THE EDUWEAVER CONTENTS APPROACH: FROM PROVISION TO INSTRUCTION

F. Waldner, M. Nemetz, D. Karagiannis
University of Vienna
Faculty of Computer Science
Dept. for Knowledge and Business Engineering
Brünner Straße 72, 1210 Vienna
Austria
{fw|mn|dk}@dke.univie.ac.at

ABSTRACT
Currently the content-centric view on e-learning is extended by didactical and pedagogical aspects. The formalization and modeling of didactical processes gains more and more interest. This development is reflected in the courseware modeling tool eduWEAVER. It supports instructors in the design, the re-use, and the adaptation of new and existing courses independently from existing learning platforms. What makes eduWEAVER unique among courseware tools is its ability to structure didactical learning scenarios in graphical knowledge models. This paper illustrates the benefits, eduWEAVER offers to contents auditors of academic programs as well as to instructors.

KEY WORDS
E-Learning, Instructional Design, Learning Objects, Content Administration, Modeling

1. Introduction

In recent years the research in the area of e-learning focused on the creation and re-use of learning objects (LOs) [1]. A lot of research has been conducted on the idea of modular assembly of whole courses and lessons, since the creation of online learning contents is a time-consuming and cost-intensive task. The result is that e-learning in many cases is limited to content provision.
Currently, this content-centric view on e-learning from previous years is extended by didactical and pedagogical aspects [2] [3]. Learning objects (LOs) are evolving to activities, that can be interactive and collaborative [1]. Now the formalization and modeling of educational processes are at the center of interest, where the ultimate aim is to combine the advantages of re-usability and interoperability of modular learning objects with a profound pedagogical basis. This development is reflected in the courseware design tool eduWEAVER [4]. The tool hereby offers comprehensive support for enriching contents with didactical considerations.

eduWEAVER has been furthermore designed as a web-based tool for designing, organising and maintaining new and existing courses independently from a particular learning platform or learning management system (LMS). In eduWEAVER courses are built upon a central repository for learning objects (LOs), which enables instructors to share and reuse their learning contents. What makes eduWEAVER unique among courseware tools is its ability to structure didactical learning scenarios in graphical knowledge models. These models can be exported into learning management systems or published as websites. eduWEAVER has been developed within the eduBITE (Educating Business and Information Technologies) project that has been funded by the Austrian Federal Ministry of Science and Research [5]. Figure 1 summarises the settlement of eduWEAVER within the e-Learning environment.

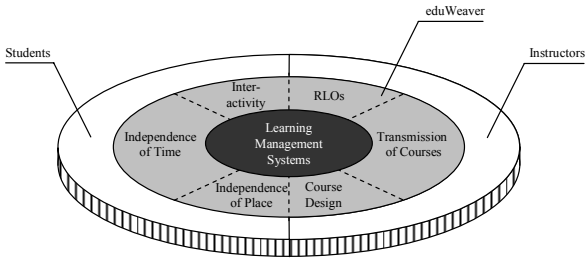

Fig. 1: Positioning of eduWEAVER

In this paper we aim to demonstrate the main advantages that eduWEAVER offers for contents auditors of academic programs and instructors. Therefore, the following section describes two application scenarios, one from the viewpoint of contents auditors and one from the viewpoint of instructors. The third section gives a brief description of the technical details of eduWEAVER and its export capabilities. Section four describes the current use of eduWEAVER at the University of Vienna before finally section five gives the conclusions and an outline on further developments of the tool.

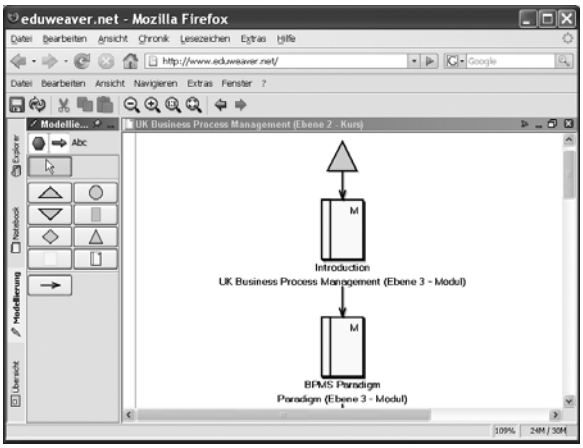

Figure 2: Web-based Modeling in eduWEAVER

2. Application Scenarios

The primary function of eduWEAVER is to orchestrate, organize, and administrate learning processes. Thus, it is not seen as an authoring tool for e-learning contents. A screenshot of the eduWEAVER user-interface is shown in Figure 2. In the following two application scenarios with eduWEAVER are presented, with the aim to illustrate its main advantages.

