

# Use and Production of Digital Information and Knowledge in Technical University Education – Cooperation of Faculty and Support Units

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## INTRODUCTION

The rapidly changing educational landscape is of increasing importance in university teaching. Universities in Finland are responsible for research and education based on research. Traditionally information and support services related to using and producing knowledge, support research, and education has mostly been seen purely from the students' perspective. Teaching in universities is still a hidden individual activity, and, as such, challenges the support units to reach and interact with the academic community. This paper will review the aspects influencing the use and production of digital information and knowledge in technical university education; examples illustrating the experiences will be given.

## THE EDUCATIONAL ENVIRONMENT

At universities of technology the core area of research, teaching and learning is about combining technology with science. The creative system thinking and reasoning that is fundamental in engineering is developed gradually during studies when the knowledge of science is applied. This is why graduate engineers are masters of science in technology since they possess expertise about man-made systems and applications rather than just being masters of science. [1]

Helsinki University of Technology (TKK) is the oldest, largest and most versatile university within the field of technology in Finland, dating back to the nineteenth century. The aim of TKK is to practice scientific research, promote research-based learning and to encourage scientific and artistic (in the field of architecture) education. TKK has some 15,000 students including post-graduates and a staff of 3,000 working mostly in teaching and research. The TKK consists of 12 departments, 9 separate institutions, and 17 study programmes. The share of operating appropriation is 55%, and that of external funding 45%, one of the biggest among the universities in Finland.

The organization can be characterized as a loose coalition of autonomous actors. The decisions are made in a dispersed manner across departments and institutions. In research

there is a strong academic tradition of collective discussion and criticism, and knowledge is cumulative within individual research groups. In teaching the tradition of profession transfer from master to pupil is still very strong and teaching is hence a very personal activity. At the moment very little instructional knowledge is being consolidated.

In the teaching process the role of students is blurred: on the one hand students are members of the community but on the other they are customers of the educational services. Opinions towards university administration and support services also vary: sometimes they are essential actors and sometimes they can be regarded as an unnecessary overhead cost.

The two-cycle structure of the new curriculum based on the Bologna declaration will start at TKK in the autumn of 2005. There will be a totally revised structure for studies. The revised structure aims principally to increase the visibility of the curriculum. The growth of international competition calls for quality assurance measures, and the increasing mobility of students is yet another challenge.

Parallel to the Bologna process, the combination of the application of information and communication technology (ICT), and co-operation within networks of universities nationally and globally, propels university teaching in a new direction (Bates & Poole, 2003). Students demand flexibility from enhanced ICT service provision: the majority of the TKK students work while they study. Yet, in most research universities ICT enhanced activities are used mainly as classroom supplements.

In the future the personalised digital learning environments will be the student's desk. The study process will include increased resources to the extent that digital format will be a prerequisite for all learning materials. The financial support of the Government of Finland in the field of digital content creation is remarkable, but not yet too widely used by the universities.

## **COURSE PRODUCTION PROCESS AND LEARNING RESOURCES**

In examining the course production process, where are the learning resources ? The teaching process starts in general with setting objectives. The orientation may be based on content, competencies, epistemology, activities or their combination. In planning the course content there is always the scientific and professional dimension linked to the competencies that the students must, or ought, to master by the time they complete the course. Planning and implementing actual teaching facilitates learning, and, therefore, the teaching method should be carefully selected. Furthermore, since the assessment of the learning outcomes guides, in practice, both the planning of teaching and learning, this also should be carefully selected. The outcomes then materialise into

components such as general course information and administration, including record keeping and student marks, general planning for the course, lectures and other forms of instructor-led sessions together with notes, student self-study and assignments, additional readings, other activities and practical exercises. A major assignment in a form of project work, essay, product, or case study may be included. Testing and examination form an integrated part of the course, together with communication, guidance and mentoring.

Integration of external resources with courses is not necessarily efficient. The average lifecycle of technical learning material is quite short and teachers usually create the material themselves. At TKK there has been a very strong tradition of teacher-created technical notes that supplement textbooks. The FinELib national library consortium licence agreements, however, allow the use of materials for educational purposes, i.e. the inclusion of material in non-commercial courseware. Yet, this option is not widely used in undergraduate education.

