

Learning Lab Geomatics

– Virtual academy: reengineering university concepts

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ABSTRACT

Virtual Academy is a hot issue. It represents the challenge of implementing the new IT paradigm in all aspects of the academic world. This paper argues that the role of the universities will have to be reengineered, and that the keyword in this process will be knowledge management.

In the academic debate, virtual academy is often reduced to the issue of implementing new technology. In the political debate it often is reduced to the issue of representation in the university management boards. Meeting the challenges of the information age is, however, a complex process that will call for a more comprehensive reengineering of university concepts. The process includes change in the on-campus activities towards a more flexible learning environment, and it includes change in the role of the universities towards a more open communication with society.

Learning Lab Geomatics is a strategy for implementing the concept of virtual academy in the area of educating surveyors at Aalborg University. The strategy includes a number of elements such as reengineering the learning process through web-based lecture materials; quality assurance in digital publishing; pedagogical innovation in the learning process; and internationalization of the total study environment.

Learning Lab Geomatics is designed to provide a new and flexible learning environment based on knowledge management. It will provide educational innovation through a more focused self-learning perspective, and it aims to provide an efficient interaction between education, research and professional practice at national as well as international level.

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1. INTRODUCTION

Technology development is a major driving force in changing not only the face of the spatial information world but also the total academic learning environment including the student/teacher interface. Technology development will arguably be faster than we can predict. However, a number of challenges can be identified and universities will have to respond. The idea of “virtual academy” may be seen as such a respond.

The applications of “virtual academy”, however, represent a huge diversity throughout the world. This is partly due to structural and institutional differences, but also due to differences in the preparedness to implement major changes such as reengineering the total learning environment and changing the role of the universities towards a more open communication with society.

The concept Learning Lab Geomatics is an attempt to adapt the total learning environment to meet the challenges of the new Information Technology and Communication Age. The concept is based on the Aalborg University virtues: project-organized and problem-based education. Implementing IT in the learning process will, however, change the traditional way of teaching and learning. Knowledge management is the key word determining not only the new face of learning environment but also the new profile of learning communities through an increased interaction between education, research and professional practice.

2. GLOBAL DRIVERS AND WINDS OF CHANGE

Technology development in the area of information and communication represents a global driver for change within the academic world and the university learning environment.

In the late 80’s the fax was speeding up communication. In the first part of the 90’s developments in the communication technology have changed the accessibility to all levels of information. But also the speed and integration of other media is changing. Starting with e-mails and later the worldwide web the pattern of communication have been constantly changed and enhanced.

Developments in the communication technology have had a huge effect on the learning environments at universities all over the world. From focusing on the local learning environment and its available learning tools, the universities are now facing a situation, where the students just under their fingertips - and with the same speed as their own thinking and capacity for formulating questions - have access to the sum of knowledge throughout the world. Consequently, not only the role of the professor is changing, but also the whole university institution and the principles of learning in relation to both methodology and

pedagogy. The role of the universities will have to be reengineered based on this new paradigm of knowledge sharing. During the coming years the pressure of change will be further increased. These winds of change are indicated below.

Always on. Today, connection to the Internet means to be situated at a PC-workstation, which is wired to internet-based digital resources. Within only a few years, all campus areas will be “hot points” where the students and staff are all wirelessly connected to internet resources, using personal digital assistants (PDA). Next step, within 2-3 years, will be the tablet-PC with a huge storage and processor capacity for handling multimedia data. . This development means that the on campus learning resources are available for the students at any time and any place they may chose.

Deep computing. The development in the personally designed storage capacity is amazing. Today, scholars in highschool set up their own individualized use of storage resources for fun, entertainment and learning. This means that university students will have access to what is known as deep computing - a very personally designed storage of all digital documents such as lecture courses, their own project reports and course writing, the professors textbooks, and material from other universities and learning environments.