The first one describes the use of eduWEAVER from the viewpoint of contents auditors of academic programs. These are people who create the structure of a curriculum by considering how content is presented on a summary level to the learner. The contents auditor's role can be considered as that of a quality manager in learning processes.

The second part looks at the use of eduWEAVER from the viewpoint of instructors, people that actually teach a subject according to the brief structure provided to them by the contents auditors of the particular curriculum. Their role is to enrich the structure of a curriculum with didactics and adapt it to their particular learning setting.

2.1 Contents Auditors View: Reference models

Similar to compliance initiatives in business process management (see e.g. [17] and [18]), learning institutions are interested in the standardization and alignment of curricula and lesson plans. Learning institutions aim to standardize the contents and structure of courses on the same subject, and also want to guarantee high quality levels. In many countries federal ministries or supervisory school authorities provide learning institutions with curricula on a variety of subjects [6]. Contents auditors of academic programs implement their own lesson plans conforming to the afore-mentioned curricula. With eduWEAVER the structure from a given curriculum can be modeled into a graphical reference process model for the particular subject (Fig. 3). Reference models are generic conceptual models and are currently used by a large number of practitioners in the field of business process modeling [7]. In this article we use the term reference model as a general description of a learning process that is valid for a number of more specific learning processes. The contents auditor can then communicate his course design to the actual instructors, who conduct the courses on basis of these models (Fig. 3). Using eduWEAVER is an effective way to communicate general reference models of learning processes to a number of instructors.

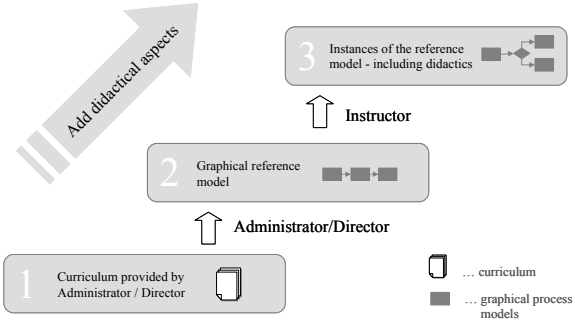

Fig. 3: Contents Auditors' View

Given the case presented above, i.e. as soon as instructors receive reference models for their courses, they may enhance these models with didactical considerations and eventually also adapt it according to their learning settings and teaching styles.

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Processes in eduWEAVER are modeled in four hierarchical levels. These are courses, modules, lessons and learning objects (a more detailed description on the structure of courses can be found e.g. in [8] or [9]). The course level represents an overview of the process, whereas the level containing learning objects offers the highest granularity. Learning objects are the smallest, reusable, and modular units of learning material in eduWEAVER [8]. Contents auditors of academic programs may provide their reference models not in the most granular level available. This gives instructors the necessary flexibility for adapting the reference models to their own teaching style while ensuring that all mandatory topics are covered. Every instructor develops a unique style of teaching. For example, they may have preferences on the mixture of face-to-face and online activities (cf. Section 2.2).

Since eduWEAVER is a web-based tool it allows working on instructional designs in collaboration. Therefore, instructors can share their "best practices" with fellows and continuously adapt their processes.

2.2 Instructors View: Course planning

Instructors are often confronted with teaching similar subjects in different learning settings or even within different learning institutions. Learning settings can differ in the number of participating students, the timely structure (e.g. two hours per week, the whole course within three full days), or in the way students are asked to work on themselves or in group (e.g. if homework is regular, voluntary, or there is none at all). These differences impose difficulties for instructors involved in a variance of learning settings. Although to a certain level it is still possible to present the same contents in different settings, if the subject of the course is the same, still the structure, the amount of content, the learning management system (LMS) used, may be of a different kind. This requires preparing the contents for each course separately and involves many repetitive tasks.
eduWEAVER allows managing units of learning independently from structure and learning management systems. In eduWEAVER all learning objects are pooled in a learning object repository. The instructor then is able to pick out the relevant content pieces and build an appropriate course for a specific learning setting out of the modular and reusable learning objects. Another problem for instructors working in different organization sis the usage of diverse learning management systems (e.g. Moodle, Blackboard, etc.). In this case an instructor has to create his courses separately for each learning management system. As eduWEAVER offers export functionality in various formats and standards (e.g. SCORM 1.2, SCORM 2004, HMTL, and XML), it is possible to apply the same contents in all major learning management systems by a simple automatic export [10].

