

Building re-configurable multilingual training media

Ines Grützner¹, Ludger Thomas¹, Silke Steinbach-Nordmann¹

¹ Fraunhofer Institute for Experimental Software Engineering, Fraunhofer-Platz 1, 67663 Kaiserslautern, Germany

The article demonstrates the importance of designing re-configurable and re-useable training media for trainers, course-providers and course-developers. It analyzes the underlying concepts of re-configurable training media and their authoring, production and distribution processes and shows the importance of sound development for the conceptualization and realization of modular training media. It illustrates how re-configurable training media can be built in various languages and media-formats using open standards and open source technologies. Based on a multi-national project, the practical application of such an approach and show how trainers and course providers might be supported in building individualized sets of training media and across various media formats (WBT, print) are discussed.

Keywords e-Learning; content development; multilingual; re-use

1. Motivation

A recent study from UK's e-Learning guild showed that, even in the upcoming e-Learning 2.0 era - content is still "the king" for most training departments and instructional designers [5]. According to the participants interviewed in the study, "content re-use and re-purposing" as well as "rapid development of content" are some of the most challenging fields for the near future. The exchange and adaptation of existing training media can be seen as one of the most emerging fields and critical for the success of e-Learning, since it helps to close the gap between contents which are proposed and those which are in-demand. Especially in the enterprise sector, where content is produced individually for one company, the exchange of content needs to go hand-in-hand with a re-configuration of the existing material. Traditional approaches to training media production focus on building fixed collections of information and material. These collections are more or less static and delivered en masse, e.g., in a SCORM package. This leads to a major problem, namely, exchange and adaptation to the needs of a special company, a department, a trainer or at least a specific context, is complex since the whole packages must be analyzed, modularized, re-configured and re-packaged. This leads to the fact, that in most cases training contents are not being adapted to their individual context of usage and their structures and contents conflict with the foreseen structure of the training and the target group might regard them as being loaded with useless information.

This paper presents an approach to build re-configurable multilingual training media using open-source technologies which is being used within a running multi-national research project.

2. Designing configurable and re-useable training media

Even today, Trainers and content authors have to spend lot of time designing and building high quality content for their target groups. At first this might be seen as some investment which needs to be done in order to achieve self-paced learning work. As the e-Learning field emerges and the processes, concepts and contents mature, such strategic investment into content should not support a specific usage scenario, but should also enrich other products and services (e.g., other courses on similar topics). The study [5] illustrates, that trainers in e-Learning or blended-learning scenarios are satisfied with the technological support in building *initial* versions of their contents, but have a strong need to re-using this investment in other contexts. Nearly every delivered course differs from previous courses in its content, instructional

strategy etc. On one hand, participants often request a shift in the focus of the course requiring specific content elements. On the other hand, trainers, course-providers, and course-developers have a strong need to adapt pre-developed training media to their individual needs in order to reduce course production and delivery cost.

Most of the development methodologies for training material described in the literature either focus on producing homogeneous monolithic training media (e.g., WBT) or cover aspects of building large repositories of heterogeneous, meta-data enriched content chunks (e.g., learning objects [8], [10]). The first is well established and documented since most of the e-Learning content has initially been built using such an approach. Since the contents have been built to support a fixed educational model and a specific usage scenario, they are might be usable in a few other contexts, however, if the usage scenario changes too much (e.g., the trainer or the syllabus changes), one has refer to new media since there are not re-configurable and can be adapted to new contexts. Furthermore the monolithic structure makes it difficult to exchange content chunks between different institutions since a simple change of layout might result into extensive re-work of the contents. To deal with such problems of practical re-use and exchange of content, the learning object repository approach has been introduced. It is build upon the idea of using common repositories of objects and accompanying meta-data to store media and learning objects in context-free ways so that a later user can find and re-arrange such objects to new products.

