Virtual Medical Campus (VMC) Graz Innovative Curriculum meets Innovative Learning Objects Technology

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Abstract

Experience with a large scale virtual university learning system is presented. A newly designed curriculum for medical studies is made available in electronic multimedia form and is serving the needs of 2500 students per semester. We describe the concept, the technology based on a 3-layer-software system, and especially problems and solutions in connection with mapping medical knowledge onto a multimedia learning objects repository including metadata. The résumé is that virtualised teaching is a successful method to manage high numbers of students and to organize a fair selection process. When we proceed with face-to-face communication in later phases of the education virtual teaching is still used as a powerful support function.

Keywords: Virtual campus; medical curriculum; learning objects technology; metadata

The Story

The Federal Republic of Germany executes a strict “numerus clausus” scheme for students of Medicine. Austria did not in the recent years, but: foreign (i.e. German) students were not allowed to enter unless they were eligible for studies in their home country. Because of this there was no chance for German numerus-clausus-victims in Austria.

In July 2005 the European Court of Justice stopped this practice. Now German students are able to inscribe medical studies at Austrian (German speaking) universities. The size of a typical class for beginners will rise from approximately 250 to 2500.

The Medical University of Graz (MUG) can handle this situation by using virtual teaching in the first semester. Everybody is free to start medical studies, and

we select the “best” students in examinations after the first semester. In autumn 2005, more than 3000 students started Medicine at MUG – our largest lecture hall has 375 seats but VMC can handle almost unlimited numbers by means of electronic multimedia teleteaching.

In 2002 MUG had introduced a new curriculum for Medicine, concentrating on thematic issues crossing classical borderlines of medical disciplines (Glasgow, 1997; Maerz, 1998). The new contents had to be backed by a university-wide information system as a guidebook for students and an orientation system for lecturers.

The project VMC (“Virtual Medical Campus”) started in 2002: all relevant learning contents of the new curriculum had to be mapped into an electronic system and should be accessible for all MUG students without charge and without technical problems. Contents were (and are still) provided by MUG, the technology was (and is continuously) developed by HM&S IT-Consulting and partner companies, the overall design was a task of the whole team. (Smolle, 2004)

At present VMC is “the” learning system for students of the first semester. They get all the necessary information from there, while later in the curriculum VMC has rather a tutorial function complementary to lectures, seminars and bedside experience.

Educational Background

Two decisions mark the beginning of the project: the design of a new curriculum coping with the requirements of the 21st century (Stuko, 2002), and the idea that this curriculum had to be “available” in electronic form for everybody. (Ecker, 2000) Two project groups working closely together developed the table of contents of the curriculum and the e-learning system, respectively. The new courses had to be “implemented” in electronic form. In parallel with that, the MUG lecturers were educated and supported in the use of the new medium.

In our VMC competence centre four persons are responsible for this process. The means were planning workshops, now support is provided individually on demand. There are approx.600 lecturers at MUG. 50 of them were members of the development process of the curriculum, and 10 cooperated in new media issues. At present 180 active authors are providing contents (learning objects) for VMC. Personal contacts of members of the project team with potential authors have proved to be the best way to success.

Students receive a one-hour introduction and a consultation hour is held once a month. Our experience is that there are no problems from this side: they mainly work at home using internet connection.

The whole curriculum is divided into four levels: Modules, Topics, Learning Units and Learning Objects. The Study of Human Medicine on the Medicine University of Graz is divided into 29 Modules, about 10 Tracks and about 20 “Special Study Modules”. Each of these modules has its own topics. The Learning Units on the next level hold the Learning Objects for up to four lessons (45 minutes each). This arrangement is working well because there is a hundred percent compatibility to the study “in real life” and so the students don’t get confused because of more than 4000 Learning Objects and find the important ones for their term very fast.

Each learning object (LO) has to cover the maximum contents of a 45 minutes lecture. It is possible to assemble different courses from a pool of learning objects of this size. Authors are free as to the contents, didactical norms, formats and structures within the objects are not provided either. LOs are mainly presentations in MicrosoftWord, Powerpoint, PDF and HTML formats. Powerful didactical possibilities like video and simulation are consecutively produced by the members of the competence centre in close cooperation with the responsible lecturers.