Engineers seem to have distinctive way of communicating: they favour informal and oral communication, and while they prefer easily accessible information sources, they also use a wide variety of written sources and channels of communication. Engineers value high-quality information but are not always successful in getting it or using it in an efficient manner (Tenopir & King, 2004). In this respect the easily accessible electronic resources are ideal for engineers, provided they are aware of the available resources.

Currently the digital learning environments present multiple challenges. The digital format has implications for the convergence of media, information, and even competencies. Most course management systems do not support knowledge transfer and, therefore, there is even a technical obstacle to material re-use. A more profound question about re-use relates to the applicability of a piece of learning material purposed for one context in another context. Furthermore, the lifecycle of different types of learning materials is different and hence the archiving/recoding policy and responsibility for maintenance concerning these materials needs to be tackled.

## **CASE STUDIES**

University teaching is very much teacher and context dependent, and thus the approaches with regard to the use and production of learning materials vary from course to course. The following three cases illustrate the situation:

- Energy engineering and environmental protection courses are held for a group of students ranging from 12 to 20 in number. There is a course management system that brings together the course material that also includes animations and simulations. The award-winning material highlights new pedagogical ideas, thanks

to the personal commitment of the instructor, who not only had very high technical skills but also previous experience in implementing ICT in training as well. International co-operation further encouraged the development of the course. The material has been produced with a view to re-use and it includes also externally licensed sources. However, the IT security measures at TKK were seen as an obstacle to innovative applications.

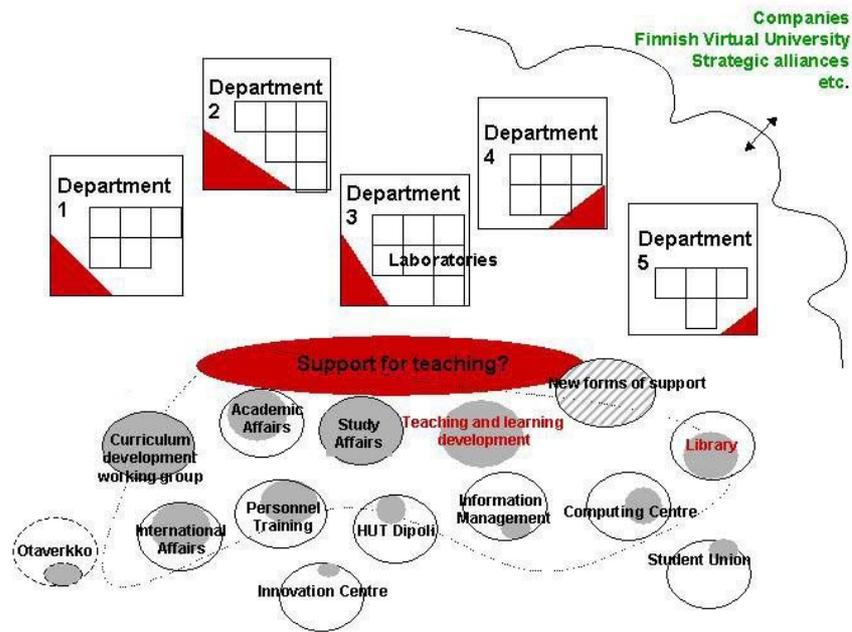
- The introductory computer-programming course is a “mass” course with some 300 students completing the course. There is a virtual instructor team governing the course, and those enrolled on the course view the web as part of their learning process. The course resembles a lubricated machine, where the role of each actor is well defined and strictly rule-governed: the responsible teacher, the assistants and the students. The student questions are anticipated and answers are provided in a form of FAQs. The structure of the course material has been developed through an evolutionary process where the resources produced to support this course are aimed to be re-used in the next course. The potentially re-usable resources related to course organisation and guidance are identified annually, and similarly external resources used by students in their assignments, such as web documents, guides and programming tips, are also reviewed.
- The TKK library course “Searching for Scientific Information” starts every half-term and lasts five weeks. It includes one face-to-face lecture, which is given in Finnish as well as in English. The course is conducted mainly by means of distance education and e-mail. During the spring of 2004, and within the EUNITE network, the transferability of the web-based course was tested between TKK and Leuven University (KUL) in Belgium. EUNITE is a network of European universities that promotes the exchange of courses, the sharing of joint courses, and joint development of programmes and courses. Before the course was run at Leuven the course web-documents needed to be rewritten to fit the Leuven context. Similarly, staff at Leuven had to familiarise themselves with the course materials before they could act as course tutors. The experiment showed that the transferability, or re-use, of web-based courses is not straightforward; adjustments are needed, and local context and content play an important role.

