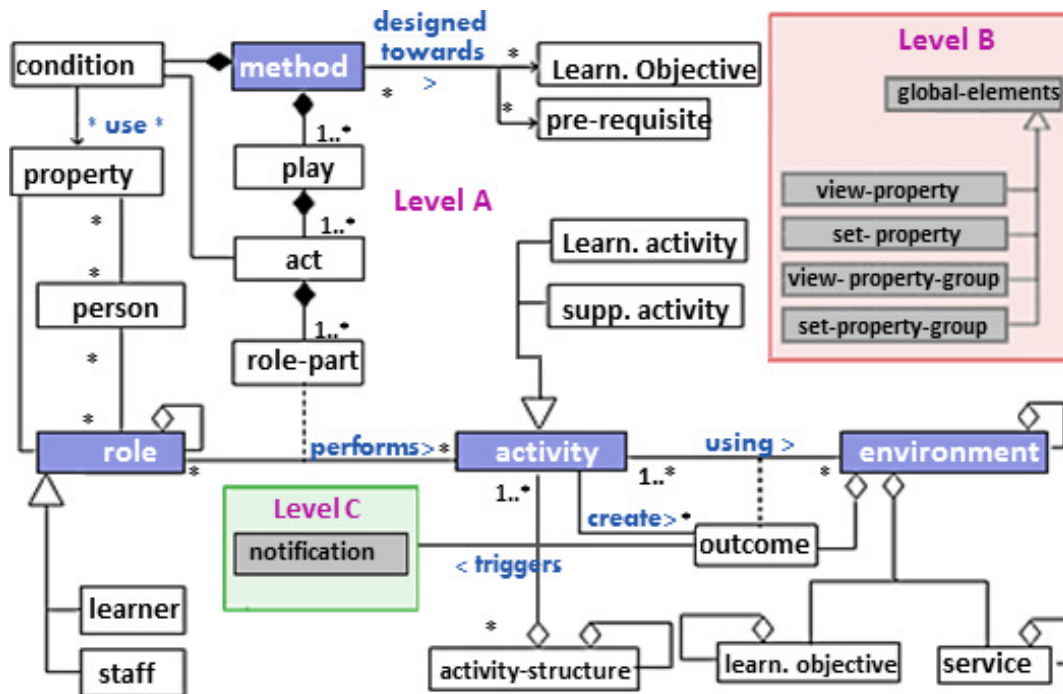


Fig. 2. Three levels of the IMS-LD specification

Each level itself provides specific features to the Learning Object:

- Level A: this level is the main part of the IMS-LD specification, as it provides the baseline to build any Learning Object;
- Level B adds powerful features to create more complex e-learning lesson plans;
- Level C sums a specific and useful trigger element (adds notifications).

In the use of IMS-LD, every single step between the creation and the use needs an IMS-LD compliant tool. The Learning Object can be created with general purpose editors or with specific IMS-LD editors, like CopperAuthor, Cosmos or Reload Learning Design Editor, and they can be run with several tools and engines, like CopperCore or Sled.

III. e-LD : AN ONLINE AND COLLABORATIVE e-LEARNING

DESIGN TOOL BASED ON IMS-LD

With the large amount of heterogeneous digital resources on the Web, modeling e-learning contents cannot be done currently without taking into account e-learning norms and standards. These standards aim to ensure the accessibility, interoperability and reusability of learning objects produced. One of these standards is the IMS-LD specification that manifests a complexity of use for teachers authors.

In this section, we will define and explain the foundation and technical choices on which rests the implementation of the online and collaborative e-Learning Design (e-LD) authoring tool designed to facilitate the use of IMS-LD specification by teachers authors.

A. Why IMS-LD specification?

The choice of IMS-LD specification as a basic standard to model and develop learning objects is based on a comparative study of the main norms and pedagogical modeling standards. Indeed, the study and analysis of the standards as LOM and SCORM allows us to identify several weak points such as abstraction, generality and lack of relevance. In these models, the pedagogical aspects have often been limited to classical models centered on the aggregation and diffusion of content. In summary, these models make little place to teaching and learning aspects and often mix the two. This is due to their strong interest in standardization and reuse issues.

