EDUWEAVER
THE WEB-BASED COURSEWARE DESIGN TOOL

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ABSTRACT

Although there are a lot of web based e-learning solutions on the market, using these tools to design and organize courses still stays a very difficult task for most teachers. EduWeaver was developed as a coursware design tool with the aim to support the courseware development process during the coursware design and implementation phases providing access to a learning object repository and a grafical language for course design.

KEYWORDS

courseware design tool, learning object, repository, reusability

1. INTRODUCTION

Technology has changed the way we live, think and work. Technology has revolutionized business and now it must revolutionize teaching and learning. Live classroom based training is becoming too costly and cumbersome. 80 % of teachers and students already use computers. So e-learning can be seen as a means supporting life long learning with a lot of benefits [Rosenberg]. The worldwide web, high-capacity networks and high speed computers make learning available to people 24 hours a day in their office, at home or also in hotel rooms during a business trip around the globe. E-learning enables the access to learning when it is convenient.

Although there are a lot of web based e-learning solutions on the market, using these tools to design and organize courses still stays a very difficult task for most teachers. They are supposed to digitize and multimedialize their course contents and to organize virtual courseware themselves. However mostly passing the first euphoria courseware creation mostly turns out to be incredible costly and time consuming. If teachers have the technical knowledge at all to author content themselves using special authoring tools, they have to work overtime to create and bring their contents into so called 'learning management systems (LMS)'. In spite of their efforts the quality of the produced output is mostly weak, monolithic contents are hardly reusable and courses are not interoperable cross LMS borders.

The reason for this phenomenon is that courseware can be seen as a form of multimedia software and its realization is a non trivial process. Courseware developed by teachers in the form described above however is comparable to the quality of software programmed in an ad hoc and non structured manner. The development of a good quality courseware demands at least a minimum of engineering work before implementation. The reuse of existing contents is extremely important in this field. Although several process models exist for courseware development the phase of courseware design is a continuous problem.

Within the eduBITE project [Steinberger02 and Steinberger03] a web-based tool called eduWeaver is developed to overcome the problems mentioned above. On one hand eduWeaver serves as a learning object repository which handles metadata-indexed learning objects (LOs), reusable content chunks with a high

degree of cohesion. The idea of this functionality of eduWeaver is to collect 'well done' reusable multimedia content. In the role of an author a teacher can add LOs to eduWeaver. These LOs can then be retrieved using metadata and reused by other teachers. Additionally eduWeaver offers teachers the functionality of a kind of CASE tool that supports courseware design and generation, that means to use a graphical notation to compose LOs to lessons, modules and courses, to reuse existing designs and to export design results to IMS packages [IMS].

Section 2 of this paper sketches the eduBITE project and shows the embedding of eduWeaver into this project, section 3 explains the educational metamodel of eduWeaver and section 4 finishes the paper with a short example within the eduBITE context .

2. ROLE OF EDUWEAVER WITHIN EDUBITE PROJECT

Knowledge concerning "Integrated Business Information Systems" (IBIS) is a basic element of most computer science studies and spans a variety of topics from the conceptual business process modelling to the implementation details using various Enterprise Resource Planning (ERP) Systems. This knowledge is also currently taught at several universities and polytechnics in Austria focusing different aspects of IBIS.

In 2001 a group of about 10 Austrian university teachers made an effort to cooperate in IBIS education, to reuse their content materials within the group and to extend their e-learning efforts. Until this point in time they mainly taught in form of face to face courses using a lot of individual teaching and learning materials (slides, books, scripts, exercises). However the existing materials soon proved to be unusable for e-learning purposes because they were very inhomogeneous, overlapping but showed different levels of detail, monolithic, hardly combinable and mainly usable in face to face classrooms. So new multimedia content in form of reusable LOs had to be developed.

LOs are defined as self-contained reusable multimedia materials describing a homogenous chunk of content to be taught. In general a LO should not proceed 10 – 30 minutes learning time and follow secial didactical and technical guidlines. Further a LO consists of three different items called Content Item, Practice Item and Assessment Item. Content Item represents the content to be taught, Practice Item gives students the possibility to exercise and the Assessment Item is to monitor the learning progress (see Figure 3) [Cisco].
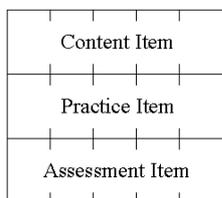

Figure 3. General concept of a learning object (LO) [Cisco]

This project is called eduBITE (Educating Business and Information Technologies) and started in summer 2002. The group agreed to start with the content for a course dealing with the principles of IBIS for undergraduate students based on a demo-enterprise called deBITE. The developed LOs should be stored in a LO repository. The LOs were supposed to be used by about 2200 students per annum.

