CASE STUDY: HOW TO IMPLEMENT CALCULATION EXERCISES IN A VIRTUAL COURSE?

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ABSTRACT
Until recently, calculation exercises were conducted in a conventional way in class rooms. Nowadays the development in information technology has created opportunities for new forms of education. For example in a virtual course called “Environmental Issues of Electric and Electronics Industry” the calculation exercises are included in web-material. To improve the quality of teaching, it was studied how, in the students’ opinion, the calculation exercises should be implemented in this particular virtual course. The aim of this paper is to present the results of the study and to examine if the opinions differ because of the season. Opinions were measured with a specific questionnaire form. According to the feedback received, results from the summer course and from the autumn course had some small differences but in both cases the use of videos wasn’t encouraged. On the whole, calculation exercises included in web-material were found to be a useful way to learn.

KEYWORDS
Virtual course, Calculation Exercises, Teaching.

1. INTRODUCTION

The quality of teaching has been a popular topic of public discussion for several years now. To meet the growing demand for more efficient learning methods a number of programs have been established in many countries. For example the use of computer assisted education has become more common during recent years. The World Wide Web has made it possible to distribute educational material efficiently. However at the same time it might have reduced the possibility to get personalized teaching and added to the students’ responsibility.

Tampere University of Technology has been involved in a national project financed by the Ministry of Education in Finland (TUT 2004). The aim of this project is to create competitive education services of high quality in the information network. One of the results of this project was the creation of virtual course “Environmental Issues of Electric and Electronics Industry” (Laitinen 2002). The creator of the course was the Laboratory of Electrical Engineering and Health (LEEH) which has also been involved in developing web-based calculation tasks (Korpinnen 2002).

The virtual course is taught during both the summer and autumn term. Part of the course consists of calculation exercises, which are included in virtual lectures. To improve the quality of teaching, it was studied if the students preferred some other way to learn the calculation exercises. The aim of this paper is to study and present students’ opinions on how the calculation exercises should be implemented in this particular course and whether the order of preference changes due to the season. To accomplish this, students who participated in the course in summer 2003 and autumn 2003 were asked to fill in a specific questionnaire form. In this form students were asked for example if they thought that studying calculation exercises independently was suitable for them. In total 96 students answered the questionnaire. The results of this questionnaire are presented in chapter four and are discussed in chapter five.
2. DESCRIPTION OF THE VIRTUAL COURSE

The course “Environmental Issues of Electric and Electronics Industry” is aimed at second year students in Environmental and Energy Technology and in the Department of Electrical Engineering. The development of the virtual course was started in spring 2001 and the virtual course has now been implemented four times twice as a summer course and twice in the autumn term. The course includes lectures in WWW, calculation exercises and a final exam. As a part of the virtual course requirements, the student also wrote a term paper on given subject. In autumn, students did a virtual laboratory exercise instead of a term paper.

Calculation tasks are included in appropriate lectures. First, calculation models are introduced in the lecture text. Below a model is a link to self-study calculation exercises. The calculations exploit the idea of constructivity so that the program gradually produces links to tips and finally to the solutions.

3. QUESTIONNAIRE FORM

After the final exam, students who participated in the course “Environmental Issues of Electric and Electronics industry” in summer 2003 and autumn 2003 were asked to give their opinion about the calculation exercises by filling in a specific questionnaire. In total 96 students answered the questionnaire, of which 51 were from the summer course and 45 from the autumn.

The questionnaire form included three parts. In part one students were asked to evaluate the following three propositions: 1) The difficulty level of the calculation exercises was suitable. 2) The calculation exercises were suitable for this course. 3) Studying calculation exercises independently was suitable for me.

The students had five response alternatives: totally disagree, mostly disagree, maybe, mostly agree, totally agree.

In the second part students were asked about the preferred way of learning the calculation exercises. Seven choices were given, as well as some free space if there were other preferred learning methods besides the ones given. The given choices were: 1) The teacher presents calculation exercises in the class-room, students don’t need to do the exercises in advance. 2) Students do the calculation exercises in advance and present those under a teacher’s guidance in the class-room. 3) Calculation exercises are solved in small study groups without a teacher. 4) Exercise meetings, where students solve the calculation exercises under a teacher’s guidance after an introduction lecture. 5) Calculation exercises are part of virtual lectures. Introduction, example tasks and self-study exercises with answers are included. 6) Calculation exercises are a separate part of the virtual environment. There is introduction, example tasks and personal exercises with a limited number of solving times. 7) Calculation exercises are on a video, which can be watched via WWW.

The choices were to put in order of preference (from 1 to 7, with 1 being the most preferred way of learning).

In the third part students were asked to briefly state reasons for their most and least preferred method. They were also asked if the order would be different, had the questionnaire been filled in for some other course.

