

# Course Production Applying Object Oriented Software Engineering Techniques

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**Abstract:** Developers of educational material like web-based training and online courses face well known aspects of classic software development processes: Reusability of course units; Supporting cooperation and resource sharing between the members of the design process, like content authors, designers, multimedia producers and quality managers and Quality management. Therefore, software engineering techniques like object-oriented analysis (OOA) based on a central database to be used in iterative design processes will also be useful for the development of educational material. These considerations are the background for our work and experiences in the project Virtual University as described in this paper.

## INTRODUCTION

### The Project “Virtual University of Applied Science”

This paper reports work done in the project “Virtual University of Applied Sciences” (period of duration 1998-2003, see <http://vfh.de>). It aims at establishing a location independent university with a curriculum for computer science of multimedia systems and for business engineering (Bachelor, Master). The authors of this paper are involved in the production of web-based courses, in the design of user-adequate learning spaces and in the support of the design process. Their focus is on usability recommendations and quality management for the course material during the development process. Other aspects like teaching strategies, learning processes or technical issues concerning the course production are supervised by other dedicated consulting groups within this project.

### Adressed Problems

During the first months of course production for the virtual university several problems got obvious:

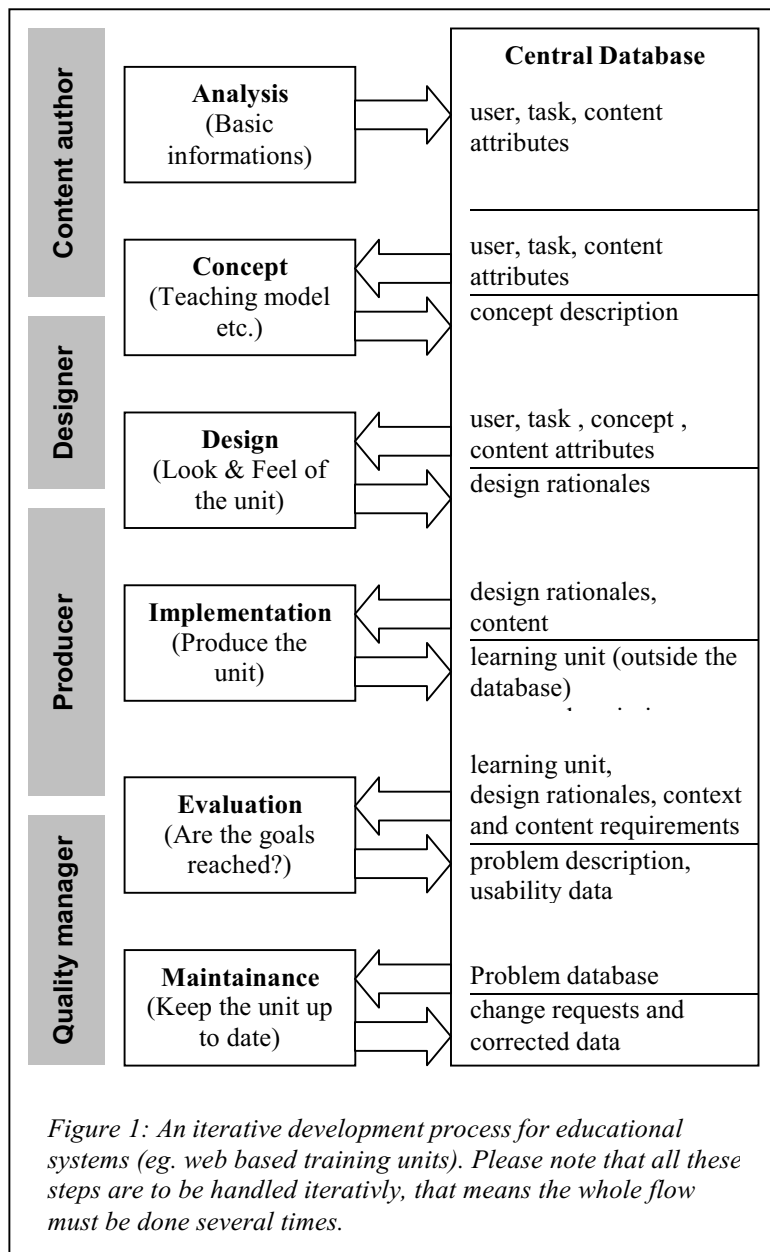
- *The lack of a appropriate context of use description*  
Practice showed that the developers of course material had only an incomplete mental model about the needs and abilities of the intended user groups, like previous knowledge, learning style, preferences in teaching mode, motivation and other information that would be important to adapt the teaching strategies and delivery of hypermedia structure and content accordingly (Kritzenberger 2000). The mental models about this user group and the assigned attributes even differed during development phases.
- *No stable base for the quality management*  
Quality management (e.g. of learning processes, functional correctness, usability) suffers from a lack of basic information about design and implementation requirements.
- *Consistency of content information and re-use of contents*  
Another problem is that the content or the structure of the course units may get inconsistent during workflow. While the content author has her or his version (e.g. a linear MS-Word-Document), the hypermedia producer has to transfer content and structure to web formats (HTML and sometimes JAVA Add-Ons). Changes in the linear version have to be manually transferred to the hypermedia version. This is a source of errors and often prevents maintainance, because of the extra effort it will take. Keeping such a training unit up to date often requires to start all over again (e.g. with updating the Word-Document) and repeat former development steps.

## DESCRIPTION

The main idea is to overcome the problems mentioned above by introducing a central information base which is used by all participants during the design process: content author, designer, producer and quality manager (see figure 1). Using a simple

relational database combined with a powerful web frontend seems to be adequate. This database should include all the context information as well as the content of the teaching units. In a first step these informations are only presented to the involved persons but no contents are automatically generated.

For database organization object oriented techniques are used. Classes of information like “user attributes”, “organisational requirements”, “content”, etc. are identified and then may be freely combined into “views”. These views are role dependent, for example the content author may concentrate on the analysis data and the contents. Whereas the producer, who has to implement the learning unit, may need additional design rationales added by the designer. A quality manager can base his evaluation of the system on the requirements identified and documented during the analysis phase.



As the size and the number of the learning units is difficult to handle, techniques of the OOA are used: abstraction, inheritance and generalization. If for instance many different user groups are to be considered, they may be ordered hierarchically: “All users” → “users of the teaching unit” → “A special group within these user group”. Attributes of the most general object (“All users”) are inherited by all following objects and then, e.g. the designer’s view includes all attributes, from the general to the specific ones. OOA techniques, like underspecification and refinement make the handling of large object sets easier and allow all participants to start with rather raw data and to refine them during the lifecycle of the developed system using OOA techniques based on a database has several advantages. The database supports the complete lifecycle of the course unit and makes all information and design rationales available again for maintaining or updating the course. As the contents are HTML-based they can be included into the courses with less manual effort. Furthermore, the connection of each unit to the position and role in the database is kept. Additionally for each production phase there is appropriate additional information available, like design rationales and the related context informations. Updating a content in the database automatically updates the course and avoids inconsistencies.

#### Current and future work

Currently two major tasks are to be solved: First the different object classes (content and context objects) and views needed for the educational systems must be identified, validated and implemented. Second the database tool has to be implemented and tested.

As the described method is similar to a special currently under development in our institute as well (project “TAToo”) see (Herczeg 1999), we reuse implementation resources from that project. Actually the database frontend and the needed JAVA/JDBC/JSP-Interface will be the same in both projects.

OOA technique

#### REFERENCES

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