EduBITE has a running time of two years and is funded by the Austrian Federal Ministry for Education, Science and Culture [EduBITE]. With the objective to feed in other LOs to the repository in future, also flexible search functionality within the pool and a simple configuration of LOs to courses had to be realized. To achieve this goals eduWeaver was put into place to serve as an LO platform and as a courseware modelling tool. To keep the project results sustainable also an association called AKIT (Akademische IT Lehr- und Lernplattform – in english Academic IT Educational Platform [AKIT]) was founded in order to use the developed LOs on one hand and to maintain and extend the repository on the other hand. EduWeaver will be offered without fee for all members of AKIT in future.

Figure 1 shows how eduWeaver is embedded in the eduBITE course development and course management process.
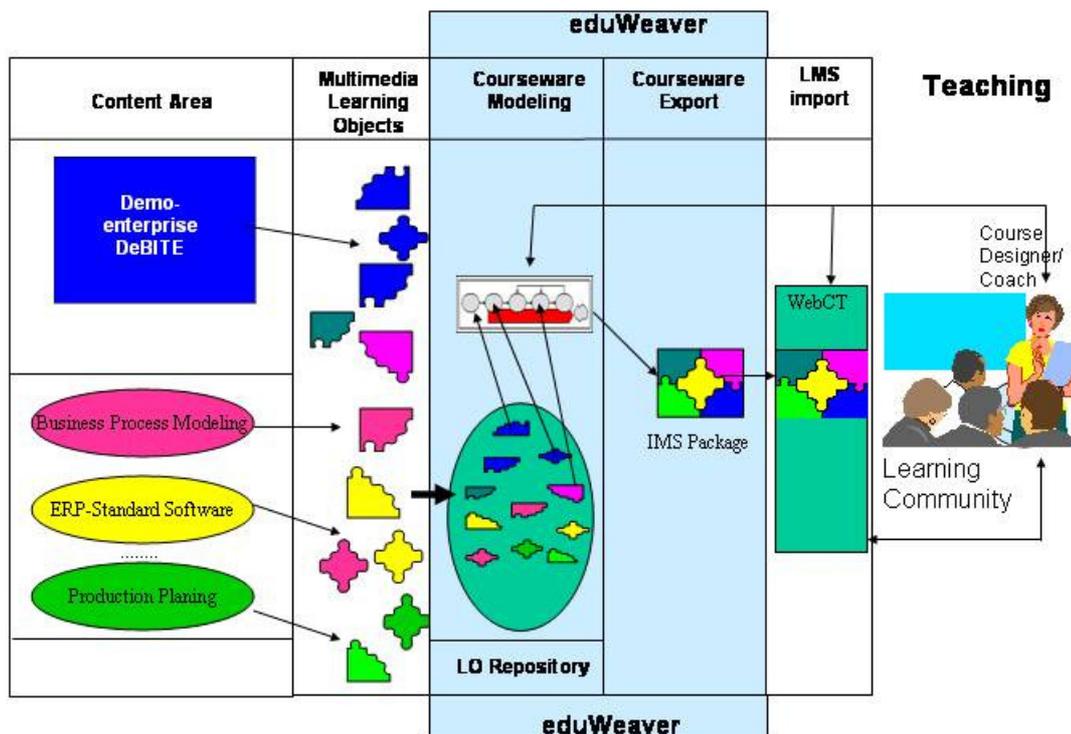
Figure 1. The role of eduWeaver in eduBITE

LOs of the content area IBIS are developed on their personal computers by eduBITE authors using different authoring tools like Dreamweaver, Hot Potato, Macromedia Flash, Authorware, Macromedia Director, SAP iTutor, etc. according to special guidelines and templates. Each ready LO (e.g. LO 'What is a business process?') is finally uploaded via the web into the eduWeaver LO repository whereas special metadata have to be specified by the author for the LO (see also section 3, figure 10).

Course designer can access the LO pool in the eduWeaver repository and graphically model a group of LOs to build the demanded courseware. To enable a comfortable retrieval during this process the LO metadata is used. EduWeaver uses special model types for course modelling. These model types are further detailed in section 3 of this paper (eduWeaver metamodel, figure 9). By this way LOs but also larger models (lessons, modules) are highly reusable using eduWeaver.

When the course is ready from the designers point of view it can be exported with all its LOs into an IMS-package and afterwards imported into an IMS-compliant LMS. In the eduBITE context WebCT [WebCT] is used. Finally the course is offered to students via the LMS. As a work package of eduBITE the IBIS course has to be evaluated twice on two different universities using WebCT.

