2006-847: LECTURE HALL VS. ONLINE TEACHING – A CONTRADICTION?

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Abstract

Can we give a lecture to resident students and offer it in the same term as online-lecture via internet to all German speaking structural engineering students? This was our project during summer term 2005.

The subject of the lecture was a very special area of steel construction currently taught only at Darmstadt University of Technology: the production process - from planning to erection - of steel structures. The use of recordings and various add-ons enabled us to fulfill this task.

The whole course was embedded in an evaluation scheme to measure the acceptance and effectiveness and to find technical and procedural problems.

Introduction

The course that was offered covered the production process of steel structures: the industrialized system of manufacturing structures from steel plates and beam or column profiles and erecting these structures. The design, financial, and legal aspects were included. This course is unique in Germany where usually the education in this area is focused on concrete technology. This is an on-site technology that is governed by parameters that differ strongly from industrialized production processes as they are used in steel manufacturing.

With a decreasing number of civil engineering students and therefore of teaching staff in this field it becomes difficult to offer the wide variety of topics at all universities. Besides the standard courses only the subjects that are within the research focus of the staff are taught. With a decreasing number of staff members some interesting subjects might be missed. Via e-learning within teaching networks this problem can be reduced because students can draw knowledge from other schools where highly specialized courses are offered. In addition this improves the possibilities for practicing engineers in life long learning.

For a number of years lecturers and professors from other universities were interested in offering this course to their students. Due to the development of Darmstadt University of Technology (TUD) to a Dual Mode university [1] (figure 1) it was possible to test this kind of cooperation. The Dual Mode TUD combines traditional (face-to-face) teaching with e-teaching and e-learning. It enables students to learn at the familiar location (lecture hall, classroom, etc.) as well as independent of time and place. Dual Mode introduces significant technological and didactic changes, and beyond that developments of the organization. Dual Mode TUD intends that – after an initial developmental phase – questions related to technology and didactics are no longer the primary focus. The Dual Mode TUD could then expect that its teaching staff and students are prepared for e-teaching and e-learning as well as for traditional teaching and learning. In the area of telemedia learning, materials currently available for self-learning and for discursive learning independent of time and place are being enhanced.

The target of Dual Mode TUD is that all students, irrespective of their specializations, will attend at least one e-learning course during their studies and thus obtain the skills required for lifelong learning. The e-learning courses will reach the high quality standards of TUD. The

entire technological infrastructure required for both forms of learning will be available in an appropriate form anytime and anywhere, and in addition the corresponding know-how for its use will be widespread among teachers and students.