Easy to use. The user interface to design and apply personal digital learning environments use icons, objects and elements from the normal daily and professional life. This appeals to a much bigger range of users. Individuals and organizations will have the opportunity to set up personalized and individualized facilities. Producing web-sites will no longer take highly qualified professionals. It t can be done by anyone having a modern IT capacity at the level of word processing, and PowerPoint with digital pictures and sound.

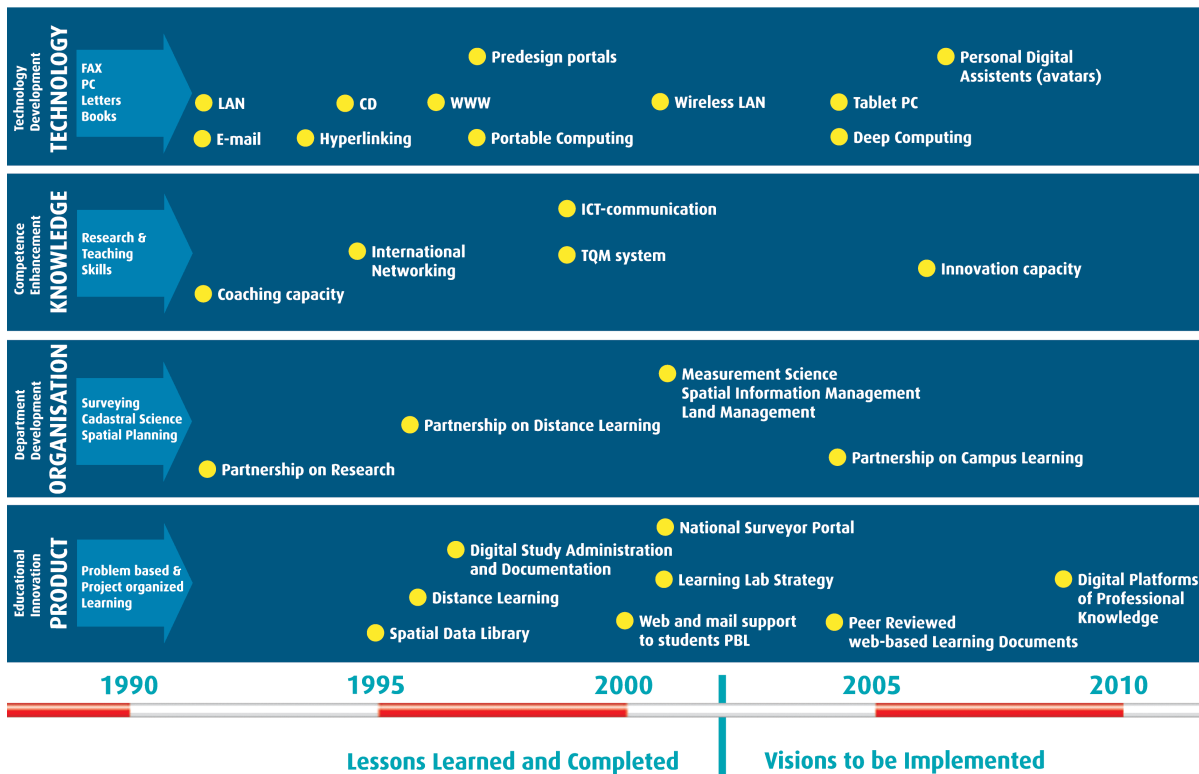
Easy to co-operate. Today’s digital communication means using mobile or fixed units for synchrone communication of speech, pictures and data, or using mail files and bigger files for asynchrone communication. Tomorrow’s technology means an integration of the different sources of communicating. It means that writing together through the sharing of programs and files over distances will be daily tools for knowledge provision, and picturing and streamed videos will be normal tools for synchronized as well as not unsynchronized presentations.

