

Remote Teaching in Design Education

Educational and Organizational Issues and Experiences

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The Department of Real Estate and Project Management (BMVB) of the Faculty of Architecture at the Delft University of Technology has been working closely with Professor Spiro N. Pollalis of Harvard University, Graduate School of Design in Cambridge, USA since 1991. His case-based interactive seminars about the management of the design & construction process have been highly appreciated by many generations of students. In Spring 2000, Pollalis suggested to extend the scope of his involvement by introducing a remote teaching component, the subject of his research in the last few years. As Information and Communication Technology (ICT) in the Design and Construction Industry is part of his lectures, it was appropriate to provide the students with a first hand experience on the subject. In the following experiment, the teacher would remain in his office at Harvard while the interactive work and discussion sessions with 130 students in a full lecture room would take place in Delft as planned. The consequences this experiment has had for the course, for the techniques and facilities used, how teachers and students experienced these, and which conclusions and recommendations can be made, are the topics of this paper.

Keywords: *Remote Teaching, Design & Construction Education, and ICT.*

Introduction

University education is changing fast. Influenced by the many possibilities offered by information and communication technology (ICT), traditional ways of giving lectures and passing on knowledge are enhanced by new options. In many places in the Netherlands, experiments are taking place to make an increasing use of new means of communication in education. The key question addressed in this research is how to use the Internet to improve the learning process. Among other aspects, this has to do with the possibilities for making educational resources available to students, for searching for information, and for improving communication between teacher and students and among students.

Case Studies

Professor Pollalis's case studies constitute an important element of the M2 educational program, and they cover the following two topics: Management of the Design & Construction Process and ICT in Design & Construction.

Pollalis, professor at the Harvard Design School, specializes in the application of ICT to the design and construction process. Among other things, he conducts research into new value propositions in the value chain, the application of databases that supply information about architecture and construction methods, and the merging of the physical and information space. He has developed a process for teaching management and technology to design students that has been used as part of his courses at

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Harvard as well as the M2 course in Delft since 1991. This process is based on case studies and the Socratic method and recently uses the Internet to provide an intensive communication between the teacher and the students.

ICT in Design and Construction

In the last weeks of module M2, the theme 'Information Technology in Design and Construction' is introduced. Learning from other industries that have preceded the building industry in further automating their processes, this part focuses on the use of information technology by pioneering design firms, on recent uses of computer-aided manufacturing techniques, on the use of extranets for process coordination, and on knowledge management systems. The main objective is to evaluate from a strategic and competitive advantage perspective the new value propositions for the real estate, design and construction and less on introducing advanced computer tools for managing the process.

Communication

Communication before and especially during module M2 among the students themselves and with the teachers takes place largely via the Internet. The e-mail address of each student is available to others. In addition, the module also has its own Internet site on which all relevant data, such as the timetable, the reading material, literature overviews and the contact addresses of the teachers involved are brought up-to-date every day. In addition, all the students' questions and any remarks about the course before, during and after the module can be e-mailed to the teachers. The students' grading is posted daily, reflecting their class participation, as well as their submitted homework. The immediate communication allows for an intensive interaction and feedback.

A new case every day

The program is the same every day, for three or four weeks. At the end of each morning, the teacher introduces a new case and a number of crucial questions that have to be answered. These include

questions such as who are the most important party in this project, how was the team put together, what were the biggest problems encountered, how could they best be solved, and what role did computers play in this project. After that, the students start to work on these questions in groups and deliver their work by e-mail as PowerPoint presentations by the end of the day, so that they can be discussed the following morning in class. The cases have to do with large, complex and trend-setting building projects that have involved many different disciplines.

Remote Teaching

The previous sub-section described case-study education as it has developed in the M2 course module in recent years. This was also the situation in the first two weeks of January 2000 — the professor involved was physically present in Delft. How, then, has Remote Teaching changed the course?

Prior research for web-based learning

The research on web-based learning was initiated in 1996 by Pollalis in an effort to improve the effectiveness of his teaching and constitutes a direct extension of teaching innovations that he had employed in the past. The objectives were:

- To bring to the classroom highly qualified people, both on the teacher and the student sides, who otherwise would not be possible to be part of the class.
- To improve the quality time in the classroom with interactive sessions and encapsulate the "content delivery" part of the lectures in the virtual space, in addition to live lectures.

