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BUILDING RE-CONFIGURABLE BLENDED- LEARNING ARRANGEMENTS

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E-learning can be much more than just self-paced learning. To enhance motivation and sustainability of learning, trainers or course providers usually set up target group specific arrangements of various learning conducive elements. They combine self-learning phases with synchronous or asynchronous online collaboration and cooperation, as well as with face-to-face training sessions. This mix of online and offline elements has become famous under the name of "blended learning".

To put blended learning scenarios into practice means to customize learning material to specific learner needs. If one uses online material, then this material has to provide spaces where blending can take place, hence it must be extremely flexible and allow easy adaptation to the concrete setting. Adapting learning materials to target group-specific domains is essential particularly for company trainings.

In the "Up2UML" project funded by the Leonardo-da-Vinci initiative, partners from Ireland, Romania, Bulgaria, France and Germany developed an approach for creating re-configurable blended learning scenarios in the software modeling domain. Based on this case study, the paper describes how such re-configurations of blended learning scenarios can be set up. It puts a special focus on the development and adaptation of training media and shows how to realize such an approach using open standards and open source software.

Keywords: blended learning; re-configuration; customization; re-use

1 INTRODUCTION

E-learning can be very much like learning from textbooks, especially if training contents are presented like book chapters with text dominance, for students learning in a self-paced way. Usually, e-learning courses are not integrated in structured learning sequences: students work through the course units sequentially or arbitrarily, depending on their preferred way of learning, or they access the content in an encyclopaedia-like manner.

Traditional e-learning requires the capability to find one's own way in self-directed learning processes and it demands a high level of self-motivation. Studies on acceptance and usage of e-learning have shown self-learning competences and self-motivation as being the biggest challenge [1]. In order to evade loss of motivation and to enhance sustainability of learning, the training sessions need to be well organized and include a broad range of activities. In this respect, there is not much difference between traditional learning in a classroom (face-to-face communication) and with support from printed textbooks, and learning with online materials (e.g. SCORM packages) and computer mediated communication (e.g. Acrobat Connect, E-Mail). By including various methods and activity types other than mere self-paced learning, e-learning was turned into a more successful method called blended learning.

For those who are experienced in building blended learning arrangements, it still remains difficult to create a reasonable mix of learning elements for each target group, especially if the learning material – which is still an important part within such scenarios, is presented in a rather static way. In most cases, the trainer cannot just cut out bits and pieces, add new material und combine it in order to create a new course or adapt the contents to the participants special needs. This would require highly flexible and modularized material, which is hard to develop with the current approaches. A study from the E-Learning Guild [2] showed that exactly this re-purposing of content is one of the features that are urgently demanded; nevertheless it is one of the least supported by common commercial authoring tools (e.g. Adobe Flash, MS Word etc.) [2].

In this article, an approach for developing re-configurable blended learning is presented. It is strongly based on the eduDocBook Format, which has been developed by Fraunhofer IESE within the Up2UML project. The article first presents an overview on blended learning concepts and underpins the need for re-configurable learning contents. Afterwards, the eduDocBook format as an approach to handle the problem of re-configuration of learning material and documentation is introduced. Based on this, IESE developed an online tool for the re-configuration of course material and course documentation, the CourseComposer. This approach is discussed in Chapter 4. The article ends with a conclusion and an outlook on future works.

2 BLENDED LEARNING CONCEPTS

Blended learning [3] can be defined as the combination of multiple approaches to pedagogy or teaching, e.g. self-paced, collaborative, tutor-supported learning or traditional classroom teaching. Blended learning often refers specifically to the provision or use of resources which combine e-learning with other educational resources.

Some authors talk about "hybrid learning" [4], "mixed learning" or "multi-method-learning". However, all of these concepts broadly refer to the integration (the "blending") of e-learning tools and techniques with traditional methods. Computer-based learning is no longer regarded as an alternative to traditional forms of learning/teaching. It is integrated into

a learning arrangement which combines those methods that have been selected for a specific learning purpose or environment.

Blended learning is not really a new concept. Teachers have always been using “combined resources”. Basically, blended learning is just a combination of teaching or facilitation methods, learning styles, resource formats, a range of technologies and a range of expertise. It intends to take the best of both worlds. From classical classroom training, it takes the

- teacher driven presentation and selection of relevant content,
- social interaction and
- the dialogue between student and teacher.

