AN OVERVIEW TO VIRTUAL ACADEMY - METHODS AND TECHNIQUES

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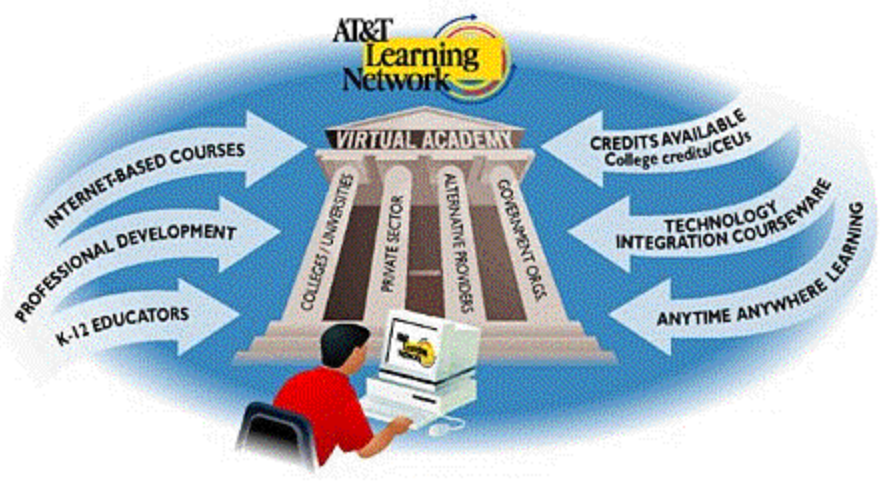
1. INTRODUCTION

Virtual academy is an academy which works within an information network. It consists of a common understanding among its members to provide their knowledge, expertise and research products to each other and for co-operative use. The modern information technology is most suitable for this purpose as the academy may function internationally and at any distance. A profound option of a network is that the information only is transferred and not necessarily the people.

The infrastructure of a virtual academy consists of three essential elements of information technology, namely the network, the content and the graphics. The network is the realization of current telecommunication technology whereas the content will be mainly the data produced by the academy. The graphics includes the physical perception of the information to work with.



Referring to a commercial press release by the company AT&T on October 16, 1998: "Virtual academy is an online centralized resource that provides teachers and educators with access to web based professional development opportunities and courses. It underscores AT&T's commitment to support lifelong learning for teachers into the next century by helping them meet their expanding credential requirements – anytime, anywhere." The virtual academy of AT&T's is a collaboration with Penn State University and a publishing company called T.H.E. Journal.

This division of the information technology to its three elements is rather ambiguous. However, it is vital for an academic discipline to distinguish these and develop its own future accordingly. Although the driven force in developing the infrastructure is no doubt the telecommunication society the value of the academy depends entirely on its capacity to accumulate the information, i.e. to collect data, to derive new knowledge, and to use it when educating new engineers or scientists.

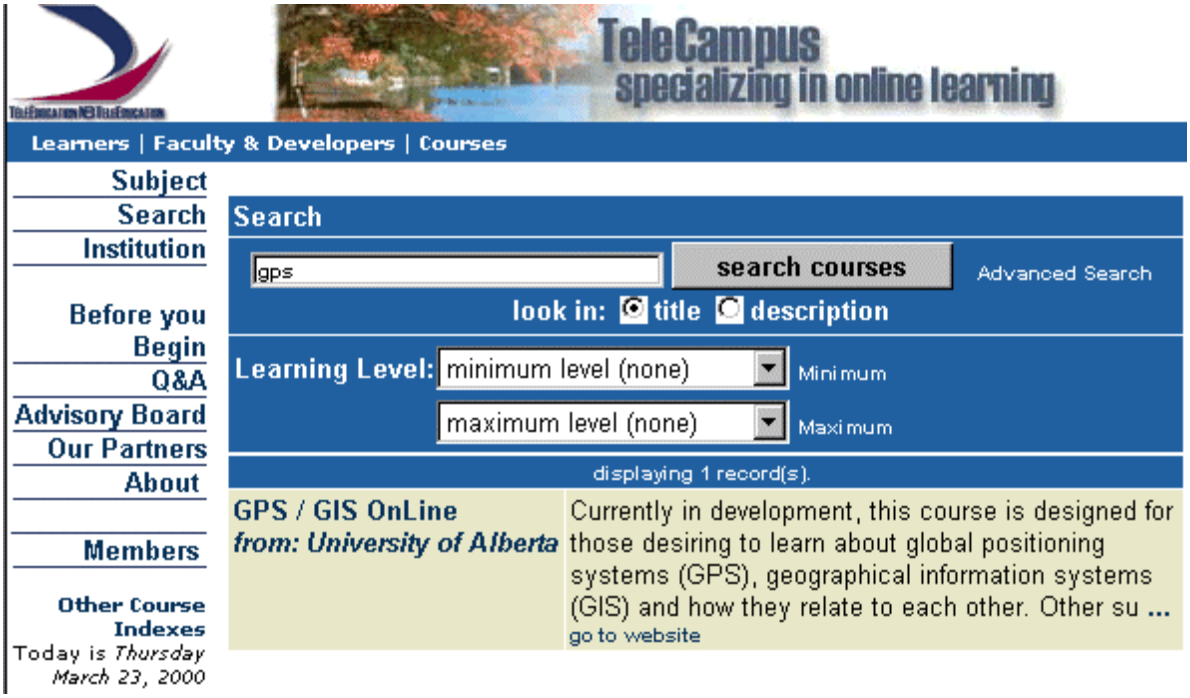
As it regards our professional discipline within geoinformation sciences, we primarily produce the information content but we also provide parts of the graphics. Thus the combination of the information technology, the geoinformation science and the education of surveyors would provide a most prosperous basis for creating a virtual academy.