Experiment

The framework of this research is presented in a 2x2 grid that distinguishes between on-campus learning (the teacher can be in the classroom) versus distance learning, as well as between asynchronous and synchronous tools.

With experience in fully-implemented web-based learning for on-campus instruction at Harvard, using sophisticated asynchronous and synchronous tools,

the objective in the M2 course was to study the effectiveness of synchronous video-audio tools for distance learning. The asynchronous tools (course website, posting of content, posting of encrypted grades for immediate feedback, electronic submittal of homework, etc) had been fully implemented in the M2 in the Spring of 1999.

As with any scientific experiment, this experiment should measure only one variable. So, the design of the remote teaching experiment was set in such a way to keep everything else the same and only move the teacher a few thousand miles away. Furthermore, the teacher had contacted two weeks of live interactive sessions with the same group of students and the students were familiar with his approaches and his teaching method. So, the only variable was the location of the main teacher and the experiment focused on the lower right quadrant of the 2x2 grid (figure 1).

Differences

In the first place, due to the 6-hour time difference between Delft and Boston, another time schedule had to be operated. Instead of beginning as usual at 8.45 am the plenary gatherings in the lecture hall began at 1 PM.

Compared with a normal course, many more technical facilities were present, such as: two

computers for the students' PowerPoint presentations and the Remote White Board from Harvard, two powerful computer projectors for projecting the presentations and the video images of the remote teacher and the lecture hall in Delft, 50 microphones distributed on the student desks for use during the discussions, loose hand-microphones for the coordinators in Delft, a number of technical control panels and a monitor, two cameras, one at the front and one at the back of the lecture hall, a small Web Cam focused on the projection wall for feedback to the remote teacher.

Two technical assistants were responsible for the Audio and Video connection between Delft and Harvard. One student assistant was responsible for synchronizing the speed of the PowerPoint presentations in both Delft and Harvard. Another assistant acted as a camera operator and thereby, as became apparent afterwards, played an important role in guiding the discussions.

In order to ensure that the general discussions about the group presentations and the subsequent debates on them proceeded as smoothly as possible, prior to the experiment, a procedure consisting of the rules was agreed with everyone concerned. All 130 students, individually and per group, were given, in advance, a fixed place in the lecture hall. All members of a group were asked to sit next to each other. Each group was numbered with a number sign and all students were given a name label (figure 2).

Figure 1. The 2x2 grid that distinguishes between on-campus learning versus distance learning. The experiment was located on the lower right quadrant

	Asynchronous Web-based	Synchronous Video-audio
University (class meetings)	Posting of content webboard, etc.	Office-hours Guest lectures
Distance Learning (without class meetings)	Webboards taped lectures	Remote interactive sessions



Figure 2. The remote teacher (left); attentive students with fixed places and name labels (right)



Figure 3. More facilities, such as camera's (left), microphones and control panels (right)

Course Evaluation

In the experiment Remote Teaching, the same program was carried out as usual, but then 'at a distance'. Thus, the way of working was exactly the same, the only difference being that the main professor involved was not physically present. After an introductory lecture, which gave the students the chance to get used to the new techniques, the week with the cases proved to be really successful, both technically and didactically. The evaluation of the experiment is based on the reaction of the teachers, assistants and students by a written questionnaire.

All the teachers involved were very positive about the experiment. The techniques used ensured that students felt confident with both the way of working and the environment. However, it was realized that this teaching method is hardly possible unless the remote teacher has been physically present at an earlier date. This enables the teacher to get to know a particular group of students, and vice versa. The students, for their part, have the opportunity to become familiar with the professor's specific way of working.

The teachers also felt that the technology was quite transparent and the students could focus on content, a real achievement given the presence of technology in the auditorium. Furthermore, the teachers observed that the interaction between the students and the remote teacher was improving dramatically every day. Everybody felt that if another week would be devoted to Remote Teaching, there would be "business as usual."

