medin: e-Learning in Medical Computer Science

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Abstract: In the e-Learning project *medin* 23 large interactive multimedia learning modules have been produced for a complete medical computer science program. These modules are used in the online distance learning program of a distance university as well as additional learning material at several other universities. The paper presents the basic outline of the project, and describes the methods, production concepts, tools and processes to create this large e-Learning environment.

1. Introduction

The project *medin* has been funded by the German Ministry of Education and Research (BMBF) within the "New Media in Education" research and development program during 2001-2004 at five universities. The goal of the *medin* project was to produce 23 interactive multimedia learning modules for a medical computer science program for e-Learning in German universities. Presently more than 1000 students are meanwhile enrolled in programs studying with the *medin* learning modules, most of them at the Open University of Hagen.

1.1 The Advantage of the *medin* Learning Environment

The project aims for more flexible forms of learning and teaching by utilising the advantages of a web-based interactive and multimedia learning environment. The environment offers the students easily accessible course material through the internet. Hyperlinks relate different course subjects and connect to other institutions providing contents for students, researchers and practitioners (e.g. physicians) in the field of medical computer science.
The 23 learning modules consist of more than 8000 HTML pages, 700 graphics, 5000 photos and sketches, and more than 400 interactive animations. A subject-oriented index and glossary interlinks all courses. A special search engine provides additional support.

Three interactive laboratories were created. The first is *JAMIP (Java-based Medical Image Processing)*, a collaboration tool for distance learning and tele-teaching digital imaging for medicine implemented by the Institute for Medical Computer Science at our university. The second is a bio-signal laboratory from the University of Applied Science Dortmund. The third is an information laboratory platform *(InfoLab)* of the Open University of Hagen. These simulation-oriented learning environments motivate the students to learn with high personal engagement supported by their tele-mentors.

1.2 Basic Pedagogical and Research Approaches

The project is based on a methodology which stems from research done for many years by the project collaborators:

- domain-specific didactical concepts for medical computer science (Institute for Medical Computer Science at the University of Luebeck, University of Applied Science Dortmund, and Technical University of Aachen)
- instruction design with interactive media (University of Erfurt) (cf. Niegemann, 2001)
- software-ergonomics und human-computer-interaction (Institute of Multimedia und Interactive Systems of the University of Luebeck) (cf. Kritzenberger & Herczeg, 2001b/c/d; Hartwig, Schön & Herczeg, 2003)

published in: J. Nall & R. Robson (Eds.). Proceedings of E-Learn 2004,
World Conference on E-Learning in Corporate, Government, Healthcare, & Higher Education,
1.-5. November 2004, Washington D.C., USA, AACE, 2004, pp. 79-84.

2. The Production Process

The presentation of the learning modules, i.e. screen and interaction design, has to be consistent from the learner's point of view even when the modules have been conceptualized, developed and produced by different project partners at various sites with a range of changing tools and environments. Additionally the production of the high volume of 23 large learning modules had to be planned in respect to resources and time needed.
To reach this goal it was necessary at the beginning of the project to set up a process, which defined the pedagogical-didactical background, the interaction and graphics design principles, and the different forms of collaboration and reviews. This process with adequate quality assurance concepts (QA) and development tools had been introduced in the early days of the project based on experiences in other large e-Learning projects (Kritzenberger & Herczeg, 2001a; Hartwig & Herczeg, 2003; Hartwig, Hadley & Herczeg, 2003).

2.1 The Production Process Guide

The goal of the production process guide (Hartwig, Triebe & Herczeg, 2002b) was to describe and clarify the production phases and responsibilities of the learning modules. The *medin* project had project members with different areas of expertise (e.g. authors, pedagogues, script writers, graphics designers, programmers), situated at different sites in Germany. The production process guide was created to clarify production phases, cooperation between developers, development tools, QA methods to optimize efficiency and reduce redundancy of work under such circumstances.

The production process guide was short, transparent and easy to understand and apply for all before the production began. This was achieved by naming specific contact persons who were responsible for the process and by holding regular meetings, e-Mail and telephone contacts with the project partners. These meetings and consultations were done in most cases early enough in the production process to avoid later problems.

