Reusing and Sharing Learning Designs in a Virtual University: A real case

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Abstract: In this paper, a case of study about the use of XML standards and computer based tools for the reuse and sharing of learning designs is presented. Authors have defined a process for creating Units of Learning. To this end, different tools have been used to design, plan, orchestrate, control and implement learning activities in an e-learning environment. The paper describes a real case of modeling a teaching-learning process with UML Activity diagrams that are transformed in IMS Learning Design specification format, with the aim of reusing and sharing the learning design of the subject "Management of Information System Development Process" of the "Master in Computer Science" at the University of Alcalá, through the virtual campus of this university. As a result, an unit of learning packaged in a zip file compatible with IMS content package has been generated, that can be executed using any IMS Learning Design Player.

Introduction

The design of a teaching-learning process is a task that the professionals of education must do when they plan to develop a training activity: course, course, seminar, etc. It is implies consider aspects like the context in which to develop teaching, the teaching method most appropriate in this context, the necessary resources, the contents of the training activity, or evaluation criteria to consider to determine whether they have achieved the learning goals.

When the teaching program or plan of an educational activity is developed, it is necessary to make it known to those involved in the same: teachers, students, managers, etc. Also, it is possible that the program design could be reused in future activities, or be taught in other schools or educational institutions. It is therefore important to establish a common exchange format for sharing the information in the syllabus design.

As with learning objects, about which many works have been published and proposals to facilitate reuse (IEEE 2002; IMS 2001), in the last years it has emerged proposals for reuse, besides content, the methodologies defined by educators, relying for this purpose in the definition and standardization of metadata that should be used to describe the teaching and learning processes. Organizations that have worked on this subject are those who have made the standardization of learning objects, such as IMS and ADL. In 2003, IMS published the IMS-Learning Design specification (IMS, 2003), created from the Educational Modeling Language (EML) of the Open University of the Netherlands (Koper, 2001), which has subsequently been also adopted by the ADL/SCORM specification, and that comes to facilitate the design, communication, and reuse of teaching-learning processes.

The benefits and barriers of sharing and reusing learning designs have been well documented (Oliver, 2007; Philip & Cameron, 2008). Sharing and reuse can conserve time and effort in creating learning designs by providing exposure to models of best practice; providing scaffolding and mentoring for new teachers; being a source of inspiration to even experienced teachers; facilitating collaborative review, reflection and evaluation of learning designs; allowing learning designs to be meaningfully archived and catalogued; and facilitating communities and professional and student networks. In the other hand, there are a number of barriers to share and reuse, these include: the inability to easily customize and edit learning designs to ensure currency, or so as to better suit the subject area, grade level and learning context; poor or inadequate search and discovery tools within the repository, if it cannot be found it cannot be reused or shared; insufficient examples, thereby limiting selection and choice. It is hoped that the introduction of the new planning tools with their visual and practical approach will encourage more widespread sharing and reuse of learning designs.

This article presents, first, the possibility of modeling teaching-learning processes using XML and UML, the same technologies as established by an IMS-LD specification. The following describes a real case of design

reuse of a teaching and learning process in a subject of the “Master in Computer Science” at the University of Alcalá, through the virtual campus of this university.

Modeling Teaching-Learning Processes using IMS-LD

A process can be defined as a sequence of activities in which different entities (people, machines, etc.) collaborate to achieve an objective. An example of a process, known as business process, would be one that describes the activities of a particular company or organization whose goal is to satisfy customer needs.

Since the late 80's, M. Hammer proposed the concept of reengineering processes to improve business processes of companies (Hammer, 1990), numerous techniques have been proposed to model the process as a necessary mechanism to understand how working in an organization and, where appropriate, help find the problems that not allow to achieve its objectives effectively and efficiently. Also software tools for process modeling have been developed, which allow customers to get a static view of the whole process and in some cases, a dynamic view by simulating the execution of the process.

A related concept with process is “workflow”, which refers to the total or partial automation of one or more processes. A Workflow Management System is a computerized system that allows the definition (modeling) of the processes that constitute a workflow, and the management of the execution of the processes, by means of the interpretation of the models, and the implementation of the applications necessary for the development of the documents involved in work or for the intercommunication of the participants in it. It is, ultimately, to automate the work in an organization, so that a user who logs into the system workflow, know at any time the next job to do and have, at every moment, the information necessary for this (e.g., documents received by email).

The tools for process modeling, such as workflow, use their own technology for storage of information that includes definitions of processes. The Workflow Management Coalition (WfMC) has set different standards for sharing information among commercial systems of this type (www.wfmc.org). In recent years, XML has been used to represent text documents models of processes, to facilitate reuse and interchange between tools (Martínez & Méndez, 2002). Although there are many techniques of graphical representation of processes, the standard graphical modeling system called UML (Unified Modeling Language) is one of the most used (OMG, 2003).