eduWEAVER also takes into consideration further aspects of learning. Thus, the concept of blended learning may also be included in the course design in eduWEAVER. The term "Blended Learning" means learning trough the use of a blend of educational methods and resources. There are many definitions of what exactly is mixed in blended learning approaches [11]. We refer to it as the mixture of face-to-face and online learning activities to maximize the value of students' experiences in a learning setting in such a way that the advantages of the one are used to compensate the disadvantages of the other.
eduWEAVER is able to support blended learning approaches. A single process model can include contents for face-to-face classroom settings and online learning material, as all learning objects can be assigned to either online or face-to-face situations. Learning objects marked for face-to-face use are used in the classroom, whereas all marked as online are exported to a learning management system or published as websites, where students can access the materials asynchronously. Fig. 4 illustrates how learning objects intended for face-to-face learning differ in their appearance from those intended for online learning. This allows instructors to adapt existing courses to their preferred "blend" of learning resources.

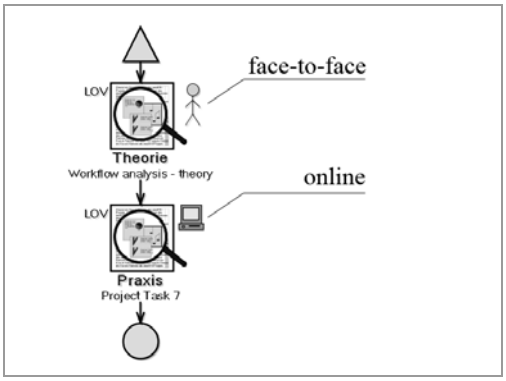

Fig. 4: Blended Learning in eduWEAVER

3. Technical Realization

eduWEAVER is a web-based tool and available over ADOweb®, which is a Java-based Web Services interface that supports browser-based online modeling with ADONIS®, a meta-modeling platform developed by the BOC Information Technologies Consulting AG [12].
eduWEAVER includes user authorization and user rights management for every user, or user-groups. Hence, rights can be limited in their access to learning objects and models. Additional export capabilities of eduWEAVER are provided by a XML interface and currently include generic XML, HTML, ADL (Adonis Definition Language), SCORM 1.2, and SCORM 2004. The SCORM 2004 export is in an early version and insofar it does not yet include the IMS Simple Sequencing Specification (IMS SS)[13]. The IMS Simple Sequencing Specification describes possible paths through a collection of learning objects and contains rules that describe the flow of instruction through contents depending on the outcomes of a learner's interactions with content.

In eduWEAVER, every modeling object includes a notebook were additional information (e.g. author, description, keywords, classification) may be stored. In different exports that are offered in eduWEAVER, modeled objects (courses, modules, lessons, or learning objects) including their additional information are transferred automatically into XML-elements conforming to the chosen standard. JDOM is used to generate the XML manifest files for different standards [14]. JDOM is a Java representation of an XML document. JDOM is furthermore open source and provides an efficient way of reading, manipulating, and writing XML documents in JAVA.

Class	Attribute (in eduWeaver)	LOM (SCORM 2004)
Course Map	Name	General/Title
	Description	General/Description
	Keywords	General/Keyword
	Version	LifeCycle/Version
⋮	⋮	⋮
LO	Name	General/Title
	Description	General/Description
	Keywords	General/Keyword
	Language	General/Language

Table 1: Matching of XML Elements and Attributes

Table 1 depicts a small excerpt of how the afore-mentioned additional information (i.e. attributes of modeling objects, such as course maps or learning objects (LO)) of modeling objects in eduWEAVER are assigned to XML elements in the SCORM 2004 export (particularly the metadata of different modeling classes).