Concerning e-learning, it benefits from the advantages of self-paced learning, i.e.

- learning anytime everywhere;
- students can work through a specific task or problem as often as they want, until they reach their learning goal. In classroom training this would be impossible. It also requires stronger involvement of learners with the subject which might be one of the reasons why e-learning is said to be more effective and sustainable than face-to-face training.

If teachers or trainers want to provide or use different kinds of educational resources, they usually put up a plan, define a specific syllabus or plan learning sequences. Training plans or blended learning arrangements present ways of how to combine self-learning phases with synchronous or asynchronous online collaboration and cooperation, as well as with face-to-face training sessions.

When trainers make use of the educational content, they often select specific parts of the content, add their own material, with the aim of bridging the gap between theory and practice, they find ways of how to motivate learners, involve them in learning activities, give them tasks that can only be done in groups, etc. Due to the enormous costs of content development, organizations (e.g. universities) are usually not in a position to provide individualized courses for each trainer or target group, but provide generalized content to be used for course delivery. In general, online course material is rather static, and that is why trainer-specific custom-made learning arrangements are difficult to realize.

A solution to that problem is to build the content in a way that trainers can customize it to their particular needs, e.g., by building individual course arrangements. This assumes that as a result of content creation there should be concise and highly modular content units (cf. “microcontent”, “microlearning”, [5]), which then enable trainers to select different content elements, in order to recombine and mix them with other teaching and learning elements, like, e.g., project work, discussions, exercises, etc. Easy adaptation of learning materials to target group-specific domains is essential for any organization delivering high-quality educational settings.

3 RE-CONFIGURABLE BLENDED LEARNING WITH (EDU)DOCBOOK

DocBook [6] is an XML dialect that was developed as an exchange format for (software) documentation in the early 1990s; it now has reached worldwide distribution. So far, it has served as a successful example for the development of structured formats for documents for XML developers. Thus the developers of the educational modeling language

(EML) report that DocBook was the model for developing their XML-dialects [7]. A wider, documented dissemination of DocBook in the area of learning media production has not been reported up to the present.

eduDocBook as developed and used at Fraunhofer IESE is an extension and specialization of DocBook, which recommends the language especially for the educational sector. The currently available version of the eduDocBook format mainly allows fine-granular modeling of sequential-hierarchical learning content (book, chapter, section, reference etc). In particular it provides the following options:

- Markup of blended learning activities (e.g., online and offline activities)
- Markup of target group specific content (e.g. `userlevel="novice"`) and content varieties (e.g. `condition="course"`).
- Assistance of relations within documents (e.g. `<eduRelationtype="isExerciseTo" linkend="nodeid"/>`).
- Heavily modularized storage and reuse of learning content and course documentation.
- Build-tool based on open source software.
- All other additional options provided by DocBook: glossary, index, directories, function references, bibliographies.

The successful implementation in industry and higher education has shown that the eduDocBook format in combination with the accompanying tools enables the detailed markup of a number of formats and provides output in multiple configurations and media.

On a technical level the (edu)DocBook-based single-source publishing approach differentiates four consecutive layers which are passed successively for compilation and processing of learning content or course documentation [8]:

1. *Storage layer:*

On this layer the components of the content are created in XML and retained for further processing. The components use the eduDocBook format, which separates content, structure and layout of documents, and hence provide great flexibility for future re-purposing of the contents.

2. *Composition layer:*

This layer provides the aggregation of the components into a complete, valid DocBook-document, which is used as the central foundation for further processing.

3. *Transformation layer:*

On this level the aggregated documentation is transformed into the desired output format. Currently various HTML and PDF formats are provided by eduDocBook.

4. *Presentation layer:*

This layer presents the formatted documentation to the user. Usually this can be done by using a CMS or KSM system.