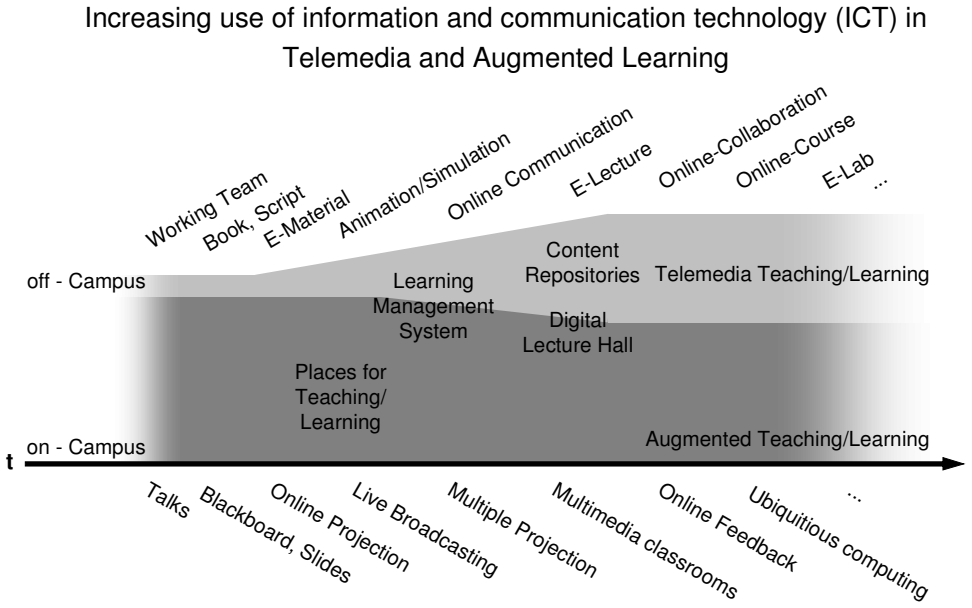

Figure 1: Dual Mode TUD

For our project we used a learning management system (LMS) that is available in the whole university and a recording set containing camera, microphone, and the software that is necessary to combine their information with the PowerPoint® presentation of the lecturer. An internet based text book (eMargo [2]) which allows the reader to make annotations that might be visible for the lecturer was also available.

Using this scheme more than 60 students from seven universities were attracted. 37 of them finished the course. 21 external and six residential students took the final examination.

Soft- and Hardware

The recordings were made using the software Lecturnity of IMC, Saarbrücken, Germany. This is a system that allows recording, processing, and presenting recordings of lectures.

Before the lecture starts the PowerPoint presentation has to be imported. It will be available with nearly all its features. The user interface of Lecturnity gives some additional tools for marking, writing, and sketching. This enables the lecturer to highlight important items, to add information, and even to produce new slides. A touch-screen is needed for this. All annotations and sketches are recorded together with the video and audio data of the lecturer on the computer used for the presentation. The whole presentation kit is shown in figure 2.

After the lecture has ended the recording can be processed using cut and paste tools. Material previously recorded might be inserted.

To record the voice of the lecturer a headset or a clip-on-microphone might be used. This enables the lecturer to walk around freely which might cause problems with regard to the video. He might leave the area that is covered by the camera.

A cameraperson can help to avoid this. It helps to improve the acceptance because a cameraperson can not only follow the lecturer but also change the focus from a close up to a long shot, depending on the subject, which will make the recording livelier.

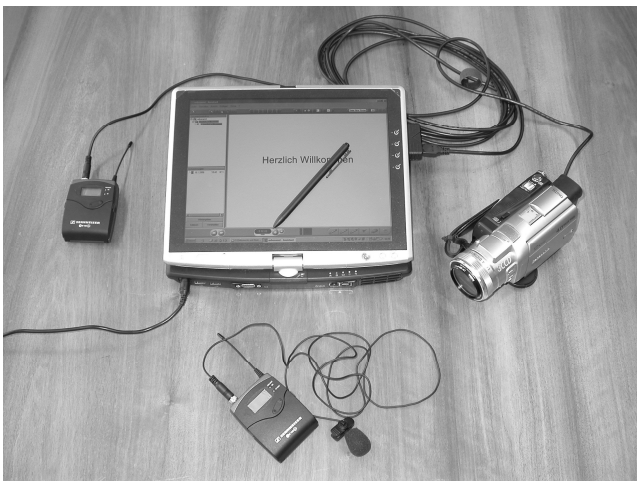

Figure 2: Presentation kit

The merger of slides, voice, and view of the lecturer is made by the software. This file is stored on the computer. The system used was stable. No loss of data occurred.

