Networked Learning in Applied Science Education

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Challanges in Applied science tertiary education

In addition to traditional universities, within the last 5 years a number of applied science tertiary education programs ("Fachhochschulen") have been developed in Austria. The reason for this development was to install programs which are targeted to specific industrial needs and provide shorter, more targeted education. The courses are industry-oriented, compact and integrate theoretical knowledge with practical know-how.

The didactical framework differs quite substantially from traditional university courses. The cooperation with industry accompanies the student through the whole study course. The majority of lecturers are working in industry and teach only part time. Projects in cooperation with industry, often including several subjects, are posed in a group oriented approach, starting from the very first year. The complexity and professionality of such projects increases during the study time. Also each student works at least half a year with a company. This practical work is an integrated part of the courses and followed up by the teaching staff.

Currently the FH Joanneum offers 9 study courses, all in very specialised, technologically oriented fields, such as automotive engineering, industrial design or construction planing and management.

Such an open organisational concept of studies provides many opportunities for implementing innovative strategies for networked learning. The knowledge space, in university often being a closed system, in this case becomes an open networked system, including the university, the companies of the lecturers and benefiting companies of project work. In order to profit and manage this augmented knowledge new technologies can play an important role as well as new didactical concepts can give more power to the individual learner.

The challenges for the university in this context are quite substantial. On the one hand, traditional patterns of teaching are deployed, and therefore structured learning processes need to be supported. On the other hand, now the university is also confronted with knowledge management processes, up to now only considered important in companies.

ICT processes for each of the scopes are traditionally designed differently. Whilst learning platforms are focused on the *delivery* of knowledge, knowledge management systems concentrate on the *creation* and *management* of knowledge.

The trainers at these courses are faced with several challenges The trainer has stopped to be the only know-how carrying person in the process. If the trainer wants to keep the overview of the created knowledge, s/he has to use the students as knowledge resources as well. In this way the process becomes one of cooperative knowledge construction, definitely differing from classical learning scenarios.

The Internet, providing a large number of possibilities of finding information, can support substantially such integrated concepts of learning. However also the ICT applications often support only one of the many functions needed in such a pedagogical concept. Therefore the work of the "Centre of Multimedia and Learning", being responsible for the set up of the technological support for these applied science courses, tries to take a formative and exploratory approach.

In the centre of the attention is always the learning group – that is the tutor and his specific group of students. A more detailed description of the approach and results will be given below.

Didactic constraints and possibilities

Before describing the FH JOANNEUM approach, a more detailed description of the organisation of courses is given, in order to define the didactical constraints and possibilities.

As mentioned, a large number of trainers is not permanently employed by the FH JOANNEUM, but rather working in industry and teaching on a part-time appointment. The lecturers at FH JOANNEUM are highly qualified and in many cases are working in management or decision making positions within their companies. Therefore, from their sid time is a very precious good and in the organisation of study plans, flexibility and odd times have to be accepted by the administration and students. Further, those lecturers are not involved in the day-to-day management and supervision of students. They need structured, additional information from the permanent staff, in order to be able to integrate their courses into the overall curriculum.

For the lecturers usually face-to-face contact to the students is extremely important, since they see their role not only in giving them explicit knowledge, but also their personal, tacit knowledge about how facts and methodologies connect to business or development processes. On the other hand, because of time constraints they are glad about information provision and communication support, giving them the chance to have a continuity in their relation to the students even though they are not permanently present.

Lecturers working on a full time schedule are faced with different problems. They usually have a very high teaching load (up to 7 classes in parallel) and in addition take on the load of accompanying student projects and setting up connections with customers in addition to their normal F&E duties within the university. They desire an efficient course management, guaranteeing re-usability of components as well as knowledge management and cooperative work support in order to sustain the project work.

Because of such diversified needs, also the solutions have to be tailored individually. Depending on the individual situation, a lecturer will choose a different approach for supporting his/her course. Designing solution therefore becomes a bottom-up processes, putting the individual needs of each lecturer and his/her group of learners in the centre of attention.

The Centre for Multimedia and Learning has been systematically evaluating for the last several years a variety of concepts for tele-learning and computer aided instruction for different target groups [1]. This has resulted in a didactical working hypothesis which serves as a basis for all other developmental steps at the FH JOANNEUM. These hypothesis can be summed up as follows:

Media must be applied or used in the context of the material being learned and the individual learner. The use of media in lesson is only meaningful when there is as true added value for the learner in the learning process.