To facilitate the reuse of learning objects in different contexts and to build re-configurable courses, the objects in a repository have to be designed to be:

- combinable in new aggregation formats (Aggregated Learning Object)
- free of context (e.g., target group characteristics, specific instructional strategies)
- separated from structure and layout information
- enhanced with meta-data to build course variants

Since the learning object repository approach and the corresponding concept of learning object meta-data have been designed to cover a wide range of topics, it requires huge amounts of available objects to make the idea of searching and re-assembling objects really work, e.g., to provide enough objects to build a courses on the topic “UML” as well as on the topic “objects orientation”. To provide enough objects for a specific topic, specific repositories with a thematic focus might be a good starting point, since they cover comprehensively the content of a closed subject matter topic. In combination with the definition of a common vocabulary (e.g., terminology to be used), this also guarantees that the learning objects are consistent in the content dimension. The definition and application of a learning objective hierarchy facilitates the adaptation of the instructional strategy to different learning levels. Commonly agreed authoring guidelines for a specific topic assure that the learning objects, although developed independent from each other, form a homogenous impression to the later users.

3. Using sound development processes for design and development

The development of training media for a later re-configuration requires sound design and development processes. This has on one hand to do with the size of a typical project team, which consists of media designers, subject matter experts, instructional designers and developers. Cooperation in such a case requires good processes which clearly define which role should to do what and when. On the other hand the number of perspective variants of the material to be built has to be taken into account as early as possible. As Fig. 1 illustrates, the resulting number of perspective versions increases dramatically with every additional option, language or media format: A course in 2 different languages, 2 output formats (HTML, PDF), for two different levels (beginner, advanced) and two target groups (developer, manager) would require the design and development of 16 different versions. Without sound development process, such complexity is hard to handle and project might run out of time, resources or the resulting quality may well turn out to be poor.

Since most of the existing and documented development processes for training material production focus on the development of monolithic courseware, they are not applicable “as-is” for the production of modular and re-configurable media. The resulting process has to support the definition of training media

variants, and to adhere to the following principles [1] of designing modular training media in all its phases:

- **Modularization**, that is, information units have to be build in a way that the content of the units are independent from each other (no or only a few links between the units). This minimum of links facilitates the arbitrary arrangement of units in a training media variant.
- **Re-use**, in order to facilitate the usage of the information units with different layouts in training media for different target groups and for different learning goals.
- **No redundancy**, that is, content that is part of several information units is encapsulated in a separate unit that is then integrated at several different places in the training media.

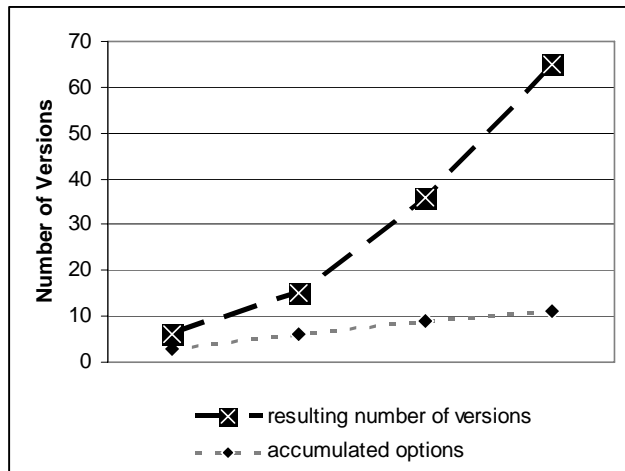


Fig. 1 The number of available options for re-configuration and the resulting number of document versions show the importance of sound design and development processes.

These principles, together with general instructional guidelines, have to be applied to specify and design three different structure levels of the modular training media [3]: Elements of the modular (blended) training as a whole, aggregations of information and educational strategies as well as the corresponding information chunks and Information and media chunks, which represent the smallest part of the content.

The proposed process for the production of modular training material proposed in this article is based on the IntView method [2], which derives from the domain of courseware engineering. An adaptation of the method for the design and production of modular training media is shown in Fig. 2. The specific activities