Hence in eduBITE a strong distinction between LO authoring, the LO repository and course modelling functionality (eduWeaver) and the typical LMS functionality (student administration, communication in groups, mail and so on) exists. Figure 2 sketches the typical use cases of eduWeaver in general.

A teacher can slip into three different roles using eduWeaver. As content author the teacher can compose multimedia LOs and publish them in the LO pool by uploading and meta-indexing them. In the role of the modeller he/she can retrieve LOs from the pool and reuse them in order to compose and model graphically lessons, modules and courses. As a coach the export functionality into IMS content packages can be used in order to provide the multimedia courses through any IMS-compliant LMS.
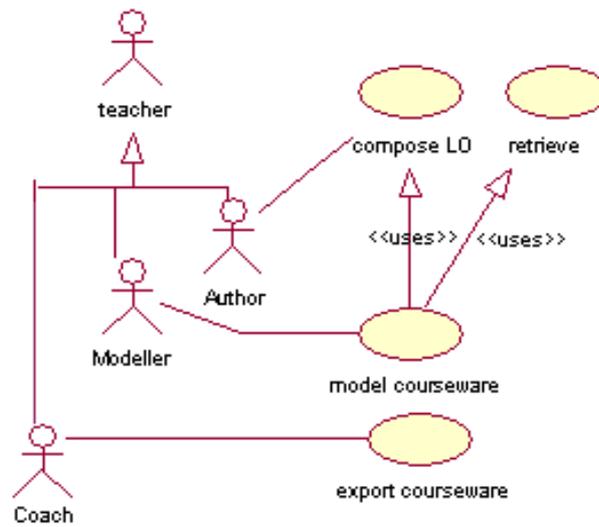
Figure 2. The eduWeaver use cases

3. THE EDUCATIONAL METAMODEL OF EDUWEAVER

Since eduWeaver aims a hierarchical and process oriented way of course design the courseware modelling use case (see figure 2) offers four interconnected model types with different granularities to be defined by the designer (course, module, lesson, learning object use). Before introducing the eduWeaver metamodel in detail a closer look at modelling levels has to be taken.

3.1 eduWeaver modelling levels

On modelling level one, the highest level of abstraction, *courses* can be defined as independent units. These courses have no connection to other learning units and represent the orientation point for course design. (figure 4).
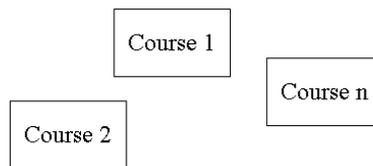

Figure 4. Courses on model level 1 of eduWeaver

On level two *modules* of a course can be defined representing thematically coherent learning units and their meaningful orders of sequence building a teaching process with possibly several different paths (see figure 5).
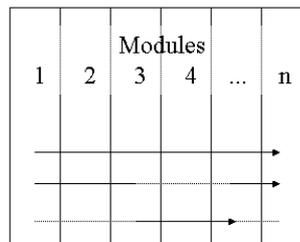

Figure 5. Modules and exemplary paths on modelling level 2 of eduWeaver

Going deeper into course modelling on level three *lessons* are modelled describing what happens in a module. Lessons correspond with one unit of about 45-90 minutes of learning time. On this level the course designer can leave the strong hierarchical and sequential way of designing models, since within one lesson loops, parallel and alternative paths can be defined considering the previous knowledge and homogeneity of the target learner (figure 6).

Figure 6. Lessons and exemplary paths on modelling level 3 of eduWeaver

Splitting the lessons into the smallest possible units the designer comes to the fourth modelling level, the level of learning object use. Here the LOs can be grouped and made part of the teaching process. In order to do so the designer defines references into the learning object pool. One lesson should consist of about 7 +/- 2 learning objects beginning with an overview and ending with a summary of all learning objects (figure 7).

Figure 7. Learning object use on modelling level 4 of eduWeaver [Cisco]

The above described way of modelling with eduWeaver represents the top-down approach. Of course designers can also start bottom-up by searching for possible learning objects, grouping them into a lesson, defining several lections as one module and finally build a whole course. Figure 8 shows an overview of the flexible usage of eduWeaver (figure 8).

