International Trends in Surveying Education

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ABSTRACT

The paper discusses the key trends in surveying education with regard to management skills, project-organized education, virtual academy, and lifelong learning.

There is no doubt that the main challenge of the future will be that the only constant is change. To deal with this constant change the educational base must be flexible. Professional and technical skills can be acquired and updated at a later stage in one's career; skills for theoretical problem-solving and for "learning to learn" can only be achieved through flexible and up-to date academic training.

There is need to change the focus in surveying education from predominantly an engineering focus to a more managerial and interdisciplinary approach. It is argued that any future educational profile should comprise measurement science and land management, and that it should be supported by and embedding in a broad interdisciplinary paradigm of spatial information management.

An interdisciplinary approach to surveying education makes it possible to address issues and problems in their real-life context. The paper describes the basic principles of this educational model and builds a case for re-engineering the role of the universities to further this new IT-paradigm to surveying education.

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1. INTRODUCTION

The evolution of modern land administration systems is seen as major challenge to the surveying profession. The institutional impact is significant. Governments recognize the importance of spatial information to economic development and environmental management and government institutions as well as private sector companies continue to evolve.

The spatial information revolution has also had a profound influence on educational and professional structures. Professions such as surveying are being re-engineered and re-invented to accommodate the spatial information revolution while endeavoring to maintain traditional services. At university level the impact on surveying has significant. The focus is on spatial information management as a core discipline to combine the traditional areas of measurement science and land management.

The challenge of the future will be to implement the new interdisciplinary IT approach in the traditional educational programs in surveying and engineering.

2. THE GLOBAL CHALLENGES

The main global drivers for change in the spatial information are technology development, micro-economic reform, globalization, and sustainable development (Williamson and Ting, 1999). These global drivers therefore also affect the profile of the surveying profession and challenge the educational basis of the profession.

Technology development is the major driving force in changing the face of the spatial information world. The GPS technologies for measuring have revolutionized the traditional surveying discipline and the high-resolution satellite imagery tends to revolutionize the mapping discipline. The database technologies for storage of large data sets and the GIS technologies for data management, analysis and manipulation arguably have had the greatest impact on the spatial information environment. And in the future the communication technologies such as the WWW and the Internet will become the focus of attention for viewing and using spatial data. However, it must be acknowledged that technological development is not the only driver.

Micro-economic reform in many countries has had dramatic impact on the spatial information environment. The micro-economic reform initiatives represent the institutional and governmental side of the changes observed during the latest two decades. This includes initiatives such as privatization, decentralization, downsizing, cost recovery, performance contracts, quality assurance, public/private partnership, and other policies to ensure service delivery and cost effectiveness. These initiatives have changed the focus from the pure technological issues to include also the more managerial components of building and

maintaining national spatial data infrastructures.

Globalization is becoming a reality driven by IT and communication technologies. A globalized world is one in which political, economic, cultural, and social events become more interconnected. The process includes that events in one part of the world increasingly have potential to impact on people and societies in other parts of the world. Globalization widens the perspectives from the local to the global level. Globalization has a social, economic, political, as well as an educational dimension. The www is the most graphic example of this trend, even if the full potential of the web as an educational resource is still to be seen.

Sustainable development will be a driving force in policies developed through the decades ahead. Sustainable development is development that effectively incorporates economic, social and environmental concerns in decision-making which "meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission, 1987). Land administration, in particular, involves decision making of such a multidisciplinary nature having a fare reaching impact at national, regional and local level of government.

Taking these global drivers into account, it is no surprise that changes are taking place in the definition and nature of the surveying profession and practice.

3. INTERNATIONAL TRENDS IN SURVEYING EDUCATION

Management skills versus specialist skills. The changes in the surveying profession and practice and especially the development of new push button technologies has voiced the need for including the core discipline of management as a basic element in today's surveying education. Traditional specialist skills are no longer sufficient or adequate to serve the client base. Surveyors need to have the skill to plan and manage diverse projects that include not only technical skills, but those of other professions as well. In short, *the modern surveyor has to be capable not only of managing within change but managing the change itself* (Hoogsteden, 1998).