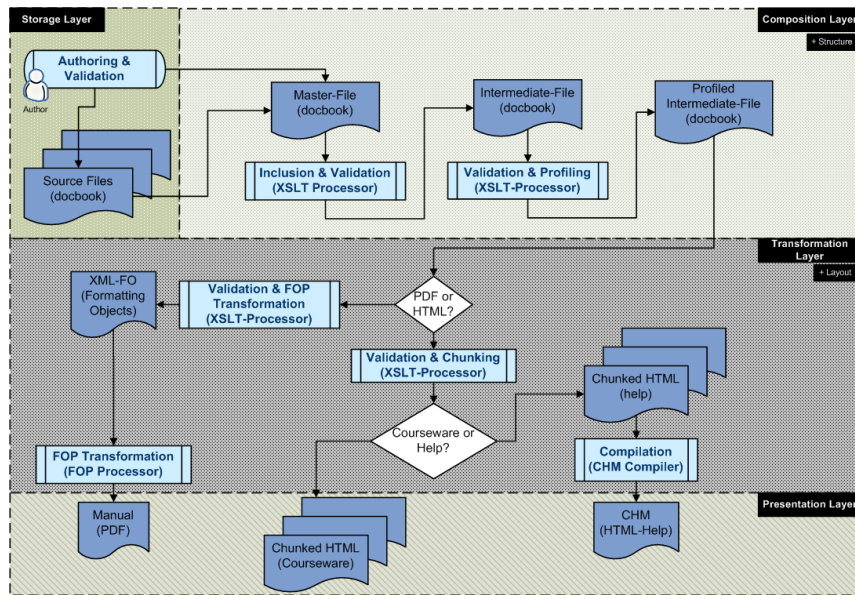


FIGURE 1. A typical DocBook Production Process [9]

On the storage layer, which is responsible for creation and allocation of documentation, the authors will typically work with authoring tools such as an XML-editor or an IDE-tool such as Eclipse. The components are for example retained in a CSV/SVN repository for further processing. Using technologies such as xinclude, xpointer, xml catalogue, conref etc. enables an extensive modularization of information as well as the reuse on a technical level. An XSLT processor is the central tool on the composition and transformation layer. It transforms the validated XML-file, the so-called profiled intermediate file, to the desired output formats. In case of XSL-FO, the free Apache FO-Processor can be used to transform XSL-FO files into PDF files - although it only provides restricted possibilities. Professional results can be achieved using commercial products such as RenderX XEP or Antennahouse XSL Formatter. For presentation and allocation of the final documentation and media, a content management system (CMS) or, in case of educational software, a learning management system (LMS) can be used to import the produced SCORM packages. The relevant files for SCORM, the IMS Manifest, can be directly written from eduDocBook. The complete production process is largely automated and is controlled by a transformation wizard. The application initially queries the necessary data from the user and subsequently starts the transformation process for the wanted data and media formats.

Within the project “Upskilling to Object-Oriented development with the UML” (Up2UML) this form of content and course documentation production was widely adopted

and further improved. In addition, specific output formats for eduDocBook with an attractive and functional interface were developed. Furthermore, eduDocBook was used to model documentation on blended learning activities – here called course documentation – and their relationships with content elements (e.g., X isExerciseTo Y). This allows not only the output of customized learning media for the students but also of the relevant documentation and support material for the trainer.

4 USING THE UP2UML COURSECOMPOSER TO CUSTOMIZE BLENDED LEARNING

The developed content modules on the UML2 were stored as largely independent modular information objects and enriched with meta-data. The overall goal was to enable future “reusers” of the components, such as trainers, publishing houses and course providers, to put together individual courses. A trainer may, for example, use the content developed in the project, for preparing a presence unit by using an online course on fundamentals of UML diagrams, and later on provide exercises together with a case study, handed out to the participants at the end of the workshop. The modular design within Up2UML supports the customization of existing blended learning concepts and the re-configuration of courses and help, for example, focusing on specific types of diagrams within UML.

The term re-configuration of content in this paper refers in general to the “authoring by aggregation” as described by [10]. Ultimately re-configuration describes the combination of content from existing content components (aggregation) or the change of this combination as well as transfer to different dimensions of reuse (re-configuration).

The creation process of learning media in Up2UML occurs in two steps: initially, the content is created and stored in a modular form. In the second step, these components, the so-called content objects, are aggregated into didactically meaningful arrangements, including various access support tools (e.g., an index or advanced organiser). A local solution was used as an aggregation tool as well as a tool for re-configuration of content tools. During that stage, the idea arose to apply the same processes to a web server and thus enable in the future a more comfortable combination and re-configuration of educational media. This application, called CourseComposer allows the users to comfortably develop or reconfigure didactically motivated arrangements of content objects – factually these are XML-files available in SVN in eduDocBook format. Subsequently, the combinations run through a number of transformations to be available for download in the desired output format, with the desired content (e.g. target group specific data).