Figure 8. The top-down and bottom-up approach within eduWeaver

3.2 Metamodel of eduWeaver

EduWeaver is based on the metamodelling platform ADONIS® [BOC]. ADONIS® is a process modelling platform that allows the usage of common or newly defined modeling methods [Kühn]. According to the background described above we defined a specific metamodel. Figure 9 represents a simplified part of the metamodel of eduWeaver. Some functionalities of eduWeaver like the search of LOs, best-practice definition, target group definition, simulation, analysis, export function, etc. are not focus of this paper, but provided by the tool. For further information please contact the authors.
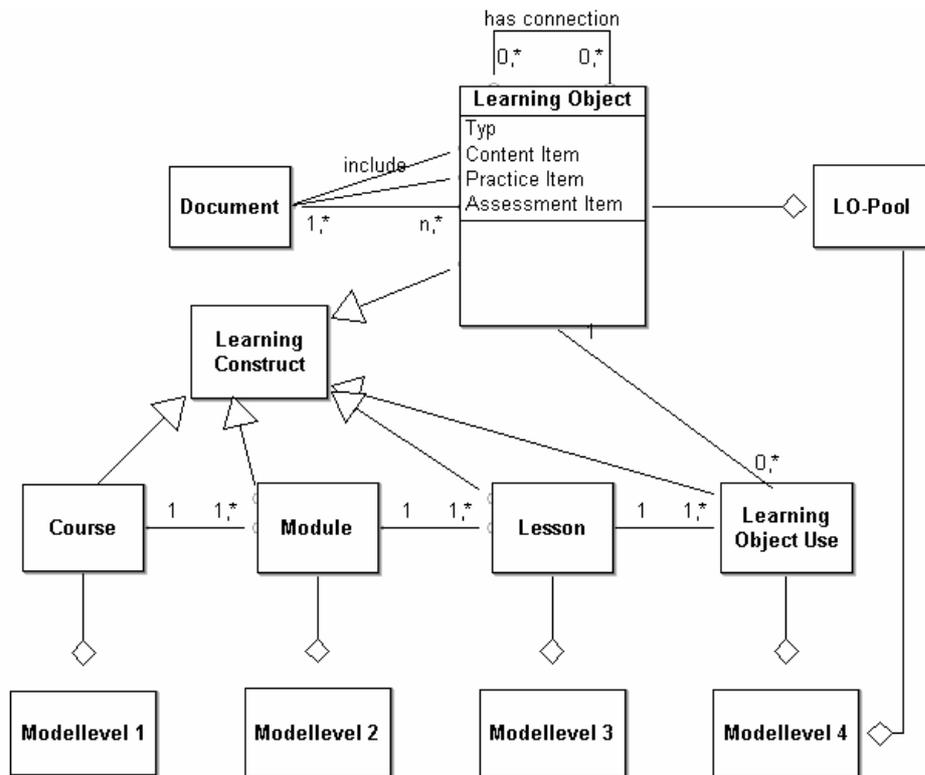

Figure 9. Simplified metamodel of eduWeaver focusing the modelling functionality

Each model level has learning construct instances that correspond to the model type Course, Module, Lesson or Learning Object Use. These model types are hierarchically linked to each other by internal references. From the fourth level designers can directly access the Learning Object Pool (repository) where the multimedia materials are stored. These Learning Objects are meta-indexed by their authors as also shown in figure 10. The different metadata are sorted into different chapters covering selected parts of the IMS standard [IMS].

In chapters General Data, Target References, Keywords and LO Data all metadata referring the IMS standard for that specific LO are to be defined through a user friendly GUI.