Our premises are based on constructivist foundation and we differentiate between three principal kinds of support for the learning process:

- Support for knowledge acquisition
- Support for situated cognition
- Support and development of a social learning environment

The choice of media for the specific areas depends on the needs of the individual learner. From this working hypothesis automatically arise practical consequences which will be explain further with the help of several evaluation examples:

- There is no "best" medium for a specific area or learning institution. The context depends on the specific situation of the individual learner.
- The greater the variety of media available to be used the more flexible one can be concerning the individual needs of the learner.
- This means that media independent design will become increasingly more important.

- The support of lecturers in this case at the FH must be problem oriented. Other lecturers and learners have other needs.

The virtual campus

Within the FH JOANNEUM the Centre for Multimedia and Learning is running a virtual campus offering the possibility of web-based courses and supporting the lecturers in the use of this medium. Beyond the technical equipment, services like continous backups of files, a hotline in the case of problems, the Centre for Multimedia and Learning provides know-how about the skills to develop web-based courses ranging from simple html pages to webdesign, treatments, storyboarding.

The virtual campus is located on an apache webserver under linux, providing

- webspaces (eventually password protected)
- mailing lists
- the tele-learning platform WebCT.

The webspaces are used to present dynamic information of the various study courses including homepages of projects, information for students and so on. Presently five of the 9 study courses of the FH JOANNEUM are using these services.

Another part of the webspaces serves the presentation of current international projects. They contain information about the project, the possibility to present the current state of the project and a password protected part for the communication within the project. Mailing lists are an important service for the communication in a project, often the whole transfer of data is managed by a mailing list.

The most important service for teaching is the tele-learning platform WebCT, a web-based, network learning environment. The platform offers instructors and students the possibility to access and create content in a easy way and to make interactive web-based learning experiences. WebCT provides flexible delivery of educational material and enables communication, interaction and collaboration between students and instructors.

The platform includes the above described service of webspaces and offers a lot of additional services. One of them is the construction of learning paths, providing a structure to the learning material. The instructor can upload all documents of the lessons into the platform and afterwards try to build one ore several presentations (learning paths) of his material, e.g. an overview of the lesson, a learning path for beginners and another learning path for advanced students.

Within the course the communication tools are used to establish contact between students and between students and tutor. The simplest service is the email forum, in addition there is the possibility to configure a chat with several rooms. In the bulletin board students and lecturers have the possibility to post news and material.

There are several types of quizzes, ranging from selftests to multiple choice. A glossary contains keywords of the presented educational material.

The instructors are the designers of the courses and have to become acquainted with the WebCT features. The Centre of Multimedia and Learning offers workshops and seminars concerning multimedia in teaching, didactic concepts and a introduction to WebCT. As a result of the seminar the trainers should be able to use the different tools nearly without further help because the tools are relatively simple and always to handle in the same way. The student management and the tracking of their learning efforts can also be accessed easily by the trainer.

Another challange to the trainers is the new way of communication with the students as opposed to the traditional patterns of the face-to-face instruction. They will only meet the students from time to time (depending on the agreement between instructor and students), additionally there is the permanent possibility to contact the trainer via email. On the one

hand this signifies less direct presence of the instructor, but on the other hand the trainer can be contacted in a simpler and easier way.

Evaluation results

In the following, some practical evaluation results are described, which have been carried out on lectures within the FH JOANNEUM in the years 1998 - 1999.

In the winter semester 1998/99 a lecture series "Information Science" was held in the framework of the information management studies. As part of the lecture the learning platform WebCT was set up to fulfil several functions:

It enabled the lecturers to store the learning materials for the respective lecture which the students could then download and work through before or after. Groups were formed and given specific tasks for the following lectures. In the bulletin board comparable to a blackboard or a newsgroup the students and lecturers had the possibility to post news and material. Furthermore communication outside the lessons between the students and lecturers was supported within the platform as well as through individually chosen mail programs (i.e. Outlook, Netscape). No paper script was produced or distributed.

Basically the students were convinced by the usefulness and necessity of new technologies at the FH Joanneum in their studies. 97% voted for an intensive mandatory use and 3% on a voluntary basis. The students saw the greatest advantage of the internet in data acquisition which the following quotes support: "The internet is an almost inexhaustible source of information .....large variety of information ....students have fast access to current information ....makes the lecture more relevant". The availability of the learning materials via WebCT was viewed favourably by four fifths of the students asked.

In contrast, disadvantages named were technical problems and difficulty with the overview of stored materials. One aspect of online communication however received quite the opposite evaluation. The reaction to the point WebCT is ideal for communication with the project group can be summed up as follows. The majority of the respondents (81%) evaluated communication via Web CT as unusable and never used it, 6% found it well suited, but not user friendly and a further 4% responded it had promoted their participation in the course. One explanation of the high disapproval for Web CT bulletin boards may be that the students are in constant personal contact and therefore spontaneous communication via electronic media is indeed superfluous.