IMS-Learning Design (LD) is an IMS Global Consortium specification, whose goal is to provide a containment framework of elements that can describe any design of a teaching-learning process in a formal way (IMS, 2003a), supporting the description of learning designs. The designs can be described by a meta-language, based on EML, and they can involve a single user or multiple users. Using this language, instructional designers and providers can implement a behaviorist, cognitivist, constructivist, or some other approach; and can design learning processes that require learners to work separately or collaboratively. These can all be captured in terms of a Method containing Roles, Activity-structures, Environments and other related concepts (Koper, 2001). For this, IMS-LD uses a XML markup language with predefined tags that represent the different elements that can appear in the definition of a learning process, as <activity>, <role>, <condition>, etc.

The combination of these tags to design a process must satisfy the rules established by IMS in IMS-LD specification. IMS uses UML to provide intuitive graphical models to help understand these restrictions. UML is applicable for modeling the sequence of implementation of activities that have been included in a teaching-learning process; for it, use so-called "Activity Diagram" (OMG, 2003), which allows to represent workflows as a set of activities connected through transitions and under certain conditions (for example, in figure 1, that all students in a group have completed the exercises before proceeding to the next item).

Example of reusing Units of Learning

Since 2007, at the University of Alcalá we reuse learning designs in several subjects of a master's degree offered in e-learning mode, called “Master in Computer Science”, with the aim of that the new teachers entering the Master, can reuse designs created by previous teachers. The process for the design and reuse of learning designs is as follows:

1. Create and package learning objects for use in the subject.
2. Describe, by means of Activity Diagrams, learning design in terms of activities to be performed by students and teachers, using a UML visual design tool.

3. Export the design to an XMI format (OMG, 2007), compatible with other UML modeling tools.
4. Automatically, transform activity diagrams and integrate it into the manifest of a Unit of Learning package that satisfies the IMS-LD specification, using a XSLT program (W3C, 1999).
5. Use an IMS-LD authoring tool (such as Reload Learning Design Editor) for the final description of the elements of the Unit of Learning created.
6. Deploy the Unit of Learning in the LMS that integrate an IMS-LD player, as ReLoad Learning Design Player.