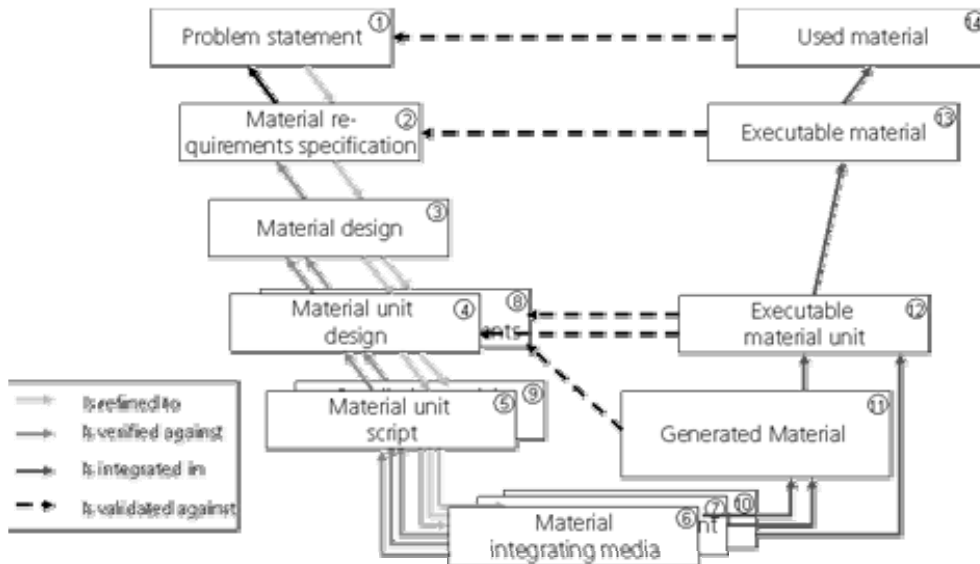


Fig. 2 The product-centered IntView life-cycle model adapted to the production of modular training media.

and methods for specifying, designing, and producing modular training media are mainly located in the phases *Material requirements specification* (2), *Material design* (3) and in the production phases *Material integrating media* (6) and *Production environment* (7). During the phase *Material requirements specification* (2), based on the results of the activities of the task oriented IntView requirements specification method [2] the functional and non-functional requirements for the modular training material are specified. This specification has to include a definition of the material variants as well as their specific characteristics (related to media elements, media content and instructional strategy) and functionality. The requirements specification is the prerequisite for the design of the information unit structure covering all media variants and for separate designs for all training media variants, if required (3). Separate designs are developed in the case that the training media variants are used in different contexts and therefore require different media designs and functionalities. The structure of the information units, however, has to cover the content of all media variants and its relationships to build a consistent network of the whole content space. To build the variants from this network, specific variants have to be defined for each information unit (e.g., as decision table [7]). The realization of the modular training media in the phases *Material integrating media* (6) and *Production environment* (7) has to support the efficient building of the media variants regarding the media content and the media layout. Since the layout can be applied automatically using a Single-Source Publishing approach, the *Generated Material* (11) and the artifacts/products can directly be derived from the modeled content and the integrated media.

4. The Up2UMLCourseComposer

The techniques used for the realization the re-configurable training media may vary from project to project. To illustrate the practical application and the technological support, the following is based upon a sample scenario from the European funded project “Up2uml”. The aim of this trans-national project was to develop a modular and multilingual blended-learning training on object oriented software design and development with the Unified Modeling Language (UML). Since the trainers and later users of the training material should be able to adapt the contents to their individual needs (e.g., their syllabus), the material was designed for re-configuration right from the start.

The technical realization of the modular approach bases on a set of free and open-source software, mainly XML-based technologies such as DocBook [9], XSLT and a set of makefiles and shell-scripts. For the collaborative authoring of the contents, the project consortium decided to use the free version control system Subversion, which allowed reliable distributed working on the contents and the transformations.

For the re-configuration of the training media, a web-based application, named CourseComposer, was developed. This tool allows trainers and course providers to access the content objects, re-assemble them to new aggregation formats, so called arrangements. Since the contents are stored within a SVN repository, the CourseComposer has to continuously index and update its own files and databases to keep pace with the changes within the SVN. The CourseComposer collects all available XML objects and arrangements and allows the trainer or course provider to take an existing arrangement, add, remove or move the XML objects and save it as a new arrangement. Finally the

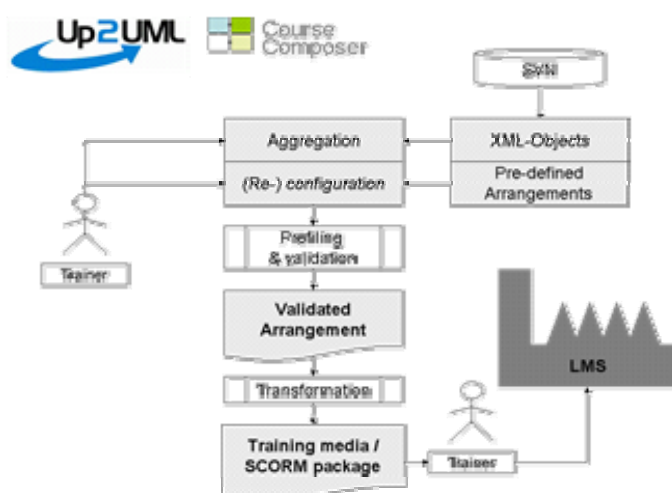


Fig. 3 Workflow in the Up2uml-CourseComposer.