Advanced information engines. Today, browsing the Internet searching for relevant information is still a creative process. Formulation of queries and trunk words is a never-ending process. The present technology in the information engines represents a powerful tool to search for and to monitor the development of knowledge and expertise throughout the world. In the very near future the information engines will be able to automate the searching process in a still more advanced and personalized way. Automated information engines will provide updated news worldwide on specific and individually predefined areas. This technology – personal digital avatars – will be an extremely powerful tool in all aspects of the learning environment where updating is essential.



Developing Learning Lab Geomatics at Aalborg University

OPENNESS - TRANSPARANCY - QUALITY - INTERNATIONALIZATION



Learning Lab Geomatics is a strategy for implementing virtual academy in a knowledge management context. The strategy includes integrated development in the four target areas: technology, knowledge, organization, and product.

3. PROFESSIONAL COMMUNITIES

The surveying community around the world is a combination of academia and practice. The profile of the community is changing rapidly due to the global drivers such technology development and globalization.

The big challenges are about how to initiate and implement policies on mutual recognition of professional qualifications to facilitate mobility; how to facilitate sharing of knowledge and learning resources at local as well as global level; and how to establish truly international learning environments.

In many professional communities the interaction between academia and practice is not well developed. Also in the surveying profession there is a need to emphasize and develop this interaction in relation to curricula development, lifelong learning policies, and innovative partnerships.

Learning takes place at the university and in surveying practice as well. The strategy in Denmark has been for many years to increase the interaction between practice, research and education (Kjersdam and Enemark, 1994). In fact, this interaction is the basic vehicle that operates the educational process. The aim is broad insight into and understanding of the links between different fields and skills that would enable graduates to function in a society which is increasingly becoming more complicated. In principle, it can thus be assumed that the graduates have obtained the skills needed to solve also the unknown problems of the future.

The universities must accept that scientific development requires networking and applied science requires interaction with professional practice. The universities must systematically integrate the knowledge developed by individuals and companies in professional practice. On the other hand, professional practice must systematically integrate the newest knowledge and skills developed at the universities and possessed by the graduates. The demand for lifelong learning is essential and training opportunities should be developed in co-operation between the universities and professional practice. In this regard, knowledge management will become a key element. The real challenge will be to rethink the existing concept of university knowledge and to reorganize the access to knowledge using different criteria than today. The aim is transparency and easy instant-on access to university knowledge and documentation.

The world of professional practice will have to rethink and reorganize their work in ways that creates pride in belonging to the profession and at the same time accelerates business cycles and a faster learning process than competitors. This may be done by developing and disseminating concepts of good practice, and by connecting "islands of knowledge" through networks within the professional community. This process should be feeding and being fed by web-based repositories of both proven solutions and new approaches.

For the two partners - the academic world and the world of professional practice - one possible way forward is to foster a cross-functional and cross-sectoral collaboration through setting up virtual learning organizations and facilities which can benefit both partners. Learning Lab Geomatics can be seen as such an organization.

4. LEARNING LAB GEOMATICS.

The strategy on Learning Lab Geomatics has been developed to meet the challenges of the future for the Danish surveying community including both the academic world and the world of professional practice.

Creating a Learning Lab express the will to develop the communicative and pedagogical methodologies for serving the society with research based knowledge for on-campus education as well as lifelong learning. *Learning* means a dynamic interaction between the actors (students, professors, researchers, and professionals) the professional areas (themes, problems, theories and methods), and the learning tools (pedagogical methodology, information and communication technology, and the physical environment). Lab means systematically and never ending experiments and development of methodologies for communication and learning.

The idea behind Learning Labs was born at Stanford University in the middle of the 1990's. At Aalborg University the idea has generated created several initiatives such as the E-Learning Lab aiming to facilitate the change of a whole region towards digital communication. Another initiative is the strategy on Learning Lab Geomatics.