#### **SUPPORT FOR TEACHING – COLLABORATIVE WORK**

Currently, communication between the actors supporting teaching and learning at TKK remains inadequate. Like most research universities, the dispersed organisation of TKK, where all units have their own practices, complicates matters. In Figure 1 illustrates this organizational landscape. The insufficient integration of essential information systems leads to inefficiency in the maintenance and use of these systems. In theory, the

customer, the teacher is not interested in knowing from which unit he or she gets the service.

Figure 1. Units supporting teaching and learning at TKK are scattered around the campus



How can the support units reach the teaching staff? At TKK the unit for Teaching and Learning Development supports teachers and students in their development activities and promotes a positive teaching culture. The focus of the unit is on pedagogy, study skills, educational use of information and communication technology, and the development of study counselling. The unit co-operates actively with other divisions to support the improvement of teaching and to develop the use of ICT in education.

At TKK the library has responded by actively participating in programmes and workshops, arranged by the Teaching and Learning Development Unit, which are targeted at teachers who are interested in developing and improving their teaching skills. This peer position in the programmes offers library information specialists a unique opportunity to establish strong working relationships with the academics. The trust between working colleagues that grows during the lengthy programmes promotes both

casual and confidential communication between the participants. This offers a dual benefit for the library as an organization: first, the opportunity to collect user feedback in the form of casual discussions, and, secondly - and perhaps more importantly - to pick up signals about the impact of change in university teaching and learning.

There are also other important partners inside the university, such as the IT Centre and the Office for Academic Affairs, which is responsible for the implementation of the two-cycle study structure (Bologna declaration). In the process of harmonising higher education across Europe the importance of study skills and information literacy skills needs to be acknowledged. Hence the Teaching and Learning Development Unit and the library explore ways of promoting the issues in the new study structure. The opportunity to market each other's complementary services to academics is an asset for all support units.

The alliances with the administrative units are an important channel for lobbying and influencing those taking part in the decision-making. Again, the signals of change can be traced earlier if one is accepted as working as part of a network. Supplementary to top-management relations are those of the staff members. For the trainers, consultants and information specialists, the planning officers responsible for Study Affairs form an important network in this respect. In an environment where decisions are made in a dispersed manner across departments and laboratories it is necessary to promote support service issues at all levels.

## REFERENCES

Bates, A.W. and G. Poole: *Effective teaching with technology in higher education : foundations for success*. San Francisco, Calif. [etc.] : Jossey-Bass, 2003. (The Jossey-Bass higher and adult education series)

Tenopir, Carol and Donald W. King: *Communication patterns of engineers*. Piscataway, NJ : IEEE Press; Hoboken, NJ : Wiley-Interscience, 2004, p. 179.

**WEB SITES REFERRED TO IN THE TEXT**

Bologna declaration. [http://www.coe.int/T/E/Cultural\\_Co-operation/education/Higher\\_education/Activities/Bologna\\_Process/Bologna\\_Declaration.asp](http://www.coe.int/T/E/Cultural_Co-operation/education/Higher_education/Activities/Bologna_Process/Bologna_Declaration.asp)

EUNITE - the European Network of Excellence on Intelligent Technologies for Smart Adaptive Systems. <http://www.eunite.org/eunite/index.htm>

Helsinki University of Technology. <http://www.hut.fi/English/>

Helsinki University of Technology Library. <http://lib.hut.fi/index-en.html>

KUL - Katholieke Universiteit Leuven. <http://www.kuleuven.ac.be/english/>

**NOTES**

1. From the speech of TKK Rector Matti Pursula at the Opening Ceremony of the Academic Year 2004-2005, 9 September, 2004