4. RESULTS OF THE QUESTIONNAIRE

Both results of the first part of the questionnaire are presented in figures 1 and 2. There are some differences, but in all cases the option “mostly agree” is the most popular choice. Most of the students found the difficulty level of the courses calculation exercises to be suitable and that the calculation exercises fitted in well with the content of the course. Almost everybody felt that studying exercises independently was suitable for them, even thought there were a few students who hoped for a teacher’s guidance.

The results of the second part of the questionnaire are presented in averages of preference among the students in figures 3 and 4. Three students misunderstood the guideline in autumn 2004 so their answers were not included. As can be seen, in both seasons the most preferred way was clearly number five: “Calculation exercises are part of virtual lectures. Introduction, example tasks and self-study exercises with answers are included.” According to the students’ comments the main reason why this was thought to be the best way is that in the virtual course all the material, also the calculation exercises, should be available on the WWW. In this option the exercises were also clearly included in lectures content. A negative side to this alternative was
that the self-study tasks might be left undone when there is already a good example calculation.

Many commented, that the exercises were easy enough to learn independently thus a teacher’s guidance wasn’t needed. The freedom of time and place was also mentioned as a positive side to virtual calculation exercises. Option number six was thought to be a good alternative because calculation exercises were in this way easier to find, but some students didn’t like the fact that they had limited opportunities to solve the task. It was hoped, that there would be an automated system in the internet to check the correct answers and that the correct answers would positively influence the final grade. In option number one students are offered ready answers. Opinions about this were split in half. A positive side of this option was that the students could concentrate on learning from the right answers and also it was mentioned that this option didn’t require any work in advance. However, some thought that the best way to learn is by making mistakes and trying it yourself learning by doing. This can be done with most of the other alternatives. The negative side in option number one was that it might be more of copying the right answers than learning the answers.

Altogether, the most disliked alternative was number seven: “Calculation exercises are on a video, which can be watched via the WWW”. It was mentioned, that this sets too high requirement for the students’ computers. The quality of picture and sound was suspected to be poor and also the downloading of the video was thought to take too much time with the slow internet connection. Teaching by video was also suspected to be unclear and boring. Despite the high mean value, in some papers the use of videos was thought to be the best alternative. The reasons for this were that the video would be always available, it could be watched in private and still there would be a verbal explanation and answer to the exercises.

Figure 3 shows that in autumn option number three “Calculation exercises are solved in small study
groups without a teacher” was as disliked option as number seven. Some were suspicious about doing calculation exercises in small groups without a teacher’s guidance because they discovered that finding a time and place to meet was be difficult. Also the lack of knowing if the answers were correct was found to be a negative aspect.

In the third part of the questionnaire students were asked if the order of preference would be different if it had been made about some other course. In both inquiries opinions about this were split. The side which said that it would be different, explained that in this course there was only few rather easy calculations and that the importance of the calculations wasn’t that big. However there are many courses where there are much more difficulty calculation exercises. In those courses students would prefer a teacher’s guidance.

5. DISCUSSION

Information communication technology has been widely integrated to teaching. Based on studies, one advantage in this is that the content can be presented more rich and lively. Fewer teacher-student interactions has been considered as a negative aspect. [Wu 2002]

There are many ways to organize calculation exercises. This study examined which of the alternatives that could be organized on this course would be the best. Based on the students’ answers, the system now used is the most preferred one for this course. On the whole, the use of WWW based applications is thought to be a good addition to the traditional teaching methods. However, the preferred learning way is dependent on the importance of the calculations. In this course the calculation exercises are only a small part of the courses content and on the final exam calculation tasks are about 20% of the final grade. But there are courses which are based on calculations, and the importance is about 100%. In those courses students prefer a teacher’s guidance over independent studying.

The course “Environmental Issues of Electric and Electronics Industry” is organized both in summer and in autumn. It was studied if the season influences student opinions, because in the summer many are on holiday or have a summer job so the freedom of time and place could have been appreciated more than in the autumn term when students already are on the university premises on daily basis. The results show that the season only has minor effect on the student’s opinions.

Based on the results of this study the use of videos in teaching wasn’t encouraged. Videos requir adequate programs and a fast internet connection to work properly. Students commented that all this sets too high a requirement on their home computers. However, not so long ago only few students even had an internet connection or a computer, so the limits of the technology used probably won’t be a problem in the future. There are some positive experiences about the use of videos supporting traditional teaching. In the Chydenius Institute students have an opportunity to watch video taped lectures if they are not able to be present when the actual lecture takes place. Feedback has generally been positive. (Hakala 2004)

The feedback gathered gave valuable information about the preferred teaching methods. The system used now was found to be suitable and will be kept in use in the near future.

REFERENCES