Technological developments take the skill out of measurement and the processing of data. Almost any individual can press buttons to create survey information and process this information in automated systems. In the same way, technological developments make GIS a tool available to almost any individual. The skill of the future lies in the interpretation of the data and in their management in such a way as to meet the needs of customers, institutions and communities. Therefore, *management skills will be a key demand in the future surveying world.*

Project-organized education versus subject-based education. An alternative to traditional subject-based education is found in the project organized model where traditional taught courses assisted by actual practice are replaced by project work assisted by courses. The aim of the project work is "learning by doing" or "action learning". The project work is problem-based. *The aim is broad understanding and the ability to deal with new and unknown problems.*

In general the focus of university education should be more on "**learning to learn**". The traditional focus on acquisition of professional and technical skills (knowing how) often imply an "add-on" approach where for each new innovation one or more courses must be added to the curriculum to address a new technique. In is argued that this traditional subject-based approach should be modified by giving increased attention to entrepreneurial and managerial skills and to the process of problem-solving on a scientific basis (knowing why).

Virtual academy versus classroom lecture courses. There is no doubt that traditional classroom lecturing will be supported by or even replaced by virtual media. The use of distance learning and the www tends to be integrated tools for course delivery, which may lead to the establishment of the "virtual classroom" even at a global level. This trend will challenge the traditional role of the universities. *The traditional focus on the on-campus activities will change into a more open role of serving the profession and the society.*

The computer cannot replace the teacher and the learning process cannot be automated. However, there is no doubt that the concept of virtual academy represents new opportunities especially for facilitating for the process of learning and understanding and for widening the role the universities. And the web techniques that are used for course delivery on a distant learning basis represent a key technological engine, especially in the area of lifelong learning programs.

Lifelong learning versus vocational training. There was a time, when one qualified for life, once and for all. Today we must qualify constantly just to keep up. Consequently, the concept of lifelong learning or continuing professional development (CPD) has gained increasing attention. The CPD concept includes the continuous review of personal capabilities and the developing a structured action plan to enhance exiting existing and acquire new skills. *University graduation, in this context, is only the first step in a lifelong educational process.*

4. A MANAGERIAL AND INTERDISCIPLINARY APPROACH

Surveying has traditionally leaned strongly towards engineering. There is a need to shift to teaching management skills applicable to interdisciplinary work situations.

Surveying and mapping are clearly technical disciplines (within natural and technical science) while cadastre, land management and spatial planning are judicial or managerial disciplines (within social science). The identity of the surveying profession and its educational base should be in the management of spatial data, while maintaining links to the technical as well as social sciences.

Land administration infrastructures have moved away from being "provider" driven to becoming more "user" driven. Land administration is interdisciplinary by nature, requiring strong skills for management and problem solving. The ability to access, to interact with and to contribute to a wide range of public and private databases at a distance will become the norm in many areas of surveying. In fact, new demands on the profession will change the skill-base of the surveying workforce, especially of those surveyors holding managerial

responsibilities.

5. THE EDUACTIONAL PROFILE OF THE FUTURE

The universities should act as the main facilitator within the process of forming and promoting the future identity of the surveying profession. Here, the area GIS and, especially, the area managing geographical and spatial information should be the core component of the identity. This responsibility or duty of the universities, then, should be carried out in close co-operation with the industry and the professional institutions.

One of the main challenges of the future will be to implement the new IT-paradigm and the new interdisciplinary approach in the traditional educational programs in surveying and engineering. A future educational profile in this area should be composed by the areas of Measurement Science and Land Administration and supported by and embedding in a broad interdisciplinary paradigm of Geographic Information Management. Such a profile is illustrated in figure below.