Learning Lab Geomatics is a strategy for implementing the concept of virtual academy in area of educating surveyors at Aalborg University. The strategy includes a number of elements such as reengineering the learning process through web-based lecture materials; quality assurance in digital publishing; pedagogical innovation in the learning process; and internationalization of the total study environment. Learning Lab Geomatics is designed to provide a new and flexible learning environment based on knowledge management. It will provide educational innovation through a more focused self-learning perspective, and it aims to provide an efficient interaction between education, research and professional practice at national as well as international level.

The learning environment at Aalborg University is based on a project-organized approach. "Project-organized" means that the curriculum is taught through project work assisted by lecture courses instead of teaching theoretical courses assisted by practical labs. Education organized around projects moves the perspective from description and analyzing into knowledge synthesis and assessment. The concept is based on a dialectic interaction between the subjects taught in the lecture courses and the problems dealt with in the project work. Each term has a basic structure containing, in principle, equal distribution of lecture courses and project work. But the study-time is dominated by lecture courses at the beginning of the term and by project work at the end. The project work is carried out by groups of four to six students having a teacher appointed as supervisor.

The concept of knowledge management is a driving force in changing the role of the universities. The concept, however, must be adapted to fit the project-organized paradigm. We would argue that by reengineering the student/teacher interface through knowledge management both the learning process and the outcome of that process can be improved. The learning process will be improved to reflect the opportunities provided through the modern information and communication technology. Lecture course material will be designed and prepared in hypertext and made available on the web as a basis for more intensive preparation and self-studies to be undertaken by the students. Traditional classroom lecturing will increasingly be replaced by web based self-studies followed by tutorials. The students project work will be developed on web-sites and the resulting final report will be made available as a source of knowledge to be used by incoming students. The outcome of the learning process will be improved by not only enhancing the competence of the graduates but also by improving the accessibility to knowledge. The changing role of the universities should include that the lecture course materials, research results, and professional journals be made available on the web and packed in way tailored for use in different areas of professional practice. The graduates will then have access to the newest knowledge throughout their professional life.

5. KNOWLEDGE MANAGEMENT

The School of Surveying and Planning at Aalborg University has established a system of on-line management of the study environment. This means that all information and communication is managed through the web. Home pages and email addresses are available at all levels including each student, each group of students, and each semester.

To improve implementation of IT in all aspects of the learning environment the School has established a Spatial Data Library to serve the educational process. The Spatial Data Library contains all relevant spatial data (registers and maps) within the region of northern Denmark. The students project work, this way, is based on the actual data and the work is undertaken at the same level of IT as in professional practice. The library also enables the lecturing to be on-line when teaching theories and applications. A full-time librarian is responsible for maintaining the data sets and for developing relevant applications.

The School of Surveying and Planning has also established a one-year Master course in Geographic Information Management. The course was developed in co-operation with the surveying industry and the Danish Association of Chartered Surveyors. The course is offered as a one-year part time study lasting for two years, and it is organised as distance learning using an electronic classroom for teaching and communication. Researchers from other regions in the world such as University of Melbourne and ESRI in California are lecturing on-line in this course. The course combines lecture courses (distance learning) with supervised project work (distance communication) based on professional problems identified by the practitioners within their respective employment areas. The students take part in four weekend seminars organised each year on campus to have introductory classroom lecture courses and to discuss and develop their project work. In general, the concept provides an innovative interaction between university and industry and it provides valuable feed-back to be integrated in the full time graduate program (Enemark, 1997).

These experiences in knowledge management are further developed in the concept of Learning Lab Geomatics. The elements are presented in details below.

5.1 The project work

In a project organized learning environment the project work of course will be developed at the homepage assigned for each group of students. This way, the development stage of the group work is shared internally at each semester. Furthermore, the communication between the project group and the teacher assigned as supervisor may be managed with a reference to the homepage. For each group the project proposal and the design for investigating the problems posed must appear on the homepages within say four weeks after starting the term. Using a pdf-format the information can be shared without any problems of security.