trainer can choose the language version of the contents. After a validation against a XML-Schema, the selected arrangement is being transformed to well-designed e-Learning content or to PDF. In this version the animations and interactive exercises are substituted by static versions (images). A SCORM-export functionality provides a rich SCORM package of the contents which can be directly imported into the trainers of course providers Learning Management System (LMS). For the modeling of the educational concept and mark-up of the contents, the Up2uml project uses a specially adapted DocBook schema which has shown in slightly different contexts that it is able to handle such complexity [11]. It has been enriched with education-specific attributes, e.g., to indicate which level of the learning objectives taxonomy is addressed or which application domain is addressed by the content. Since DocBook by default provides only a little set of elements for educational modeling, it has been proposed earlier to build some kind of eduDocBook [6]. Such a mark-up would provide the normal DocBook components as well but also some special attributes and elements for the description of the educational usage context of the modeled contents.

5. Summary

This article showed the importance of building re-configurable training media especially in the context of blended-learning delivery modes. By building material using such an approach, trainers and course providers get the possibilities to build new training media from a repository of high-quality content chunks according to their individual needs and their syllabus. To ensure constituency, accuracy and correctness sound development processes are needed from the beginning. The IntView methodology provides such processes and involves all relevant roles with their own viewpoints. The so developed contents can be re-arranged to new training media.

In the research project Up2UML the approach we have described is used to build up a topic specific repository of homogeneous, multi-lingual content chunks which can be re-arranged by trainers and course-providers to new training material using the Up2UML CourseComposer Tool.

Acknowledgements The Up2UML project is co-funded by the European Vocational Training program „LEONARDO DA VINCI“; co-operation partners come from Germany, France, Ireland, Romania and Bulgaria.

References

- [1] K. Ament, Single sourcing: building modular documentation. William Andrew Publishing, Norwich, New York, U.S.A (2003).
- [2] I. Grützner, D. Pfahl, G. Ruhe, Systematic courseware development using an integrated engineering style method. In: Proceedings of the World Congress “NETWORKED LEARNING IN A GLOBAL ENVIRONMENT: Challenges and Solutions for Virtual Education”. Technical University of Berlin, Germany (2002).
- [3] Fraunhofer IESE, Erstellen von Dokumentationen für Technical Writer. Lernsoftware, Fraunhofer IESE (2005). Available at <http://www.uml-kurs.de/ITW/Produktseiten/einstieg.html> (in German).
- [4] I. Grützner, B. Paech, Requirements Engineering for Courseware Development. In: Mate JL, Silva A (eds) Requirements Engineering for Sociotechnical Systems. Idea, Madrid (2005), pp. 170-188.
- [5] The eLearningguild, The Content Authoring Research Report 2005, <<http://www.elearningguild.com/pdf/1/Oct05-contentauthor.pdf>> (13.03.06)
- [6] P. Gorissen: The dynamic appearance model and implementing SCORM 1.3 <<http://www.cetis.ac.uk/content/20030713202337/20030714000846>> (accessed 30.10.06)
- [7] Colin Atkinson, Joachim Bayer, Christian Bunse, Erik Kamsties, Oliver Laitenberger, Roland Laqua, Dirk Muthig, Barbara Paech, Jurgen Wust and Jörg Zettel, Component-based Product Line Engineering with UML, Addison-Wesley, 2001
- [8] D. Wiley, The Instructional Use of Learning Objects, <<http://reusability.org/read/>> (accessed 30.10.06)
- [9] N. Walsh, L. Muellner, DocBook, O'Reilly, 1999
- [10] E. Duval, W. Hodgins, A LOM Research Agenda. 2003, <<http://www.www2003.org/cdrom/papers/alternate/P659/p659-duval.html.html>> (accessed 13.03.06)
- [11] L. Thomas, E. Ras, Courseware Development Using a Single-Source Approach. in: Proceedings of the World Conference on Education Multimedia, Hypermedia and Telecommunications, Ed-Media 2005, S. 4502-4509