Experiences on Using ICT in University Education

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Abstract. Information and communication technology (ICT) provides a lot of new ways to support but also improve traditional means to educate students, especially in a Computer Science Department, since the necessary technical skills are available. In this paper we make a short overview of the ways ICT is nowadays as well as in the past used in education at the University of Turku and especially at the Information Technology Department. We discuss past experiences and current and near future projects. Special emphasis is given on considering ICT and teacher training.

Key words: web-based e-learning, multimedia content.

1. Introduction

With the use of information and communication technology (ICT) in education one hopes to make learning more efficient and to ease learning of difficult matters. ICT has been used because of efficiency reasons for a long time throughout the university. It is also well recognized that the new ways the ICT provides to present learning material visually can make the learning process easier to students. The Faculty of Education has taken the latter aspect very seriously and even provides a special set of courses in its teacher training for students to learn to produce multimedia content and use it to aid their teaching task.

This paper will discuss the ways ICT has been used at the University of Turku (located in the south-west cost of Finland) in education. Special emphasis is given for teacher training, since University of Turku has a rather large Faculty of Education for educating teachers but specialized teachers are also trained in other departments, e.g., in almost every department in the Faculty of Mathematical Sciences. We also attempt to describe the current situation in the use of ICT and give some details of a project to produce multimedia content at the Department of Information Technology for certain basic courses. In the department, we have used ICT in many ways and for many years, but making good multimedia content for courses is neglected to a large extent, although the technical skills have existed for a long time. In principle, making multimedia content is rather easy. However, we claim that producing good multimedia content is very challenging and requires a lot of work. Thus, we conclude to claim that teacher training should focus more on using

rezultatai, moksleivių motyvacija ir bendradarbiavimas realiame gyvenime. Projekto naudojimas reikalauja keisti tvarkaraštį ir įprastą darbo organizaciją.

multimedia content in education, and composing one's own presentations based on large basic material made on the subject. Ordinary teachers should not focus on making good multimedia content but rather on using it.

1.1. *Short Overview of Local University and Teacher Training*

University of Turku is rather new. It is founded 1920, although actually the history is much older. Academy of Turku was founded 1640, but after the great fire of Turku, King of Sweden decided to move the Academy from Turku to Helsinki in the 19'th century. Currently University of Turku is the second largest university in Finland, consisting of 6 faculties (Humanities, Mathematics and Natural Sciences, Medicine, Law, Social Sciences and Education). It has about 17000 students, 2500 staff members, 14 graduate schools, and the yearly intake is about 1800 – 2000 new students.

The Department of Information Technology is new. It was founded in January 2002 by joining computer science from the Department of Mathematics and Electronics and Communication Systems from the Department of Physics. The new department has over 1000 students and more 100 staff members. This autumn we took about 285 new students. The department gives teaching for master of science in computer science as well as for master of science in technology degrees. We have several study programs, high school teacher training among those. Moreover, we presently operate in two towns: Turku and Salo. For PhD studies the three universities in Turku have a common computer science graduate school, TUCS, Turku Centre for Computer Science.

As mentioned, University of Turku has a faculty for training elementary and secondary school teachers. Faculty of Education has about 2000 students and takes in more than 200 new students yearly. The main emphasis on their teacher training is on how to teach those elementary courses and how to manage in the classroom in general. From the ICT point of view their aspect is that how to use it to aid and enrich teaching, and how to produce multimedia content.

High school (and university) teacher training program is part of the study program of many departments. Especially, the Department of Mathematics trains many teachers yearly. Also our department trains some high school teachers every year. The ICT aspect in our teacher training is how to teach information technology, give good basic education on IT, and how to use ICT in education as well as how to produce multimedia content.

1.2. *Motives to Use ICT in Local Education*

Although the University of Turku is training teachers, it naturally has a lot of teachers and teaching to do. In the university, the motives to use ICT are basically the same as in ordinary schools, but additionally there are other reasons. For example, a university course can have up to 400 – 500 students and therefore one needs ICT in controlling the masses. ICT helps in course registration, keeping account of students credits related to the course (homework assignments, etc), and distributing general course information and course material in general. In some courses it is needed for controlling the progress of students, it aids in checking homework assignments.