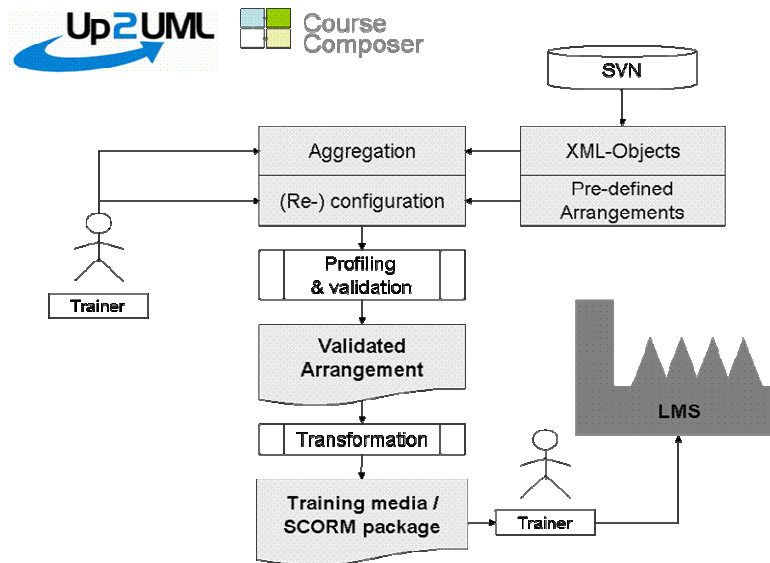


FIGURE. 1. Schematic sequence of the re-configuration of educational Settings using the CourseComposer [11]

Due to the use of Java-Script and Ajax libraries and technologies, the CourseComposer provides an intuitive interface. For example, it is possible to put together courses by drag and drop using the so-called “Arranger” in CourseComposer. It is also possible to move nodes, lectures, chapters etc. with the mouse. The so-called “Transformer” transfers the courses assembled with a few clicks into the desired format. After completion of the transformation, the courses can be made available to the students in different formats, WBT (HTML) and PDF, as well as in different languages.

4 DISCUSSION

The analysis showed that the possibility to reuse and re-configure learning content provides important stimulation of student motivation within blended learning arrangements, hence it contributes to the success of the approach. Furthermore, it represents an exciting area for the enhancement of e-learning, since similar technologies could be used to deliver truly personalized learning experiences.

eduDocBook, as well as related tools provide solutions that enable the realization of numerous approaches. In contrast to the many proprietary solutions (e.g. LMML [12], eEML [13], <MI>³ [14]), DocBook is an established standard, worldwide in use and with a very active user group, as well as numerous related technologies. Due to the distribution and use of standard technologies eduDocBook appears to be medium-term future-proof.

The described approach for creation and re-configuration of content has proven valid within an industry application and a research project with varying goals. It seems feasible that it is suitable for other topics, but this can currently not be fully documented. Even if the use of DocBook in social sciences and humanities is demanded sporadically [15], we only have few experience reports about the suitability of the standard for the markup of corresponding texts, e.g. for medicine, law, etc. [16]. As a result of the flexible adjustment and specialization of DocBook - which increases further with the upcoming version 5 – it can be assumed that such solutions are possible. Generally eduDocBook has proven to be an applicable markup language in the mentioned contexts. Its low specialization in the area of educational media modeling is also a problem of eduDocBook: its ability to describe exercises in a semantically accurate way is limited. Complex didactical scenarios, often demanded, but rarely implemented in practice, can only be realized rudimentarily with the textbook logic implemented in eduDocBook. Furthermore, the feasibility of educational modeling with eduDocBook outside the described projects has to be examined. It is necessary to explore whether the techniques also work in the context of further blended learning projects and if the expected results can be achieved.

5 CONCLUSIONS

A perfect mix of media and methods adapted to the specific target group and optimized for the subject to be taught is one of the key factors for learning success. This has been true since the early days of adult education and it still remains true for blended learning. The creation of blended learning settings can be supported and facilitated by effective tools like the eduDocBook-based single-source publishing approach.

Within the Up2UML project a repository with learning objects and blended learning activities for UML2 was set up. It can be used by trainers, course providers and publishing houses to create their own learning products. To support re-configuration of educational media and corresponding course documentation, the tool CourseComposer was developed. It allows the assembly of modular information objects in the eduDocBook format and their transfer to multiple output formats.

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