In principle, the project work may then be carried out on a distant learning basis. This is, however, not the main objective as both the learning process and the academic training is supported heavily through the personal student/teacher interface.

The resulting reports of the project groups will be saved and made available through a web library established at the home page of each term.

5.2 The lecture courses

The lecture courses at Aalborg university is organized in modules of five times half a day lecturing, in total five times four hours plus ten hours of preparation and self-studies. A module, this way, represents 30 hours of studies equivalent to one ECTS (European Credit Transfer System). A semester is comprised of 30 ECTS. In the first half of the curriculum the division between lecture courses and project work is more or less equal. In the second half of the curriculum, the study time is divided into about one third lecture courses and two third project work.

The concept of Learning Lab Geomatics will turn all lecture courses into a digital format to be available on the web. Each lecture, representing four hours of lecturing, will be documented through a ten-page “white paper” as a hypertext document that includes the key professional knowledge including all relevant references, graphics, and links. Each lecture course, covering one to three ECTS, will then be established to include four areas or sections:

- (i) an introduction presenting the subject, the learning goals, the structure and the overall professional focus;
- (ii) a hypertext document divided into lectures of about ten pages each presenting the key professional knowledge including all relevant references, graphics, and links;
- (iii) a section that include relevant problems for testing the knowledge established through the self-studies, and explains about the relevant examination criteria; and
- (iv) a best practice section that includes relevant methods and case studies to illustrate practice and the relevant content and level of IT.

The learning documents are prepared to facilitate the learning process of the students. Some analogue textbooks will, however, still be needed as a source of specific and comprehensive professional knowledge.

5.3 Peer reviews

Even if the lecture courses on the web are designed for the learning process of the students, they should also provide a comprehensive source of knowledge to be used by professionals as well. This calls for a process of quality control comparable to the reviewing process established for publishing in professional journals.

A panel of reviewers will be established within the professional area such as Measurement Science, Geographic Information Management, and Cadastre and Land Management. The panels may consist of a number of key professionals from the academic world as well as professional practice. A corps of say ten persons within each area should be established. For each review the Head of Studies will appoint a panel of three persons, representing one internal academic staff, one external academic, and one external from professional practice.

The content of the learning document is of course the responsibility of the individual lecturer. The review process is therefore established as a process a quality management rather than a means of quality control. However, in the long term, the learning documents should provide a comprehensive source of professional knowledge structured in a way that facilitates the learning process of the students as well as the demand for maintenance and updating of professional skills in a lifelong perspective.

5.4 Learning communities

The peer reviewed lecture material may be extended to include peer reviewed platforms of knowledge tailored for professional practice within the main professional areas. The areas of knowledge may be divided in relevant subjects and organized the same way as the subjects are undertaken in professional practice.

This will facilitate an easy access for the professionals to find answers and to update and increase knowledge within all relevant subjects in professional practice. The platforms should include references to relevant research reports, articles in journals, and judicial judgements. The structure should be developed in a close co-operation with professional practice, and the peer review process will guarantee the quality.

6. EDUCATIONAL INNOVATION

When the lecture material is available on the web in a special designed version it will be possible to change the performance of the lecture courses in an innovative way. More time may be allocated to self-studies based on the web-based material, and sessions of traditional lecturing may be replaced by seminar discussions to facilitate the learning process.

This should underpin the need for the students to take responsibility for their own learning. Also, the role of the lecturer will change from transferring knowledge to facilitating the learning process of the students. Furthermore, the concept will ease the pressure currently being imposed on the academic staff due to the general decrease in university resources. This way there is a motivation for the academic staff to invest in developing the web based learning documents.

Another source of motivation for the academic staff is about the interaction between education and research. Using the project-organized approach the profile of the lecture material and the research activities is coming closer together, and is becoming even more relevant for facilitating the students project work.