More recent motive to use ICT has been to support distant learning. The Ministry of Education started some years ago a large transformation training program in computer science to transform people having some university or lower level degree to become computer science specialists. Those students often have a full time work position somewhere in the region but not necessarily in Turku, and therefore there is a need to have new ICT based forms of teaching to support distant learning besides the ordinary classroom lectures. Also, efficiently providing teaching in two towns at the same time increases the need to support various forms of distant learning.

Naturally, the matters taught in university are more difficult than those in lower level schools, but the usefulness of ICT in basic education in making learning process easier is the same. In teaching, a good picture often says more than a thousand words, not to mention a video or an animation. Yet another motivation for using ICT in university education is that it improves giving personal guidance (email).

2. Early Experiences

Among the first attempts to have new ICT based ways to teach were various experiments with video conferencing based transferring of lectures (ISDN) to certain distance places as well as video filming lectures in place and then transferring those tapes to various places. We had such experiments in the department in the middle of the 1990's. In on-line video transfer, the connection was 2-directional, but lectures seldom caused on-line feedback from the receiving end. In this sense the idea mainly worked as an extension of the lecture hall to a remote place. Experiences from these teaching experiments were not very good – partly because the transferring technology at the time was a little bit unreliable and had a too narrow bandwidth. Also the efficiency gains were seen small (or even negative), since the people at the receiving end had trouble to follow the presentation (due to the channel) and in the local place using the transferring technology reduced the teacher's ability to focus on the taught subject.

In the beginning of 1990's, video projectors were acquired to some classrooms and computers were used in teaching. When the subject of teaching was use and creation of programs, this new way of visualization was of great help. However, mostly it was used to give a slide show – overhead projector slides turned into electronic ones. Naturally, this involved better ways to visualize the taught subject, but the teaching situation remained mostly the same. Often the visualization properties were really not used for explaining difficult topics but to make the presentation look fashionable. One general drawback of slide show is also that it makes possible to present during a class hour much more material than what the students can learn.

Third area of experiences is the use of computers or the Internet as a means to provide course related material and to enable the students to discuss in the network about issues related to course content. University students in Finland have for a long time had a good access to the Internet. Thus, World Wide Web (WWW) has been a good platform for distributing course related information and material. For quite many years now,

the university courses (in the IT department) have had a home page. Besides distributing "daily" course related information, it has mainly been used to distribute slides, lecture note material, example (programs), homework assignments, etc. Although all these support distant learning, the learning material itself is still in traditional form and passing a course must still be made via traditional means. In short, the distant learning material has not really supported self studying. On the other hand, WWW, various discussion groups, email, and, e.g., learning environments such as WebCT have been a great help in keeping mass courses.

A summary of past experiences probably is that at first the new teaching forms of ICT were greeted with excitement and a lot of experiments were made. Those experiments were often technology driven and the focus was more on technology than on the content that the technology could be used to deliver. The new media has mainly been used on the basis of the "old" classroom style of teaching. Yet, the communication techniques of the Internet have proved out to be very useful in teaching. The discussion groups and even personal email communication improve student's changes to get help in understanding difficult topics. However, the Finnish students should be more active in this respect.

3. Present Forms of ICT

Presently most of the classrooms are quipped with video projectors, so technical conditions for presenting multimedia material during lectures should exist. Ordinary slides and blackboard style teaching are still used (in some departments still quite a lot, e.g., mathematics), but often most of the material is presented in electronic form. On the Internet and WWW side things steadily but slowly evolve. When considering multimedia content for courses, the main problem is that most – if not all – WWW material is too passive in nature. That is to say that the material is just given to the students, but the students often have no chance to get automatic feedback of their learning process. The idea in giving material is to make the students try to apply the taught subject themselves – in this respect, the material should also provide some means to understand how well the student has learned to apply.

The passiveness of material means that the material is mostly in textual form, perhaps including some images and figures. Animations and video clips etc are almost systematically missing. All kinds of forms of interactiveness are also mostly missing. We think that the reasons for this kind of development are not the missing of technical skills or lack of ideas on what kind of material to create. The main reasons are simply that the amount of work it takes to create good quality multimedia material is simply huge and it is often underrated by the departments. Good multimedia material doesn't just come as a side product of making "ordinary" learning material. It is not something that a skilled person can create overnight and ad hoc style. It rather requires a lot human resources, and nowadays those resources are used for more direct action: Doing the basic teaching activities.