2. VIRTUAL UNIVERSITY AND DISTANCE LEARNING

The virtual university is the concept which was recently adopted by e.g. Aalborg University, Denmark. The word "virtual" in combination with university might at first glance mislead, but is in fact nothing else than effective use of modern information and communication technology. In Aalborg this covers not only education and research but also administration activities. Sørensen describes the virtual university being an "integration within the university as a whole of the technological tools which can prepare, develop and make more efficient the university's services, especially education and research, including those services which support education and research". (Munk Sørensen, 1999).

The guiding principles in Aalborg have been described as strict demands upon quality, competency and openness. The information technology should not be used for the sake of technology itself but whenever any qualitative boost is expected. The competency of a graduate can be qualified by the level of education, by the level of both professional expertise and cross disciplinary awareness, as well as by individual skills for communication, for creative work, or for socio-economic judgment. The openness is argumented in order to promote both internal and external accessibility to education, knowledge and information.

The strategy within Aalborg virtual university is emphasizing not only the global aspects but also the local ones. The global aspects are essential on the university level in order to complement the local faculties and their expertise. The local aspects are essential on the research level. The university will maintain and enforce its leading role in research fields which are ranked internationally high in the university's strategy plan. The continuity is crucial in attracting capable researchers and in recruiting them to the university in the future. (Munk Sørensen, 1999).



In Canada, the TeleCampus of New Brunswick is a good example of organized distance learning. It provides to the residents of New Brunswick and other regions cost-effective, equitable access to a range of training, information and educational services. Special priority is given to residents of the more geographically and socially isolated communities of the province. The province not only profits from the educational content accessed by residents, but also by their exposure to and active use of modern media. Among the values upon which the network is based we may find the cooperation and resource sharing, the partnership approach to development and educational innovation, and the openness, creativity and innovation.

Access to distance learning is made possible locally via a network of Community Learning Centres and globally via TeleCampus, which is an online teaching and learning environment. It collects courses from various universities and the access to these courses is managed by a search able database. TeleEducation New Brunswick provides assistance in the development and delivery of distance education programmes.

3. VIRTUAL ACADEMY

An academy is originally a suite for creative thinking. In such a function the Greek academy lived for 900 years before it was closed in 529. Thereafter it took more than five hundred years before the European universities lived up again. Now they have developed in 900 years to the modern academy of our time.