However, motivation may still be main barrier for implementing the concept of Learning Lab Geomatics. Production of high-class and web-based lecture material will to some extent have to compete with traditional research activities. Therefore, quality and flexibility will be the key elements of the implementation strategy - quality in terms of the output and flexibility in terms of the process. Professional and personal integrity must be respected as important factors in relation to successful implementation.

7. INTERNATIONALIZATION

An innovative learning environment covering Geomatics must include a fully integrated international dimension. International co-operation must take place not only in the research areas but also in order to facilitate exchange of staff and students, and to facilitate an international learning environment offering master program taught in English. This should facilitate development of a learning environment on the very frontline of the professional areas covering measurement science and mapping, cadastre and land management, and geographic information management.

The aim is, within the next four years, to establish master programs taught in English covering the specialization in the last two years of studies from 7th to 10th semester. Foreign students having completed three years of studies at their home university (typically having completed a Bachelor Degree in surveying) may then be able to complete a further two years of studies leading to a Master Degree within one of the three specializations offered.

Most of the existing lecture courses will be taught in English. The project work may be undertaken in Danish or in English depending on the students participating in the group and depending on the subject to be investigated. In the same way, supervision of the project work will be offered in Danish or in English depending on the specific needs.

By establishing such a bilingual learning environment it should be possible to interact closely with leading universities throughout the world. This interaction may also include knowledge management in terms of sharing teaching capacity through virtual opportunities of lecturing. Another area of interaction may be the development of lecture materials tailored for the international surveying community and for the needs of international aid organizations such as UN and the World Bank.

8. FINAL REMARKS

Learning Lab Geomatics is not just a matter of upgrading the graduate program to keep pace with information technology development. Learning Lab Geomatics is a vision that will cause reengineering of both the total learning environment and the future role of the university.

On-campus courses and distant learning courses will be integrated even if the delivery may be shaped in different ways. Existing lecture courses should always be available on the Web. Existing knowledge and research results should also be available, and packed in a way tailored for use in different areas of professional practice. All graduates will then have access to the newest knowledge throughout their professional life.

In short, knowledge management is the key to the future.

REFERENCES:

- Castell, Manuel: *The Rise of the Network Society*. Second Edition, Blacwell. Oxford, 2000.
- Coleman, D.J. (1998): Applied and Academic Geomatics into the Twenty-First Century. *Proceedings of FIG Commission 2, The XXI International FIG Congress*, Brighton, U.K. pp 39-62.
- Enemark, S. (1997): The Role of the Universities in Provision of Continuing Professional Development. *AUSM Journal on Land Information Systems*, Vol.57, no 3, pp 194-197.
- Enemark, S. and Prendergast, P. (2001): Enhancing professional Competence of Surveyors in Europe. FIG and CLGE. FIG Office, Copenhagen.
- Enemark, S. (2002): International Trends in Surveying Education. *Proceedings of FIG Commission 2, The XXII FIG International Congress*, Washington.
- Haggren, Henrik and Sorensen, Esben Munk (2000): *Virtual Academy - methods and techniques*. *Proceedings of the FIG Working Week*, Prague, May 2000.
- Kjersdam, F. and Enemark, S. (1994): *The Aalborg Experiment - Project Innovation in University Education*. Aalborg University Press.
- Laurillard, Diane (1994): *Rethinking University Teaching*. Routedledge, London and New York.
- Sorensen, Esben Munk (2001): *Vision for Universities - A 5-10 Year Perspective*. *Proceedings. FIG Working Week 2001*, Seoul, Korea, May 2001.
- Sorensen, Esben Munk (1999): *On the roads to Virtual Universities*. *Proceedings of the FIG Working Week*, Sun City, South Africa, 1999.
- Sorensen, Esben Munk (1998): *Applications of Distance Learning and Virtual Universities in Management of Geographic Information*. *Proceedings of FIG Commission 2, The XXI International FIG Congress*, Brighton, UK .

BIGRAPHICAL NOTES

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