One clear reason for not having high quality multimedia material in teaching is our own society. Finland is a rather small country and the language is very different from

other languages. Since creating material requires a lot of work and the markets are small, it is tempting to think that creating the material is not worth the effort. The information technology field has one additional drawback in this respect: The field constantly evolves and chances – there is a high risk that created material becomes obsolescent.

The lack of multimedia material is now recognized by many. In response to this, some projects to create such material have been started and, e.g., the Faculty of Education has created a special set of courses, aimed at teachers and teachers to become. The extent of the set is 30 ECTS, and the objective of those courses is how to use ICT equipment and software in teaching, and how to produce multimedia content (e.g., Flash animations) for courses. The main focus is on face-to-face learning situation, not so much in distant learning. The courses are naturally very popular, and the university teachers are encouraged to take those courses.

4. Multimedia Content for Computer Science Basic Courses

In our Department of Information Technology, we have recently started a project which aims to create multimedia content for the first year computer science courses (two introductory courses to computer science and two programming courses). We have chosen this set of courses, although due to the nature of computer science there is a risk for such material to become old or obsolete quite quickly. On the other hand, our experience on these courses is that most of the material has stayed unchanged for years.

Currently five persons are working in the project. We have a teacher, persons with technical skills, and persons who have taught those courses for several year. However, the main issue is that we ourselves have written extensive lecture note and study guide material for those courses. In other words, we have large set of basic material (in textual form) so that we own the copyright. We think that this is essential, when starting to create multimedia content for courses. There are several very good books written about the course topics in English and in Finnish, but building multimedia content with respect to such books would be very short-sighted, since the content and availability of those books might change rapidly.

Although the basic goal in our project is to produce multimedia material that supports the present courses, we have set our objectives higher. We aim to go through all the topics the courses cover and also some closely related (but not really covered) topics. Then we try to modularize the topics to rather small but clear modules, identify their relations (i.e., what modules one should know before studying a given module), and finally design material for them. The benefit of module thinking is that, e.g., in some other institute a teacher might want to use the material, but divide it into different courses.

The modules we aim to design to support distant learning and self-study so that the student could take some on-line exercises or tests to see how well s/he is doing. As mentioned, we have a lot of textual material already, but we do not intend to move it in the modules as such. Rather the idea is to have the main issues clearly presented in textual form, aid understanding of concepts and techniques with images, figures and animations, and create a lot of well-explained examples. Of course, the material will also contain a

lot of cross references and navigational aids. However, the most challenging part will undoubtedly be adding interactiveness.

5. Conclusions

We have discussed the ways ICT has been and will be applied in teaching at the University of Turku and how it will currently be part of teacher training. Currently ICT is used in many ways, but yet the full potential of ICT is not taken in advantage. Especially, the multimedia style content is mostly missing. We claim that this is not due to shortcomings in technological skills or ideas, but rather due to lack of time and human resources.

In teacher training the new ways of ICT should be strongly present, since it can make easier to teach difficult subjects. Good visualizations are especially well-suited for us humans. Teachers should have the skills to use the technology. On the other hand, we also claim that teachers should be composers of multimedia presentations rather than those who make all the material. Not every teacher writes the material that s/he is teaching – making good quality multimedia material should be left to professionals (who might also be teachers), since it is so time consuming and requires a lot of resources.

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Ville Leppänen has received MSc, PhLic and PhD degrees in computer science from the University of Turku, Finland in 1992, 1994 and 1996, respectively. Since 1989 he has acted as a researcher, lecturer, assistant professor and professor at the University of Turku. Currently, he is a professor (software engineering) at University of Turku and Turku Centre for Computer Science (TUCS), Finland. His research interests include parallel algorithms and architectures, computer networks and software engineering. During years 2000 – 2002 he acted as coach of the Finnish team for International Olympiad in Informatics.

Informacinių ir komunikacinių technologijų naudojimo mokymui universitete patirtis

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