2.2 The Styleguide

The *medin* styleguide, which has been based on a generic e-Learning styleguide model derived from other e-Learning projects (Hartwig, Triebe & Herczeg, 2002a), defines the standards concerning the media didactics (e.g. instruction models), presentation of learning content (e.g. screen design) and the design of the interactions (e.g. navigations).

The production and QA process, supported by the styleguide, concentrated particularly on the various aspects arising from the production of interactive and multimedia learning modules for an internet-based learning environment. The process comprises of the application of certain didactic principles, as well as rules for usability and technical requirements. The styleguide is a document outlining guidelines, giving detailed instructions, and containing checklists for the production teams. It was provided online as an integral part of the development environment. This enabled the producers to check their design decisions immediately while using the production tool.

2.3 The XML–Markup Process and Tools

The production team of the project *medin* consisted of a different specialists each with his or her field of expertise. Domain experts or authors wrote the learning content for the 23 learning modules. Pedagogues optimized the structure of this raw material using didactical principles. The scriptwriters transformed learning material into scripts, which where used by the multimedia producers to create the learning modules. It had been decided early in the project to use an XML-based tool to accommodate the variety of project members, their specific contribution of expertise, and to improve the production efficiency to be able to produce the high volume of content within the short lifetime of the project (Hartwig & Herczeg, 2003).

The production tool XMendeL (Hartwig, Herczeg & Hadley, 2003) was used. Additionally other tools like text editors and communication systems were used as well. Typical process information within the production tool includes user descriptions, didactical concepts, use scenarios, and quality requirements. All production relevant information, i.e. specifications and content, had been meshed into a semantic web within the production tool and its relational database.

The application core of XMendeL offered the central functionality to generate self-contained objects in context specific views. The system maintains a set of cascading templates (similar to CSS) that define the appearance and the inheritance strategy of the specific view. The production data is then made available to all the participants using three different interfaces of XMendeL: a standard web browser, import/export functions, and web-services.

2.4. Collaborative Production

The XML markup process combines different professional competences. This requires a certain mode of cooperation for the production of the computer-based training modules (Schön, Hoffmann & Herczeg 2003). The following four main tasks have been defined:

- authors (domain experts) of the learning material define the learning goals and the content
- media pedagogues and scriptwriters conceptualize the appropriate instruction method and narrative models
- media designers and multimedia producers create the suitable multimedia elements
- computer scientists are responsible for the implementation and the production environment and the tools

The defined process and the production environment kept the content pieces and tools together and enabled all participants in the process the access the common repository to read, change and extent the structures and contents and to generate and export the modules for the installation into the learning management systems.

3. Multimedia Production

The following outline presents some of the production results. All the learning modules produced in the *medin* project conform to the styleguide.

3.1 Aesthetic Screen Design to Support Perception, Orientation and Information Awareness

The positions of the graphical und typographical elements draw the attention of the students to relevant information and act as orientation aids. The readability of the learning material is supported by a monochrome white background, the spacing between the borders and the text and by appropriate font type and size. The students can immediately identify at the left-hand side of the screen, where interactive elements (e.g. links and animations) are available. The navigation elements are used for efficient and goal-oriented navigation and exploration through the system. The buttons are positioned according to their functionality their estimated frequency of use.