Virtual seminars and exercises are obligatory complemented with Computer Based Training Objects (CBT). So there is a structure in the Learning Object where the students learn in a guided way. The feedbacks for this Learning Objects were very positive in the first term. The lecturers

could build a LO in the way they used to teach in their lecture (e.g. questions and answers) and the students found it very easy to learn with CBTs because the handling is very easy and clear. Furthermore, the students got an Email after working through a CBT giving the percentage of right and wrong answers. This procedure was also used by the university to log the result of each CBT (test) and if there was a positive grade on the Test the students got a certification for it.

At the end of each CBT there is also a possibility for the students to send a feedback to the author. This was, for the students the important link to the lecturers. It was used very often for questions on the learning matter and also for criticism (positive and negative).

The CBTs could be created online; so for the lecturers, there was no need to install any Software for creating their LOs. They just needed to open the Internet Browser and to write their questions and answers into the system.

Technological Background

The challenge was that conventional textbooks do not fulfil the requirements of an integrated curriculum (overlapping special disciplines). There is a necessity of an electronic learning system.

vmc.meduni-graz.at has been implemented by an international group of software companies under the leadership of HM&S and coordinated by MUG. The 3-layer-system consists of a front-end with its user interface for students and lecturers which is accessible via Web-Browsers, a middleware layer as the functional heart and a multimedia repository which is the LO data base.

The system is designed to handle 2000 concurrent users. Software technology is based on Microsoft's **.NET** suite.

The Clustering of the Front end was handled by the integrated Software-Cluster of the Windows 2003 Server Enterprise Edition, the Clustering of the back-end was realised by a SQL-Server-Cluster from Microsoft. With this technology there was not one problem to handle the massive count of requests from the students.

All LOs are accompanied by metadata (LOM = learning object metadata) following the SCORM standard (sharable content objects reference model) version 1.2.2.

LO metadata are a key issue for any computer based university training system. They allow the flexible construction of various courses out of “LO-atoms”, re-use of LO content – also in different languages, and the handling of accompanying question/answer modules for self evaluation. Metadata are inevitable for the ongoing exchange of LO based courses with the Faculty of Medicine of the University of Maribor and the Medical University of Vienna.

The middle layer organizes all interactions of the Learning Management System: access to LOs using subject/discipline or module identification, the question – answer - system for the students’ self assessment, and the management of users: students, authors, and administrators. Another main task is the setup and control of the LO – course – subject – structure (using LO metadata), and the release of individual LOs.

Experience

Since autumn 2005, VMC is in full operation handling the needs of 2500 students – beginners of their medical studies. More than 6000 learning objects are available and are being used. 500 to 600 concurrent users are not causing technological problems. Students can use any Browser (in the newest version) they want. Authors have to use the Internet Explorer as a standard.

Each LO contains a clear reference to the corresponding textbook, and represents the topic in adequate electronic form from text and diagrams to video, animation and simulation. Interactive LOs are provided to allow the student to check her/his knowledge. Seminars and practical work

are mapped onto elaborated Computer Based Training (CBT) objects, which can be sent to professors/tutors. They are an integral part of our examination system.

While students regard VMC as a “no problem”-issue, authors, i.e. lecturers/professors, had to learn their new job: a new curriculum that is neglecting traditional discipline borders, and its presentation in electronic form – creation of interactive, “life” textbooks. As the VMC team did not prescribe presentation standards the content was and is growing fast. On the other hand we can see an abundance of pure presentation LOs – mimicking traditional classroom teaching. We are trying to promote the creation of interactive objects via support, training and consultancy. Also discrepancies in the didactical quality are visible. LOs range from textbook copies – not to be understood without explanation – to didactically excellent teleteaching objects. As a third observation we found that different authors use different internal structures in their contents. This led to some confusion on the side of the students.

We therefore initiated a review process including the students – with considerable success in form of quality improvement. Last but not least, some guidelines for LO and course structures were issued (Smolle, 2005).

At the end of the virtual semester, more than 1000 students attended the examinations, which were held in Graz on two consecutive days. These tests covered all topics that were taught through the VMC during the virtual semester. It turned out that the examination results in particular multiple choice questions were significantly related to the mode and intensity of presentation in the VMC. Topics which were entirely covered by interactive computer-based training learning objects yielded significantly better examination results than those which depended mainly on presentation and visualization learning objects or textbook references.