In chapters Content Items, Practice Items and Assessment Items the multimedia documents can be referenced. These documents can basically have any format, for the project eduBITE we focus on common documents formats like HTML, PDF, Power-Point, Flash-Movie, but these are no product side limitations.
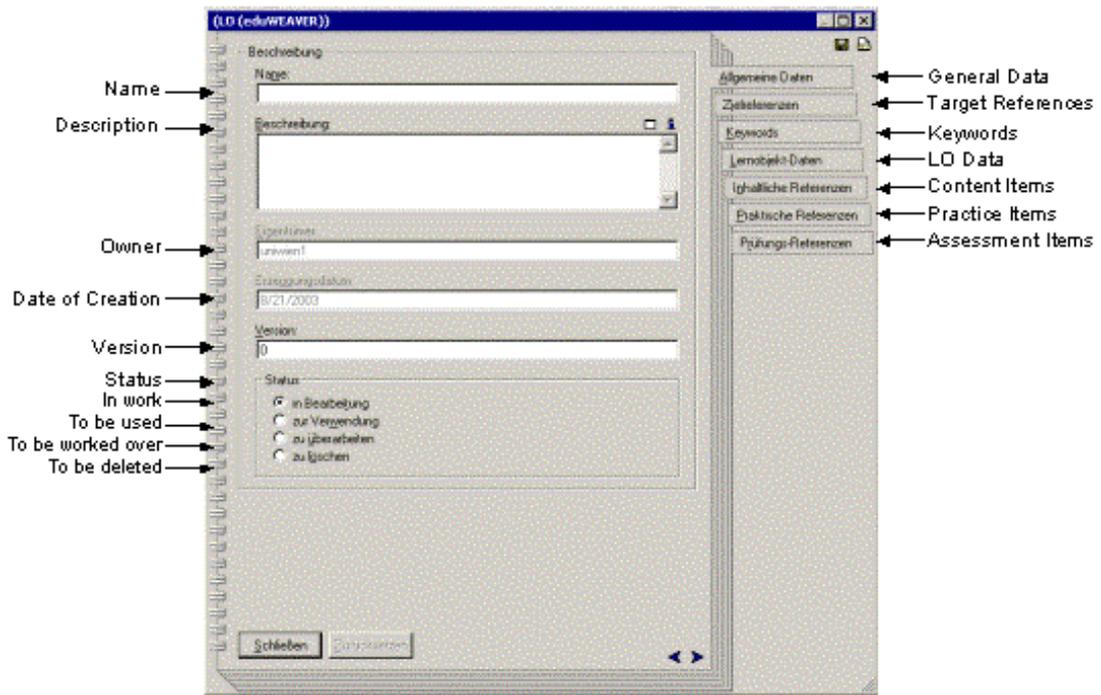
Figure 10. Metadata indexing of a Learning Objects

4. COURSE MODELING WITH EDUWEAVER

Taken as given that several learning objects have been already authored and provided in the content pool, a teacher can start with the design of the course. The bottom-up approach has been applied for the following short example where one lesson is modelled with eduWeaver.

This exemplary lesson consists of three LOs and two different paths can be chosen by the teacher. This lesson is about process modelling and starts with an introductory LO to this topic. Then the teacher can follow either with a theoretical LO or use a practical example. Then this lesson is finished (figure 11).
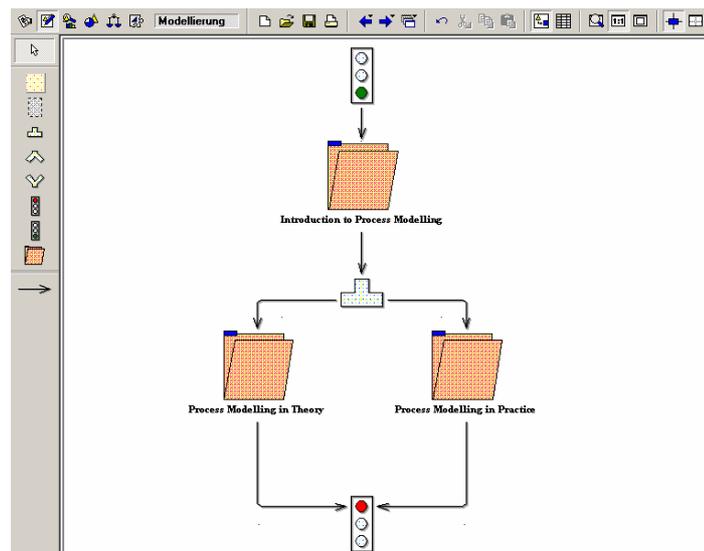

Figure 11. Simple example for modeling level 4

5. CONCLUSION

Multimedia content authoring and web-based provision of courses is becoming one of the most challenging tasks for teachers. Without access to reusable high quality learning objects in a user friendly, tool supported environment courseware development is very expensive or of low quality. This problem is aimed to be overcome by eduWeaver which provides user-friendly support throughout the course provision process starting with reusing or authoring multimedia contents, designing the course and providing it within a LMS.

By providing an open learning object pool, teachers are helped to exchange their multimedia material or to reuse material created by professional authors. The main functionality of eduWeaver supports teachers by creating their courses by providing a graphical modelling surface where on different granularity levels coursware can be designed easily. The export functionality of eduWeaver creates IMS packages consisting of the course structure as well as of the multimedia material, which can easily be imported into any IMS-compliant learning management system, allowing an easy provision of web-based courses.

To be accentuated eduWeaver does not offer any authoring possibilities in terms of multimedia content creation neither fulfills functionalities of a learning management system, like students authentification, course provision or communication functions. On both sides the market offers highly sophisticated tools. EduWeaver supports teachers bridging the gap between these two sides and so making it easier to realise e-learning.

Future development possibilities for eduWeaver cover the handling of individual learning patterns and support personalized learning. So not only e-learning provision but learning on demand and life long learning become realistic scenarios in everyday life.

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