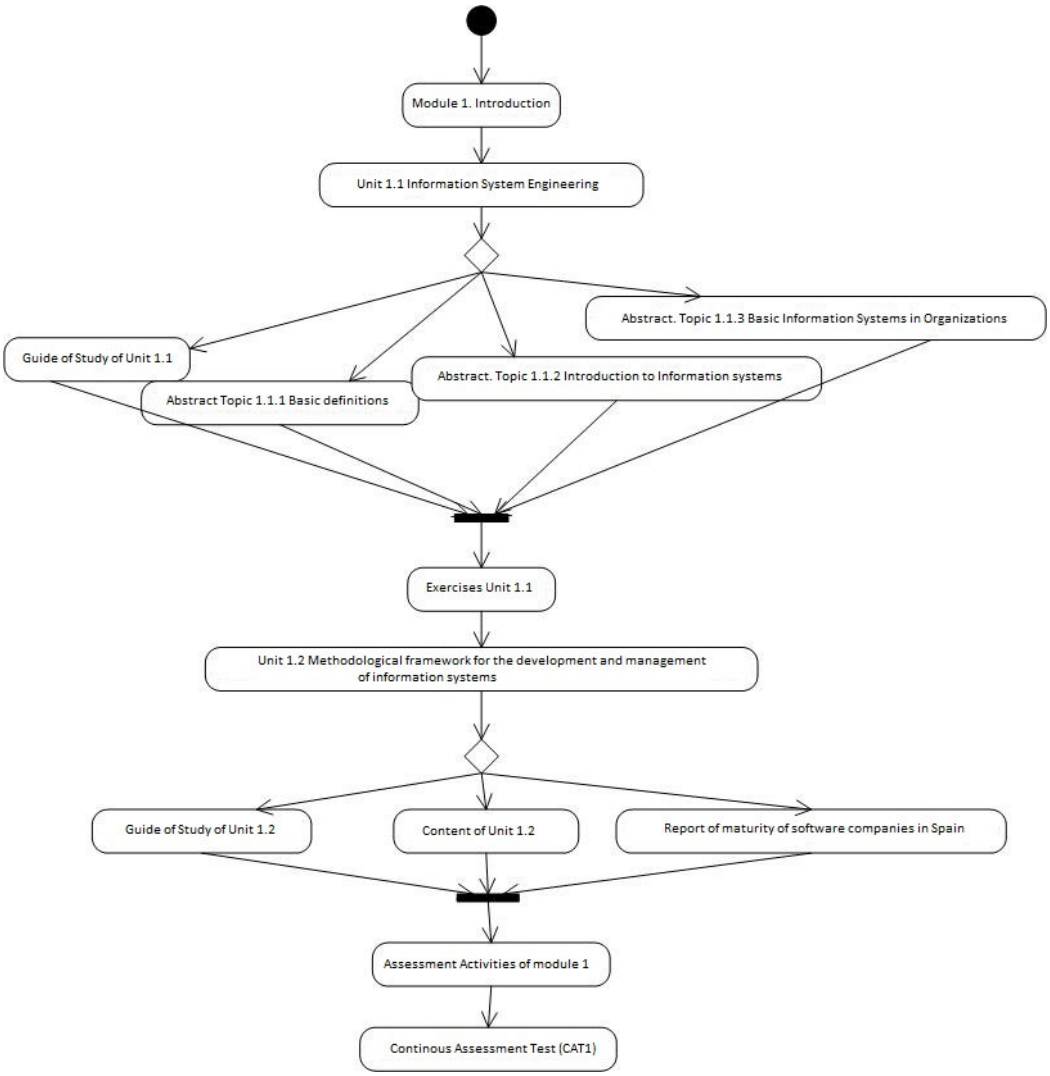

Figure 1: Activity diagram of the first module in a master's subject.

We have applied this process with the subject "Management of Information System Development Process". The course is organized in 3 modules. Figure 1 shows the different activities that will be executed along the first module of the course ("Module 1. Introduction"). Reload tool has been used to finalize the learning design. Thus, figure 2 shows a ReLoad LD editor window, with the description of the activities included in the design. For this subject only two roles have been created: student and teacher, and they have been associated to activities using Role-Part elements (see listing 1). In the Unit of Learning have been included, using the section content, learning objects and other resources created previously for the subject. Finally, we have packaged all into a single .zip file containing the Unit of Learning, which includes a manifesto describing the learning design, and all the archives with the resources to be used in the subject. And it has been distributed to the teachers of the subject.

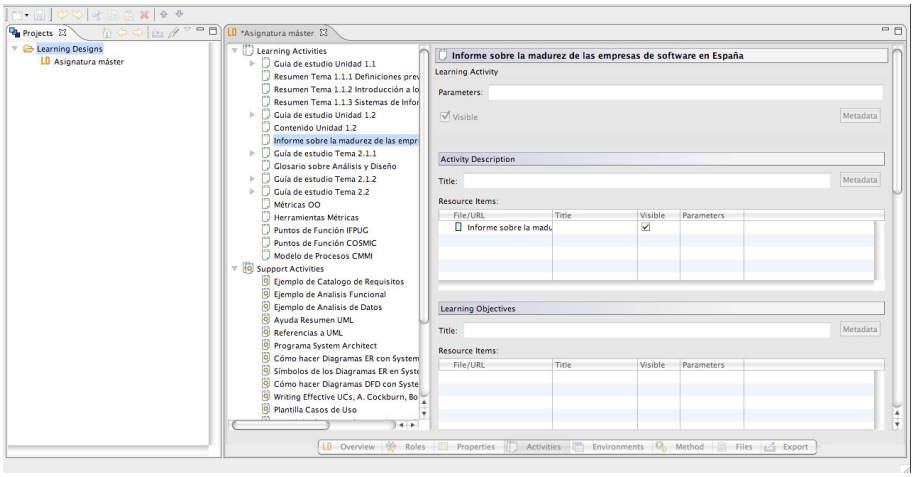

Figure 2: Reload Learning Design Editor: Activities

To be useful this learning design, it is necessary to perform its automatic processing, using a tool to control the execution of the activities designed, and to assist the teacher in monitoring the syllabus schedule. If teaching takes place in an environment of e-learning, the LMS (Learning Management System) used should incorporate a subsystem or process management module, which would act as a control unit, running the operations necessary to ensure that learning is carried out as planned in the learning design; for which it must provide the technological support necessary for this to be possible (for example, a workflow engine). So that those involved in the process know all of the time, the next activity, and had at their disposal all necessary resources to carry it out. For this, a run time environment is needed to control the execution of the learning process, by means of the activation of a software generically denominated Learning Design (LD) Player. One of the most used is ReLoad Player (http://www.reload.ac.uk), that is based on a Web engine named CopperCore (http://coppercore.sourceforge.net), developed by the Open Universiteit Nederland (OUNL). We currently use Reload Player (figure 3 shows the execution of our Unit of Learning in this environment). But in the Department of Computer Science at the University of Alcalá, it is being developed a system, based on the Coppercore engine to support instruction satisfying IMS standards (Hilera et al., 2008), with a module for designing and implementing teaching-learning processes compatible with IMS-LD.