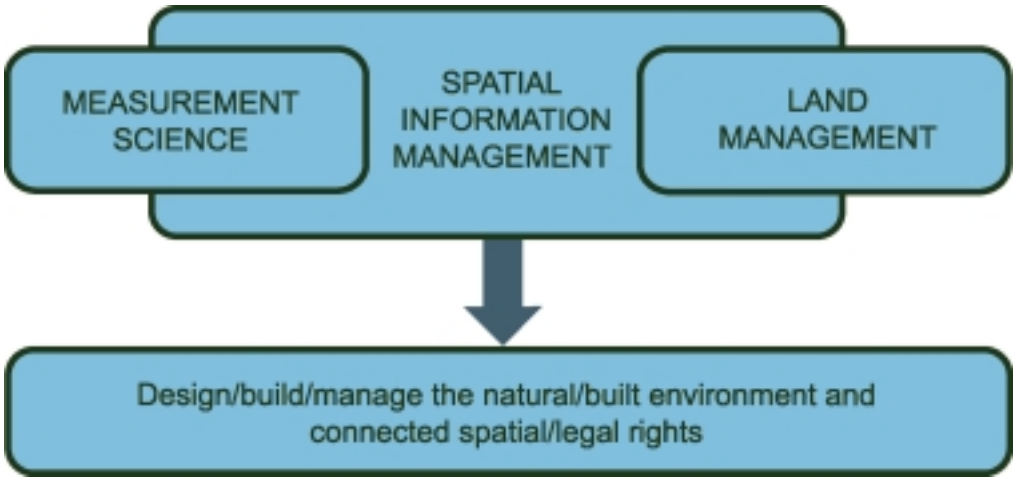


Figure 5. The surveying education profile of the future (Enemark, 2001).

This future profile was developed through a joint FIG and CLGE seminar held at Delft University of Technology, November 2000 (Enemark and Prendergast, 2001). The seminar also concluded, that a better understanding of different educational and competence models can establish a general improvement of the educational base and enhancement of professional competence in the broad surveying discipline throughout Europe and also at a more global scale (Mattsson, 2001).

6. LEARNING TO LEARN

Another main challenge of the future will be to accept that the only constant is change. To deal with constant change the educational base must be flexible. Graduates must possess skills to adapt to a rapidly changing labor market and they must possess skills to deal even with the unknown problems of the future. Professional and technical skills can be acquired and updated at a later stage in one's career; skills for theoretical problem-solving and skills

for “learning to learn” can only be achieved through academic training at the universities.

Recent studies (Coleman, 1998) have confirmed that students retain only 10 per cent of what they read and only 20 per cent of what they hear. However, if a problem is simulated, then up to 90 per cent of the lessons learned may be retained. This finding is behind the shift in the pedagogical doctrine toward project work and problem-based learning. It emphasizes learning instead of teaching. Learning is not like pouring water into a glass. Learning is an active process of investigation and creation based on the learners` interest, curiosity and experience and should result in expanded insights, knowledge and skills.

A consequence of this shift from teaching to learning is that *the task of the teacher is altered from the transferring of knowledge into facilitating learning.* Project work also fulfills an important pedagogical objective. Student must be able to explain the results of their studies and investigations to other students in the group. This skill appears to be vital to professional and theoretical cognition: *Knowledge is only established for real when one is able to explain this knowledge to others.* In traditional education the students restore knowledge presented by the teacher. When the project organized model is used, the knowledge is established through investigations and through discussion between the student members of the project group, and mainly without the presence of the teacher.

7. PROJECT-ORGANIZED EDUCATION

Project-organized means that traditional taught courses and labs is replaced by project work assisted by lecture courses. The project-organized concept moves the perspective from description and analyzing into synthesizing 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 their supervisor.

Problem-based means that traditional textbook-knowledge is replaced by the knowledge necessary to solve theoretical problems. The problem-based concept moves the perspective from understanding of common knowledge into ability to develop new knowledge. The aim of the project work is "learning by doing" or "action learning". The project work may be organized by using a "know-how" approach for training professional functions, or it may be organized by using a "know-why" approach for training methodological skills of problem-analysis and application.