The teachers alert the students to the fact that, compared with the normal way of giving the course, remote teaching brings with it a number of additional moments of learning, such as working with new communication technologies, taking part in the PowerPoint presentations and speaking and presenting in public in English, with the help of microphones. For good and efficient progress, it is vital that the part of the course during which the teacher concerned is present in person should precede the remote teaching. The use of microphones during the presentations and debates in the lecture hall went so well that it will become standard practice to use them in both the normal course situation and

in Remote Teaching in future. The electronic Remote Whiteboard, used as a replacement for the traditional blackboard, on which the teacher makes notes during the discussions, offers even more possibilities. For example, the Whiteboard can be used in parallel fashion, next to the presentations and the Web Cam (fig 3).

The role of the cameraman during the discussions turned out to be more important than had been expected beforehand. When a number of students put their hands up to take part in the discussion, the cameraman zooms in on one of them. After that, the student concerned is free to speak. In concentrating on this activity, the cameraman often did not see the other raised hands. There was, therefore, too great a responsibility on the cameraman to facilitate the discussion.

The majority of students thought that in spite of the new technical facilities used, they could nevertheless concentrate well on the content of the material, the cases, and the questions. A great majority of the students was very enthusiastic about the quality of the video and audio of the remote teacher. The students also considered it very important that Pollalis should be physically present. An ideal course scheme therefore would be one in which the first two weeks have physical presence, followed by one week remote and finally, to round the course off, one week of physical presence again.

Conclusions and Recommendations

The most important conclusions and recommendations are listed here in response to the Remote Teaching experiment. The following options should be considered when adapting ICT to higher education. In the first place, one can put the Internet to good use for education by making information available. This can be in the form of general information on training (courses or teachers), practical information (module books, timetables, or consultation times) and administrative facts (knowledge and skills assessment). Internet can also be used as a distribution channel for study material (syllabi, readers,

presentations and video recordings of lectures). In the second place, the Internet can be used to search for information, such as, for example, project courses or theses. In working through the case assignments, for example, other Internet users can also be called in to help. Thirdly, Internet and e-mail can be used in the communication between teachers and students. In this area, three educationally interesting applications can be identified: Computer (video) conferencing (communicating electronically), Homework (receiving back and assessing) and Group-work (exchange information with each other and supervisors). All three of the applications came to the fore during the Delft experiment.

The relation between teacher and students with Remote Teaching

Good progress with Remote Teaching on a classroom scale depends entirely on how familiar the teacher is with the students, and vice versa. That applies to the teacher's manner of working, the fixed daily program, the assignments that have to be carried out, the way of presenting and the method of assessing. The physical presence of the teacher responsible in a period prior to the Remote Teaching is a necessity.

The students experience the physical absence of a teacher, who can react immediately and quickly to what takes place in the hall, as a great deprivation. Nevertheless, when the situation calls for it, Remote Teaching is seen as an excellent alternative for making use of the knowledge and expertise of an external teacher. In spite of the new communication techniques, the interactive meeting - an absolutely essential component of the course - was, in essence, not affected. Addressing the students personally by the remote teacher increased the students' participation and decreased the physical difference with the live teacher. Also this is only possible when the teacher has worked with the students at an earlier date and when each student and group has a fixed place in the hall. The availability of a ground plan of the hall with the names and photographs of the students is essential.

Risks

There is an absolute dependency on technology for the Remote Teaching. During these sessions, back-up teaching systems to replace techniques that break down are virtually non-existent. If the video connection fails, one can indeed still go further with the sound links, but if the teaching method is an interactive one, then this is far from ideal. If the sound connection fails, then Remote Teaching stops immediately.

It is of utmost importance that it is realized beforehand how critical the technology is, how vulnerable the audio, video, monitoring, presentations, computers and connections are of the systems involved: Look at the weakest link, replace them by better, more reliable, apparatus and ensure that there are back-up systems where possible. That also applies to connections, projectors, cameras, web cams, computers and microphones (including the necessary batteries!). In the unlikely event of one of the many necessary communication lines (in this case ISDN or IP) becoming blocked or going down, then it is sensible to break the connection immediately and to phone in again for a new connection.

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