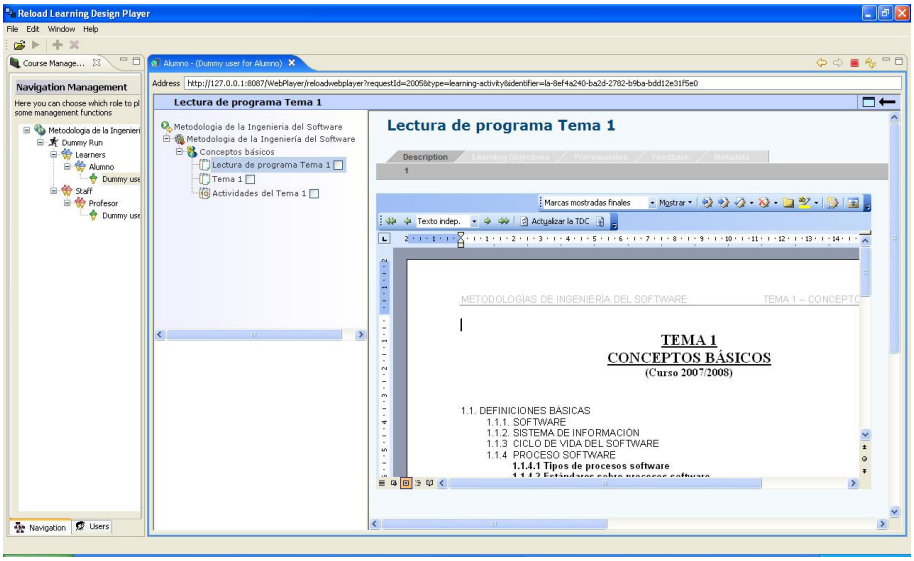

Figure 3: Reload Learning Design Player

```
<method>
 <play identifier="play-module-1" isvisible="true">
  <title>Module 1. INTRODUCTION</title>
  <act identifier="act-unit-1-1">
   <title>Unit 1.1 Information System Engineering</title>
   <role-part identifier="rolepart-unit-1-1">
    <title>Guide of Study of Unit 1.1</title>
    <role-ref ref="role-learner" />
    <learning-activity-ref ref="la-unit-1-1" />
   </role-part>
  <role-part identifier="rolepart-topic-1-1-1">
   <title>Abstract. Topic 1.1.1 Basic definitions</title>
   <role-ref ref="role-learner" />
   <learning-activity-ref ref="la-topic-1-1-1" />
  </role-part>
  <role-part identifier="rolepart-topic-1-1-2">
   <title>Abstract. Topic 1.1.2 Introduction to Information systems</title>
   <role-ref ref="role-learner" />
   <learning-activity-ref ref="la-topic-1-1-2" />
  </role-part>
  <role-part identifier="rolepart-topic-1-1-3">
   <title>Abstract. Topic 1.1.3 Basic Information Systems in Organizations</title>
   <role-ref ref="role-learner" />
   <learning-activity-ref ref="la-topic-1-1-3" />
  </role-part>
  <role-part identifier="rolepart-ex-unit-1-1">
   <title>Exercises Unit 1.1</title>
   <role-ref ref="role-learner" />
   <activity-structure-ref ref="as-preparation-ex-unit-1-1" />
  </role-part>
  <complete-act>
    <when-role-part-completed ref="rolepart-unit-1-1" />
    <when-role-part-completed ref="rolepart-topic-1-1-1" />
    <when-role-part-completed ref="rolepart-topic-1-1-2" />
    <when-role-part-completed ref="rolepart-topic-1-1-3" />
    <when-role-part-completed ref="rolepart-ex-unit-1-1" />
   </complete-act>
  </act>

  <act identifier="act-unit-1-2">
  ...
  <act identifier="act-assesment-CAT1">
  ...
  <complete-play>
   <when-last-act-completed />
  <complete-play>
 </play>
 <play identifier="play-module-2" isvisible="true">
  ...
 <play identifier="play-module-3" isvisible="true">
  ...
 <play identifier="play-other" isvisible="true">
  ...
 <complete-unit-of-learning>
  <when-play-completed ref="play-module-2" />
  <when-play-completed ref="play-module-3" />
  <when-play-completed ref="play-other" />
 </complete-unit-of-learning>
</method>
```

Listing 1. Extract of the IMS-LD code to formalize the learning design of figure 1.

Conclusions

Business process modeling is an activity that started to be used in organizations in the 80s to improve their production. Experience in the application of this technology since then has originated, in the field of e-learning, standards like IMS-LD that facilitates sharing and reusing educational processes in form of learning designs. Nowadays, the emergence of modeling and editing tools for learning designs (such as LAMS or Reload) have made this a reality, as has happened at the University of Acala, in our virtual studies.

The research in this field must be multidisciplinary, because it is important collaboration between experts in information technology and experts in education, to identify new mechanisms to increase the possibilities of technology in the field of modeling of teaching-learning processes, such as automatic transformation of models or the definition of meta-languages for creating meta-models more complex than proposed in the IMS Learning Design specification.

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