The difference between traditional subject-oriented education and this project-oriented educational model may be expressed in short by an old Chinese proverb:

"Tell me and I will forget
Show me and I will remember
Involve me and I will understand
Step back and I will act"

8. FLEXIBILITY AND ADAPTABILITY

In order to provide for the use of project work as a basic educational element the curriculum has to be organised into general subjects or "themes" normally covering a semester. The themes chosen in a programme must be generalised in such a way, that the themes in total will constitute the general aim or professional profile of the curriculum. The themes should provide for studying the core elements of the subjects included (through the lecture courses given) as well as exploring (through the project work) the application of the subjects in professional practice.

The flexibility and adaptability of the project-organized educational model may be explained under three headings:

- The adaptability of the *individual theme*. This means that the focus on subjects presented in the courses and dealt with during the project work is easily updated or changed to reflect technical and professional development in society. Subjects and contents of the lecture courses are planned in advance, before starting the semester, to ensure that they include the most topical issues within professional practice.

- The adaptability of the *total curriculum*. This means that the focus of the themes in total may easily be adjusted or changed according to the needs and development of professional practice, and consistent with the current technological development

- The adaptability of the *graduates*. Each graduate will possess specialized knowledge within one of the three main areas (Mapping, Land Management or Spatial Planning). However, graduates will also possess the ability to understand and adapt interaction between the three main areas because of the basic knowledge they acquired during the second phase of the curriculum and the methodological skills established during the project work.

The consequences of this educational model are that the new graduates are less experienced in solving standard everyday problems, as they will appear in a further employment. They are, however, expected to be much better qualified to undertake large and complicated tasks, to combine insight from different fields, to analyze new problems and to make them acquainted with new fields to which the problems of practice are related.

The aim is a 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 ensured that the graduates have obtained the skills and experience needed to solve also the unknown problems of the future (Kjersdam and Enemark, 1994).

9. VIRTUAL ACADEMY AND KNOWLEDGE MANAGEMENT

The role of the universities will have to be reengineered based on the new IT-paradigm. The key word will be knowledge management. 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 made available on the web. Existing knowledge and research results should also be made available, and packed in way tailored for use in different areas of professional practice. All graduates will then have access to the newest knowledge throughout their professional life.

The first step forward could be establishment of web-based platforms within the different professional areas. The content of these platforms should be peer reviewed just like the content of professional journals is reviewed. The platforms should be developed to include a local, national, and an international approach. The international approach could be developed through agreements between leading universities throughout the world aiming to provide knowledge tailored to the needs of the international community and international aid organizations such as the United Nations and the World Bank.

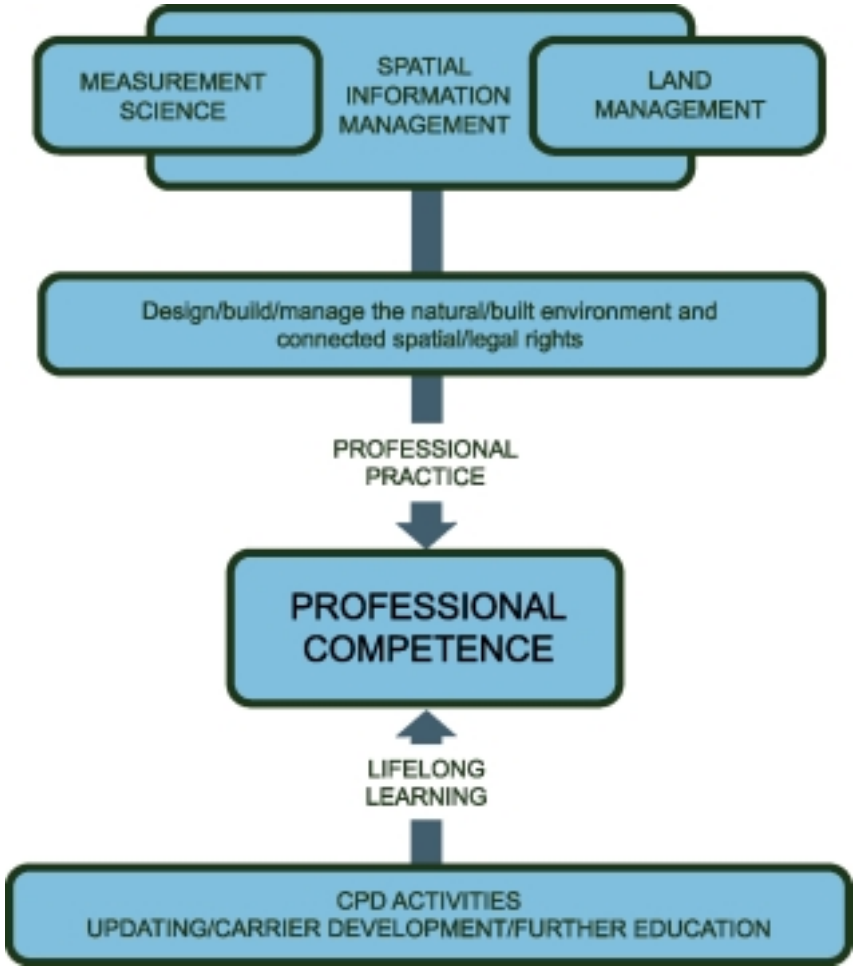
The concept of knowledge management has a lot in common with the concept for National Spatial Data Infrastructures that provides the basic policies for data sharing.