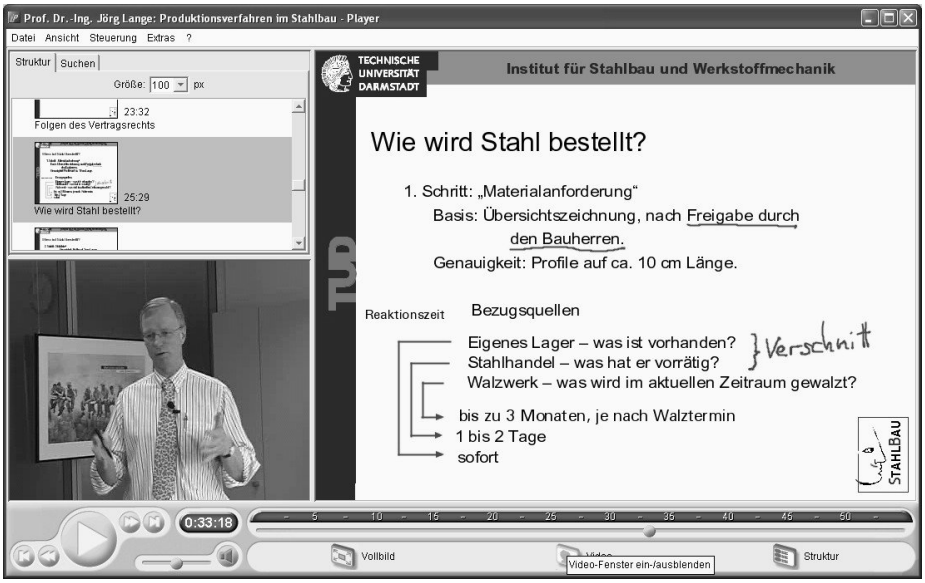

Figure 3: Lecturnity player (screen shot including annotations)

The final product is a file containing the whole lecture with video of the lecturer, slides, and annotations. This can be presented using the proprietary player of Lecturnity (figure 3), which is currently only available for Windows®. For other platforms an html-file with

embedded video in Real® format may be produced. A timeline and an overview of all slides (with a scroll bar) allow the navigation through the file and the repetition of single slides. A full-text search over all slides is available.

The distribution to all participants was carried out using the Learning-Management System (LMS) of Darmstadt University of Technology, which is Clix of IMC, Saarbrücken, Germany. This LMS is not only a system for the storage and delivery of content but also offers a number of communication tools such as chat-rooms and forums. These were used to give the non-resident students an occasion to communicate with the lecturer and with their classmates. They replaced the face-to-face-consultation hours that were not available for them. The placement of questions via email was also allowed but discussion in forums was preferred.

Challenges

The enlargement of the lecture with a distance-learning-section offered numerous challenges. The large amount of data that was produced by the video had to be handled. Also the out-of-class service had to be rearranged.

A great challenge was the distribution of the recordings. The files had a size of 450 to 550 MB and were produced once a week. Many participants were not able to draw these files from our server to their home computer due to insufficient capacity of their connection. We therefore reduced the quality of the video leading to a size of 70 to 140 MB. A reduction to voice-only-files led to a size of 30 to 50 MB. Former research showed that the video increases the rate of acceptance and the motivation of the participants significantly [3]. Therefore we decided to so send a CD via surface mail to those students who had no access to a powerful internet connection.

The forum proofed to be the first-choice medium for consultations. Questions and answers are stored and available throughout the lecture period and therefore it is also a medium for FAQs. Students were informed that on a certain date (Thursday afternoon) the lecturer was reading the forum and during these hours a chat-like discussion of problems was possible. The persistent quality of the forum made it superior to a chat in our case. Additionally, organizational matters take much more time in a chat-room compared to a forum [4]. Unfortunately the students did use the forum mainly for matters concerning the technical support. Only few questions related to the topic of the lecture were raised. The final evaluation had to give reasons for this.

The freedom and advantages that are given to the students from recordings are contradicted by a certain anxiety of the lecturer. The recording preserves and presents every slip of the tongue, every repetition, all “hms” and “ohs”. This might lead to perfectionism that might slow down thinking and acting. A light improvement might be achieved with the use of a clip-on-microphone which is felt not as much as a headset (figure 4). Familiarity with all technical devices is also important and positive. The lecturer must feel comfortable; he has to know all features very well. After a while he might concentrate so much on his subject that he forgets that the camera is running.

An inspiring lecture will lead to questions and discussions. A clip-on-microphone proves to be disadvantageous in these cases. The questions have to be repeated by the lecturer before he answers to make them available to the students who are participating via computer. But also

students tend to feel restricted by the camera. As soon as it stops they ask many more questions as they do while it is running.