When to them, IMS-LD is an open standard that offers an explicit separation of "activities" and "resources" by specifying the semantic relations linking them. It is used to code a wide variety of digital courses in a formal, semantic, and interoperable fashion. The IMS-LD supports a wide range of modern pedagogical approaches such as active learning, collaborative and socioconstructivist learning and adaptive learning. This pushed us to the choice of IMS-LD as the base model.

B. e-LD authoring tool

To facilitate the task of development and delivery of e-learning contents as standard learning objects, it was proposed to develop an online and collaborative authoring environment called e-LD (e-Learning Design). It is a scenario development tool to generate the executable version of the learning object compatible to IMS-LD format to ensure reusability and interoperability.

1) e-LD development process

In e-LD authoring tool, the process of implementation of an e-learning course consists in describe the structure of the learning object in terms of various components defined in IMS-LD specification: roles, activities, environment, method, etc. This process is composed of three main steps: Instructional Design, creation of learning path and scenarios (development) and delivery of learning objects (Fig. 3).

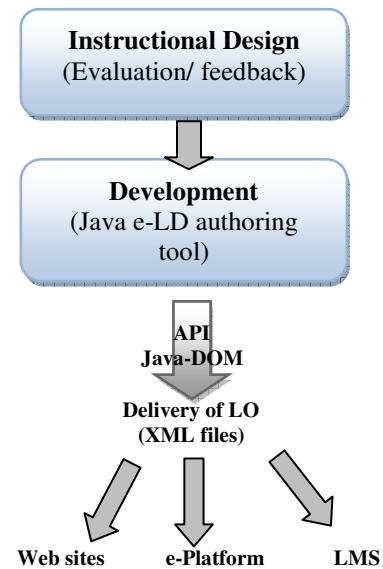


Fig. 3. Process of design/development of a Learning Object using e-LD tool

In the Instructional Design phase, teacher's authors develop and evaluate a structured and hierarchical representation of concepts and knowledge to teach and model the learning paths, scenarios and possible sequences.

The development phase concerns the mediatization of learning paths and scenarios developed in the previous step. Here, the learning objects are produced by the e-LD authoring tool according to IMS-LD format. Teachers authors select a mediatic object (image, video, animation, etc.) previously created and saved in database. Every selected mediatic object is linked with one or more acts.

The result of the development process is the delivery of an interoperable and reusable learning object, formalized by an XML file structured and compatible to the IMS-LD specification.

C. Technical choices

The e-LD authoring tool should be designed as an environment responding to pedagogical functions proposed by IMS-LD specification. It should also be convivial and adapted to novice teachers in computer science.

On one hand, to meet all these constraints, it was chosen to use the Java programming language to develop this

environment and the XML standard for the storage format of learning objects produced.

Java is an object oriented language, portable and having a great richness of basic libraries. These qualities seem appreciable to develop this environment in the form of a Java applet (Fig. 4).