10. LIFELONG LEARNING

There was a time when university graduation was the ticket for a lifelong professional career. This is no longer true. Today, one must qualify constantly just to keep up. The idea of "learning for life" is replaced by the concept of lifelong learning. The response of many professions to this challenge has been to promote the concept of Continuing Professional Development (Enemark, 1997).

It has been estimated that the knowledge gained in a vocational degree course has an average life span of about four years. While this will vary according to the discipline it does nevertheless highlight the increasing need to maintain an active interest in keeping up to date with changing technology, legislation and operational procedures. If at the same time professionals have expectations of increased managerial responsibility the need to acquire new skills and knowledge is even more acute (Kennie and Enemark, 1996).

University graduation is not the end in itself but only the fist step in a lifelong educational process. A model of learning for life in the surveying field is shown in the figure below.



12. CLOSING REMARKS

Even if the content of surveying curricula may vary between countries, some general trends may be identified. There is clearly a trend towards increased focus on managerial issues and the acquisition and application of interdisciplinary problem-solving skills. Regarding course delivery, there is a trend towards increased use of project-based education as well as skills for teamwork, co-operation and communication. And web based learning tends to become an integrated tool for course delivery.

The challenge of the future will be to apply the new IT-paradigm and a new interdisciplinary approach to surveying education. Furthermore, it should be recognized that the only constant in the future is change. To deal with such significant change the educational base must be flexible. The graduates must process skills to adapt to a rapidly changing labor market and they must process skills to deal even with the unknown problems of the future. Skills for learning to learn have become increasingly essential. In this sense, the project-oriented educational model at Aalborg University has proved to be successful.

University graduation must be seen as not the end in itself but as only the first step in a

lifelong educational process. In this regard there will be a need to establish a new balance between the universities and professional practice. This new balance should allow the professionals to interact with the universities and thereby get access to continual updating of their professional skills in a lifelong learning perspective.

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BIOGRAPHICAL NOTES

Prof. Stig Enemark is Head and Managing Director of the Surveying and Planning School at Aalborg University, where he is Reader in Cadastral Science and Land Management. He is Master of Science in Surveying, Planning and Land Management and he obtained his license for cadastral surveying in 1970. He worked for ten years as a consultant surveyor in private practice. He is Vice-President of the Danish Association of Chartered Surveyors and Invited Fellow of the Royal Institution of Chartered Surveyors, UK. He was awarded the Danish Real Estate Prize in 1991, and in 1994 he was appointed National Expert to the European Union within the areas of land management and spatial planning. He was Chairman (1994-98) of FIG Commission 2 (Professional Education) and he is an Honorary Member of FIG. His teaching and research interests are in the area of land administration systems and the application of cadastral systems for land management and spatial planning. Another research area is within project-organized educational and the interaction between education, research and professional practice. He has consulted and published widely within these topics, and presented invited papers at more than 40 international conferences.