Fig.4: Headset vs. clip-on-microphone

To compare the situation for students and lecturer some sessions were recorded without audience. This made it easier to repeat lecture parts that seemed faulty but it led to a barrenness that reduced the acceptance. The direct, non-verbal feedback from students with regard to speed, style, difficulty, and amount of information was lacking.

The course of lectures was closed with an examination. We preferred a written test to an online-examination due to these reasons:

- This kind of examination is well known to students.
- There are no problems with regard to the identification of the student and with correlating the result to the student.
- No network- or software failure may obstruct the examination.
- Writing formulae or making sketches is much easier for the students.

The examination was conducted at the home-university with supervision of a local lecturer. We had to offer two examination dates due to different examination periods at the schools that took part in the project. At these dates the tests were performed within the same time period.

There were no observed differences in the results with regard to the residential compared to the external students. The grades were evenly distributed over all schools. Therefore we conclude that no difference between the two ways of teaching exists.

Some Results of the Evaluation

The lecture was embedded in an evaluation scheme. It included an entrance- and an exit poll using a questionnaire. Most answers had to be given by writing text, not by multiple-choice, to avoid leading the students in a certain direction. We started with a survey covering the personal prerequisites of the participants to get a general idea of them and assess avoidable problems. The second poll was retrospective. It was taken after the examination. The students who did not participate in the final test received a different questionnaire. The questions covered the lecture theme, the software, and the use of the forum. 30% of the students who broke off and 54% of the student who finished returned the second questionnaire.

The entrance poll showed that 88% of all participants had no experience at all with e-learning. Most of them were not convinced that e-learning is a reasonable alternative to classic face-to-face teaching. 66% mentioned that they are good to very good in self-motivation and 51% classified them self as concentrated learners. 75% pointed out that they have no problems to obtain learning material needed to close knowledge gaps independent. 39% saw a lack in their time-management and 55% in the self-depended control of their learning outcome.

The comments given hereafter were stated by the students who finished the course.

Students mentioned that it was a great advantage to use the recordings due to the independence from time schedules and lecture hall. The external students had to fit our lecture into their schedule and with different lecture hours at each school it was very important to have this freedom. But even our own students used this to improve the flexibility of their schedule. 52% of the students studied the recordings at home, 22% used the PC-lab of the university and 26% used various other places. 67% used the recordings to repeat certain parts of the lecture to improve their understanding of difficult items. The recordings were used for the preparation of the examination too. One student mentioned that this was a reason for him not to use the forum. He had the possibility to re-listen to the lecture until he understood what was meant.

The freedom of the time schedule was seen very positive by 67% of the participants. This result contradicts the results gained in a project we conducted in 2004 [5]. In this project that was aimed at third-year-students the freedom in the schedule led to the negligence of the e-learning elements. One reason might be, that third-year-students have to study in a very tight time schedule, comparable to secondary school, whereas our new project aimed at students in their last year with more flexibility in their curriculum. This teaching method encourages senior students to arrange their tasks to meet their individual schedule limitations. But even at this stage students have problems to manage their tasks: 19% wrote that they had difficulties resulting from the freedom in time and place.

In contrast to the many advantages that were seen, 39% wrote that they missed the personal contact to the lecturer. The possibility to ask questions in the moment they arise, the discussion with the lecturer, the whole area of verbal and non-verbal communication is severely reduced. To write the questions and post them to the forum, where they are available for all peers was a severe disadvantage for 24% of the participants.

The motivation of the participants was manifold. It started with a simple interest to gain credit points for their diploma (38%). 71% of the students were very interested in the subject itself, and 58% were mainly interested in the new form of teaching and learning. (This question allowed multiple answers.)

The software that was used was rated positive. After a short period of getting familiarized it did not lead to any problems. An important problem that was mentioned earlier was the insufficient capacity of the internet-connection of some participants. We solved it by offering a reduced quality video for download and by sending some recordings by surface mail. 50% of the students loaded the recordings form the internet; the other 50% received a CD.

The communication tools were not used as much as we expected. Some technical questions were raised at the beginning by email and in the forum. Only a very small amount of

questions concerning the lectures was written in the forum. Within a short period before the examination some questions were asked by email.