In the evaluation, the overwhelming majority of the students agreed that they would prefer face-to-face teaching in the first semester, and that they would prefer a selection process prior to admission rather than at the end of the first semester. They found, however, the VMC easy to use. They particularly valued the computer-based training learning objects as useful and efficient tools for learning and self-assessment.

Ongoing Development

Apart from the ongoing improvement of VMC contents both in quantitative and in qualitative respects (as described above), and the introduction of both examinations and student feedback considerations, we have to continue developing the system in technological respect.

The main issue is the enhancement of both hardware and software to handle up to 5000 concurrent users. In the new system which is introduced step by step without any interruption of the continuous use by students and authors, we run 11 server computers: 5 for the presentation layer, user interface and web communication, 4 for the middle layer managing all important functions, and two to hold the database: our repository. The whole task is performed by HM&S. Programming of the Front end is done by using ASP.NET from Microsoft (Visual Studio.NET, 2005). The repository is fully compatible with the Content Repository for Java technology API (jsr 170, http://www.jcp.org/en/jsr/detail?id=170) and written in Java.

Authoring tools (Musch, 1999) have not been an integral part of the system for some time. The most common external tool used is a CBT-tool, mainly an intelligent text processing system including the possibility to construct learning (or even diagnostic) paths. For special medical applications a “virtual microscope” is used: the student works with the Internet browser in the same way as he would do with a real microscope.

Recently an authoring tool for presentation and visualisation objects has been integrated into VMC so that authors and administrators can provide new contents more easily and make better use of interactive features.

Multi language features that are necessary for international exchange of courses are in the beta testing stage. Collaborative work in the web has not the same priority in Medicine than in other fields – face-to-face communication will play the main role but will be heavily supported by virtual learning of necessary facts.

One important interface will soon be implemented: the connection of the VMC to the new "Med-Online"-Software which organises the whole study for each student, providing a timetable, an overview of class rooms and so on.

Apart from classical medicine, other curricula at MUG are virtualised e.g. the curriculum for dentists and postgraduate studies.

In the future there will be more universities integrated in the VMC-Infrastructure. The University of Maribor and the Medical University of Vienna will be online in autumn this year and some other universities asked for an account to test the system and may want one or more own study courses in the future. Some meetings with very concrete conceivability have already been held.

Final Remarks

High quality curricula for future medical doctors and for dentists at MUG require large amounts of resources of persons, rooms, infrastructure and money. They cannot be made available for extraordinarily large numbers of students. Our view on "numerus clausus" is a fair, transparent selection system solely based on the medical knowledge and skill of the candidate. Virtual teaching in the first half year of study is a very good way to provide large numbers of students with clearly defined and structured subject matter. They get equal chances in the following examination/selection process.

Teaching medicine cannot be fully virtualised. Our curriculum provides workshops and tutorials, early bedside experience which can only be organized for small numbers. This will start in the second semester after the selection. Virtual teaching via VMC will play an important role also in the later phases of the curriculum. VMC is support; it helps both students and lecturers to concentrate on the important activities in their time budget, namely personal communication!

Without VMC, either a random, "casino-type" selection process would eliminate many of the best candidates, or when we take everybody, the medical curriculum would nearly impossible to put into practice.

Thus virtual teaching at the beginning is the key to get the best students and to have the most excellent medical doctors in the future.

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Biographies

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Since January 2006: dedicated to the newly formed Department of VMC Graz at the Medical University of Graz in the same duties.

DI Christian Steinmann. Christian Steinmann is the managing director of HM&S IT-Consulting in Graz, Austria. His thesis at the TU-Graz in 1994 deals about the approach for efficient software process assessments and was the basis for his ongoing consulting in the area of software engineering (automotive industry & finance, mainly). He is the author of the SPiCE 1-2-1 assessment tool and he has lead several IT projects for knowledge management, balanced business scorecards, benchmarking and e-learning. Since 1997 he is also teaching computer science for automotive engineers at the University of Applied Sciences FH JOANNEUM.