Further WBI-oriented lectures were "System theory", "Estimation of results of technologies" and "Ecological technology". The complete teaching material was updated to an internet standard by "classical" information-carriers (paper and word processing, Word) and was made accessible via WebCT. Written paper-scripts did not exist. Students could work through the scripts either before or after. An extract of the online script was worked through during the lecture. Groups were formed and individual seminar assignments which were administrated and delivered online, were given to the students. During the design of the course presentational Design ("Webdesign") was of minor importance since only the lecturer was responsible for the production and conversion of the classical material.

Additionally, he had to become acquainted with the WebCT features which allowed him to innovate by giving tests followed by an immediate evaluation.

In the lectures as well, the Web as principal instructional method was positively approved, with over 80% of the students finding it very good or good and only 5% „unusable" or „unnecessary".

However, nearly half of the students wanted a paper script which they could use to follow and make notes in. Also, approximately one third of the students criticised the design of the Web lecture with regards to scope, structure and design as needing improvement. At the same time a significant number of students said they were distracted during the lecture by surfing or mailing.

We therefore conclude that the simultaneous processing of learning material through an open learning system during the lecture is not productive and recommend rather that the lecture material be placed online for preparation or repetition. The lecture itself should be held in „classical" fashion, working interactively with the students by discussing and presenting the prepared material. There was practically no spontaneous communication in the lectures; in contrast, the Bulletin Boards became the main support of stimulated communication with regards to the presentation and documentation of the project tasks.

During winter semester 1999/2000 the learning platform was used in the lecture "Industrial Management I". The original material, a paper-script, was automatically converted in html and integrated into the platform. Additional informations such as scanned graphics were added. The students splitted into several groups had to work through the material before the lecture, prepare summaries and solve tasks relevant for the understanding of the material. A lecture was held every two weeks that allowed the students as well as the instructor to discuss the results and solve occurring problems. The students could communicate via email with the instructor, discuss open questions within their group under supervision of the instructor and enter the chat to meet their colleagues.

The students response to the ICT was high (86%). They liked the greater flexibility in their timetable and the control over their own learning. The mixture of virtual and real lecture was positively approved. The students got along well with and had no problems finding and downloading materials. However some of the students took a printed version of all topics of the lecture at the beginning in the semester and never entered the learning platform again. Altogether they evaluated the possibilities of online communication critically, there were positive (44%) and negative (49%) reactions. The chat wasn't used frequently because there was a relatively high personal contact of the students caused by the attention of the other lectures.

The reports on seminars show how the students appreciate and like the media WBI. On the other hand however, they show a strong preference for paper-versions, i.e. paper-scripts. We assume that the importance of complete scripts will decline due to online courses as well as to an enormous increase in WBI design.

The target group of teachers interested in WBI shows remarkable features: They are familiar with internet, they are fond of experimenting, they are very disciplined when dealing with resources, they aim at new efficiency or better learning results in the courses and they wish to increase the contact and communication with the learners. Some trainers already developed precise concepts how to adopt the new media in their teaching whereas others are beginners and in this respect learners and investigators of the new possibilities presented by the internet, as well as the use of multimedia products. For the advanced group the service of providing a functional platform or webspace is sufficient. The group of beginners/learners needs an intensive coaching to develop the necessary skills for a productive use of the new media. Our experience demonstrates that one needs to begin with simple tasks, step by step, in a bottom-up process. Working on the lecture (maybe only converting a paper-script and uploading it in the telelearning platform) and using the platform with the students can cause a lot of new ideas which can be realised in the next course.

The virtual campus of the FH JOANNEUM expands rapidly. The number of teachers interested to use the possibilities of WBI increases constantly. In the process of supporting the instructors and developing new modules for the train-the-trainer program the team of the Centre of Multimedia and Learning gets more efficient and experienced. What is worth to emphasise is the intrinsic factor of democratic relationship between trainers, students and the supporting team in the field of networked learning. All the three groups involved in this process are learning and profiting from each other.

In order to support asynchronous learning and to minimise the learners' need for having a printed version we will focus on the development of an adequate Web-design of the teaching materials.

Apart from the support of the above-mentioned courses, in near future, FH JOANNEUM expects to offer "dual courses2, where students are permanently employed at a company, but change every three months between courses at the university and practical work at the company . This approach requires an even closer integration between learning context and work-space. Setting up support systems for such courses will benefit heavily from the experiences drawn from the last years at the courses and provide a challange in integrating structured learning with knowledge management systems.

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