In the evaluation we tried to find the reasons for this. 24% of the students wrote that it was difficult for them to express their questions in written form. This might be due to the lack of the ability to express a technical question in a written form or due to an anxiety to show the lack of knowledge to the whole community. They preferred to look at the lecture another time and to read the lecture notes. 39% mentioned that the lecture was so understandable that they had no further questions. This might be seen with the possibility to re-view the lecture as often as necessary.

Many students started to prepare for the examination within a short period before the test (Fig. 5). They may have been afraid not to get an answer on time or to show that they started to work on the subject very late. A positive view might state that the lecture notes together with the recordings covered the subject well enough.

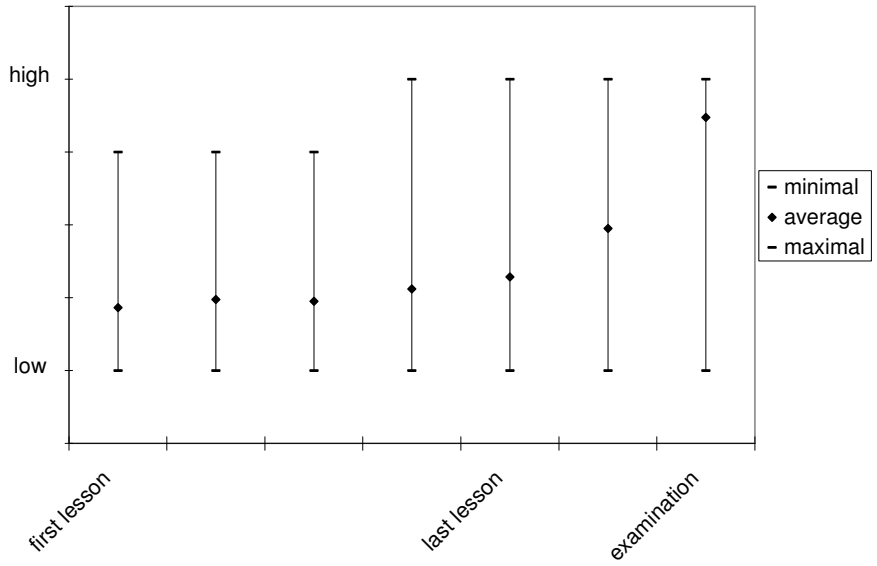

Fig.5: Learning-intensity during the term

The overall impression of the participants was very positive. Especially the group of external students stated the positive effect of making lectures available to students who otherwise would have no possibility to learn anything about the subject offered. On a scale form 1 (very good) to 6 (very bad) the course was rated 2.2.

A great challenge is to motivate the students to hand in their voluntary exercises. The rate of return from the external students was very small. Due to the different examination regulations of the schools involved it was not possible to ask for compulsory exercises. New ways of activating the students have to be found.

Unfortunately a large number of students dropped out. 65 students enrolled. 37 wrote that they followed the whole course but only 27 took the final examination. We developed a questionnaire for the persons who did not take part at the tests to learn about the reasons they had. None of them expressed the modus of the lecture or the chosen software as being their

motive. Other external causes were given. The drop-out-rate was very large for two schools. This leads us to the speculation that peer-group behavior or interference with other lectures was the drop-out-reason.

Summary and Perspective

Aim of the project was to open a lecture to a large number of external, non-residential students. This was done by the use of recordings that were distributed over a learning-management-system. Further items were an internet-based forum and lecture notes.

The results of the examination and the positive evaluation show that the online lectures were a good way to reach this goal with small effort. The external students had no problems getting to the recordings and the recordings were an additional positive feature for the residential students.

The recording of the lecture leads to better results than the preparation of the lecture in a studio without audience. Lecturers have to overcome their anxieties and see the advantages of a live performance.

In the upcoming year we have to find ways to motivate students to ask questions while the camera is recording and to present their questions via internet-forum to the community. Until then we hope that the students attend more lectures that are recorded. They might become familiar with it and might behave as in usual lectures.

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