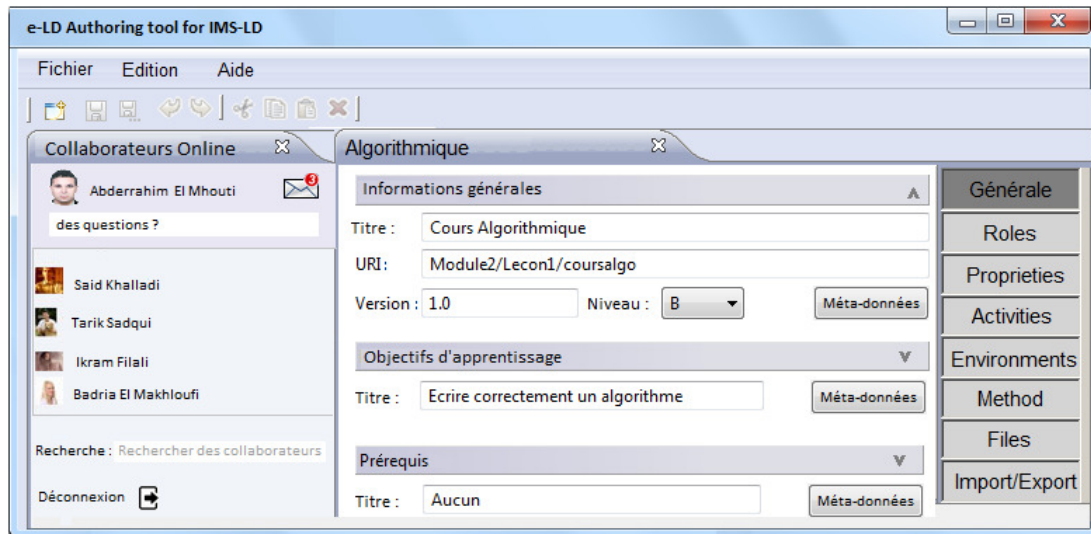


Fig. 4. Interface of e-LD Authoring Tool

The creation of teaching materials is therefore facilitated by an author interface (Fig. 4). It is a dedicated editor, based on the pedagogical functionalities defined above, and allows the generation of standardized learning objects.

A novel aspect of this approach is that the collaborative learning design process is becoming less the product of a single author, but this is a team work, consists of a manager who ensures the educational coordination (coordinator) and several teachers (authors) who design educational contents. The authors, freed from the constraints of time and place, must work together, pool their efforts and exchange relevant data.

On the other hand, to describe the structure of learning objects and their indexing, it was agreed to use XML language. Indeed, XML is adapted to the storage and manipulation of documents representing the learning objects, and this through the granularity and the markup syntax very suitable for the hierarchical structuring adopted by IMS-LD to organize pedagogical content. As well, XML separates content from the presentation by using XSL. Finally, XML allows to standardize description of learning objects produced and ensure interoperability and reusability.

The passage XML-Java is done using the Java DOM (Document Object Model) API. Java DOM is a standard proposed by the World Wide Web Consortium (W3C) and plays the role of interface to edit an XML document. This parser is perfectly suited to the programming of interactive applications, in which the entire graphical trees of an XML

document is exposed to the application, and, through it, to the end user.

Thus, the learning objects produced includes resources, web links, activities, roles, acts, sequences, etc, assembled in a Zip file (Fig. 5). This zip file can be easily stored, shared or imported into IMS-LD-compatible software.

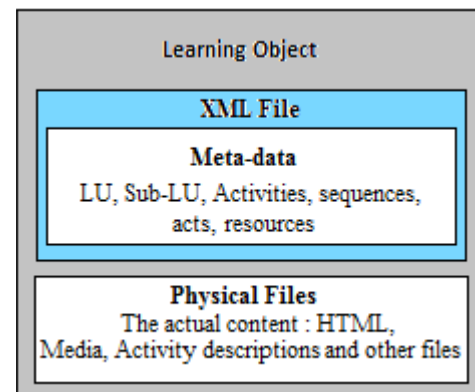


Fig. 5. Technical architecture of a learning object produced by e-LD tool

All of the tags related to the structure and the type of their content will be defined using the Document Type Definition (DTD) or XML Schema. The rules of adaptability or display will be defined in the XSL stylesheets (eXtensible Stylesheet Language).

IV. CONCLUSION AND FURTHER WORK

The development of Learning Design practices cannot succeed without the consideration of some pedagogical and technical aspects. One of these aspects concerns the e-learning contents development phase of the learning design process, which is confronted to the problem of the relevance of norms and standards of educational modeling.

In this context, this study focuses mainly on the complexity of use of the IMS-LD specification, a standard characterized by its relevance to describe and create e-learning courses.

In this paper, we have presented the e-LD tool, a generic e-Learning Design authoring environment based on IMS-LD standard. The introduction of such a tool seeks to assist and guide teachers in implementing pedagogical contents.

The authoring tool proposes a method for modeling LO upstream of IMS-LD standards. The production is done using an graphical user interface that describes the different components of a pedagogical scenario and facilitates the generation of the standardized learning objects for no-expert teachers. An important aspect of this method is that the e-learning design process is done collaboratively.

As part of the continuity of this work, we have planned to experiment the authoring tool in real conditions of e-Learning Design with a restricted group of teachers.

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