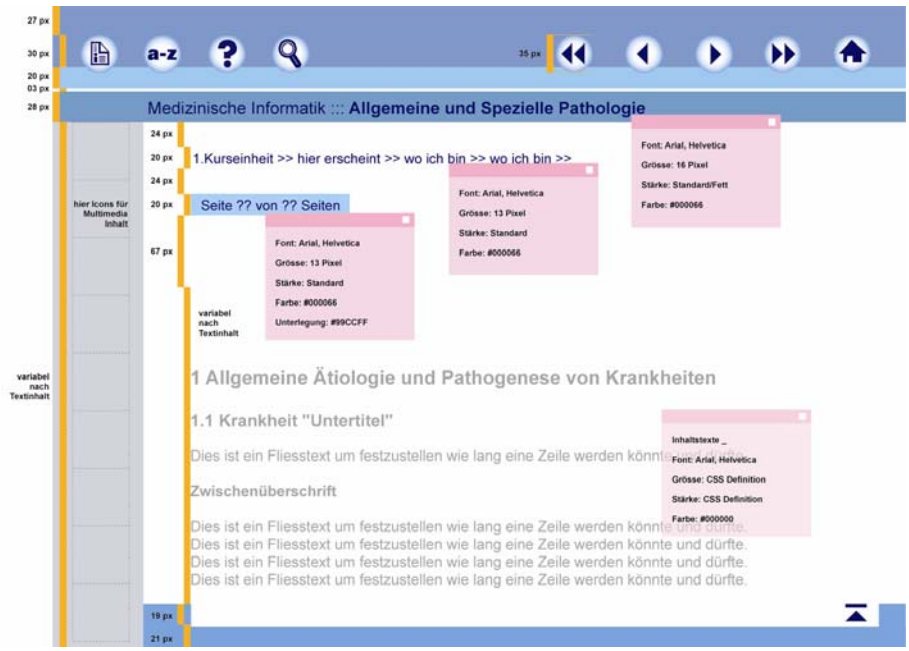

Figure 1: Screen Design

3.2 Interactive Multimedia Elements to Motivate for Positive and Active Learning

The interaction between the learners and the learning environment is crucial for the success of a system like this. In the pedagogical context like e-Learning, interactivity has to go hand in hand with instructional design. Computer-supported interactive teaching and learning methods encourage the students to deal with their “living” and dynamic learning environment in a positive and active manner.

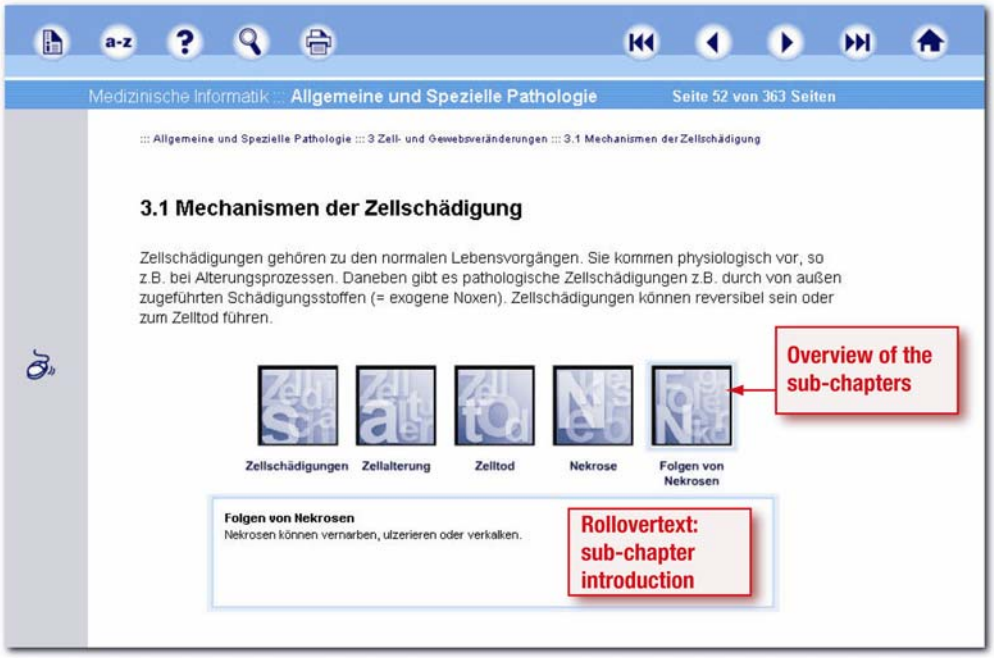

Figure 2: Rollover presents an overview over the following sub-chapters. A short introduction tells the students what they will encounter next. The students are able and encouraged to select their individual learning path.