The following code illustrates how the mappings shown in Table 1 for the model type Course Map are implemented in Java using JDOM. In the first line a new element <*general*> is created. This element contains the element <*title*> to which the name of the course map is added by using the function *getName()*.

```
Element general = new Element("general");
Element title = new Element("title");
title.addContent(model.getName());
general.addContent(title);

Element description = new Element("description");
description.addContent
        (model.getAsString(attr_description));
general.addContent(description);

Element keyword = new Element ("keyword");
keyword.addContent(model.getAsString(attr_keyword1));
keyword.addContent(model.getAsString(attr_keyword2));
keyword.addContent(model.getAsString(attr_keyword3));
keyword.addContent(model.getAsString(attr_keyword4));
general.addContent(keyword);

lom.addContent(general);

Element lifecycle = new Element ("lifecycle");
Element version = new Element ("version");
version.addContent(model.getAsString(attr_version));
lifecycle.addContent(version);
```

This code generates the XML tree below, where in this example *BPM* is the title of the Course Map, *descr*. is the textual description of the course, and *key1* to *key4* are the keywords for this Course Map:

```
<lom xmlns="http://ltsc.ieee.org/xsd/LOMv1p0">
  <general >
    <title>BPM</title>
    <description>
      <string>descr.</string>
    </description>
    <keyword>
      <string>key1</string>
      <string>key2</string>
      <string>key3</string>
      <string>key4</string>
    </keyword>
  </general>
  <lifecycle >
    <version>
      <string>1.0</string>
    </version>
  </lifecycle>
</lom>
```

4. Usage and Experiences

eduWEAVER is currently used to teach the course 'business process management (BPM)' at the University of Vienna. The Department of Knowledge and Business Engineering (DKE) at the University of Vienna currently offers five courses on this topic within different academic programs. In the following the programs are listed including their corresponding institutions:

- International Business Administration - University of Vienna
- Information Systems - University of Vienna
- Information Systems - University of Applied Sciences Technikum Wien
- Project Management and Information Technology - University of Applied Sciences bfi Vienna
- International Master of Business Informatics - Virtual Global University (VGU)

Each of these programs contains one course (C in Fig. 5) on BPM. One of the courses is mere online, three use a blended learning approach and one is held in a traditional face-to-face setting. These courses share the same topic but are different in their focus, extent and their structure. For instance the course for students on International Business Administration focuses more on case studies and less on the implementation of workflows, which is of more interest to students on Information Systems. Five instructors are currently assigned to these courses (I in Fig. 5), and two learning object pools are in use (LOP in Fig. 5). The difference between the two learning object pools is that one is intended for face-to-face and blended learning settings while the other has been established for pure e-learning courses.

At the conceptual basis for all five courses rests on a single reference process for BPM. Each instructor adapts this reference model for his course setting according to his own didactical preferences.
Instructors can export their adapted courses and use them in a learning management system (LMS) offered by the organization at which the course takes place. The course in International Business Administration uses Moodle, whereas the course at the Virtual Global University uses WebCT Vista (i.e. Blackboard). The experiences in the usage of eduWEAVER so far have been very positive. The instructors are in a frequent information exchange and have faster access to new materials or ideas brought in by fellow instructors.

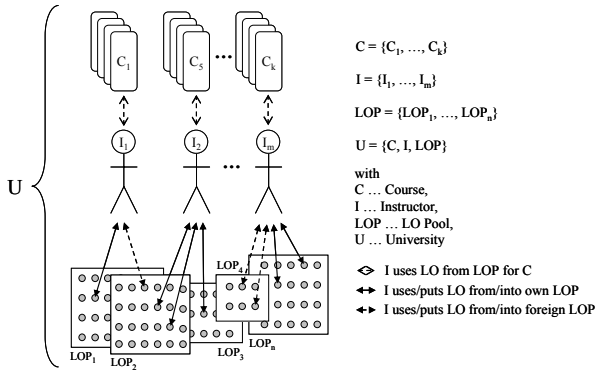

Fig. 5: Storage of Learning Materials and LOs for Course Design [15]

5. Conclusions and Outline

eduWEAVER offers comprehensive support in the reuse, the administration, and the organization of learning contents independent from a specific learning management system. In contrast to other content authoring tools it allows the representation of didactical aspects. Currently, we are working on the implementation of the IMS Learning Design [16] export and improvements in the graphical representation of the modeling language, as well as on tasks for improving the general look and feel of the user-interface.

The tool eduWEAVER is available with free access for schools, universities and polytechnics via the internet page http://www.eduweaver.net.

Acknowledgements

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