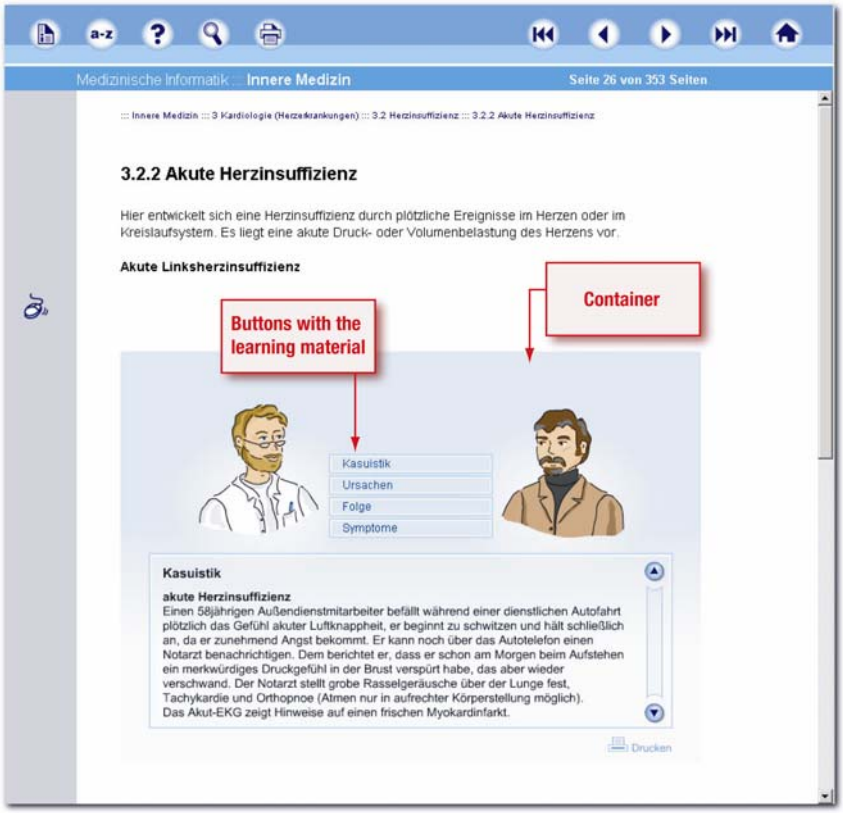

Figure 3: Doctor-Patient discussion. All relevant information concerning a medical case is presented in a “case container”.

3.3 User-Oriented Navigation for Self-Directed Learning

The interactive courses of *medin* support the activities of the learners and motivate them to learn self-directed. The presentation order of the learning content is structured and controlled by a course index, A to Z glossary listing, path tracking, search engine and chapter overview pictures. These diverse access guides provide multi-perspective navigation, which enables the students to have a flexible and personal relationship with the learning content.

4. Results and Conclusions

In the project medin a full medical computers science program has been implemented as an e-Learning system. The 23 multimedia courses that have been produced are currently used in a distance university program as well as additional material in blended learning programs at several universities by more than 1000 students.
The production of the high volume of content has been supported by a process-based development approach, connecting participating producers with different backgrounds and tasks at different locations. The process was supported by using the production tool XMendeL managing the specifications, styleguides, XML-definitions as well as the multimedia contents. Quality assurance has been applied in all phases of the production and ensured a high level of consistency and other qualities defined for the modules.

Interactive multimedia learning modules based on instruction and interaction design concepts and methods are the foundation for a highly motivating personal learning environment.

In the future a higher level of semantic modeling is planned to be applied to the courses and more links to medical information systems shall be installed. Further methods of didactical support and learner profiles based on the semantic model of the content shall be provided to support the learners and their individual learning process.

Many other universities are interested to incorporate the *medin* learning modules into different study programs. The online medical computer science program, which has been produced in the project *medin*, is unique as far as we know and can be used to enrich and extent different study programs.

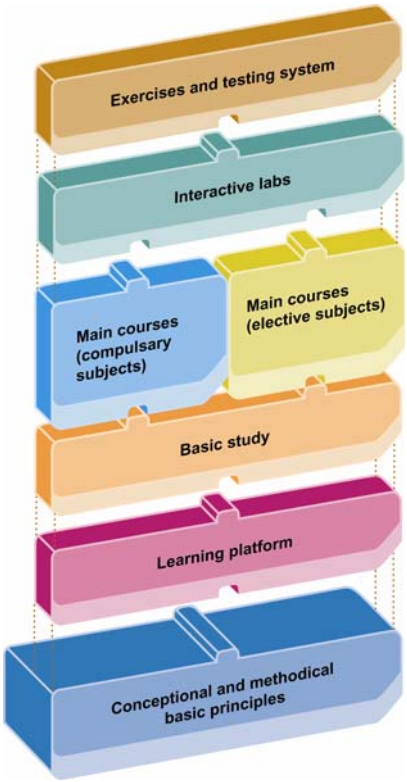

Figure 4: System Overview of *medin*

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