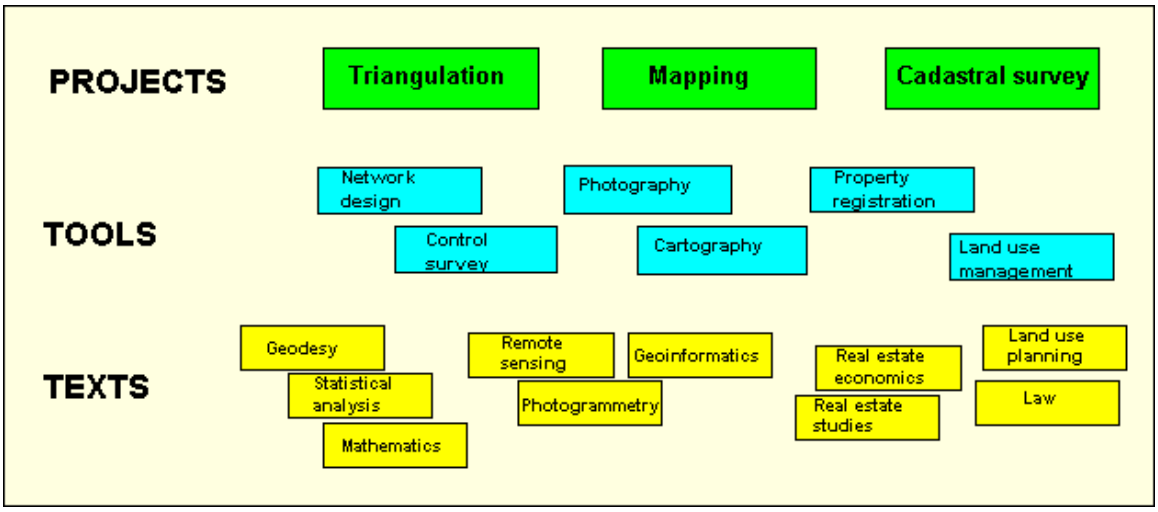
Meanwhile the academy has become more like an educational institution serving the economy rather than a scientific institution for its members. The current option for the virtual academy is to let the academy and education functions join. In other words, the academic research projects and the project based education could face each other and interfere.

Plato and his students gathered in the garden of the Greek hero Academos. At Helsinki University of Technology the graduate students of geomatics still gather within the department building. However, the department introduced in 1997 a virtual academy called M-net which is now developing. The necessary infrastructure for both internal and external telecommunication was based on Internet and switched Fast Ethernet network.

The first phase in producing contents for the M-net has consisted transformation of analog teaching material to digital one and serving it both to the lecture rooms and for the students via network. Although having nearly nothing to do with the information accumulation this first contact within the M-net has shown to be vital in experiencing the available technologies both in communication and in producing the contents. The practical tools for producing and serving the material have been the WWW and respective composers.

The second phase has been in activating students to produce their own works within the network and to publish the material for common use. Usually these have been seminar works and special assignments which are published as hypertext documents. The third phase will be the interactive one where the teachers and students "solve" problems together.

Regarding the modules which will be necessary for problem oriented education we may divide them according to pedagogic levels. We call these levels "TEXTS", "TOOLS" and "PROJECTS". The attached example is imaginary, but tends to describe how a curriculum would be composed through the three.



- The "TEXTS" level consists of individual courses and contain the necessary lectures for detailed theory and links to the references. The level also produces the necessary manuals for later works.
- The "TOOLS" level contains software and all technical support like instrumentation for students when exercising the theory and parts of the technology. The tool level is also for experimenting procedures by combining tools and algorithms.
- The "PROJECTS" level is the one for solving practical professional problems. This is performed according to the project specifications and given data.

As a fourth level we add a level for "RESEARCH".

4. INFORMATION ACCUMULATION

Level	**Elements for information accumulation** **Medium** **Material** **Competence**		
TEXTS	theory, algorithms	text books, manuals	undergraduates
TOOLS	Procedures	software, hardware, instrumentation	bachelors
PROJECTS	data, specifications	Documentation	masters
RESEARCH	knowledge, information	theses, publications	postgraduates (incl. post doctorates)

As it regards the virtual academy its prosperity depends solely on its capacity of information accumulation. The four levels of the academy can be characterized in the process of information accumulation in following way:

- On level of "TEXTS" the media for information transformation is the theory and algorithms. These are published in text books written primarily for pedagogic purposes or in manuals written for professional purposes. The competence to which this first level relates would be the one of undergraduates.

- The "TOOLS" level deals with procedures for building functional modules based on theory and algorithms. These modules consist of application software, necessary hardware and instrumentation. The competence relates to the one of bachelors and engineers.

- The media for information transformation on the "PROJECTS" level is any practical data necessary for managing the project according to given specifications. The documentation would contain case studies on previous works and aspects of quality, legislation, standards, etc. The work is based on combining previously learned procedures and the information outcome would be the professional skill. The competence relate to the one of masters or diploma engineers.

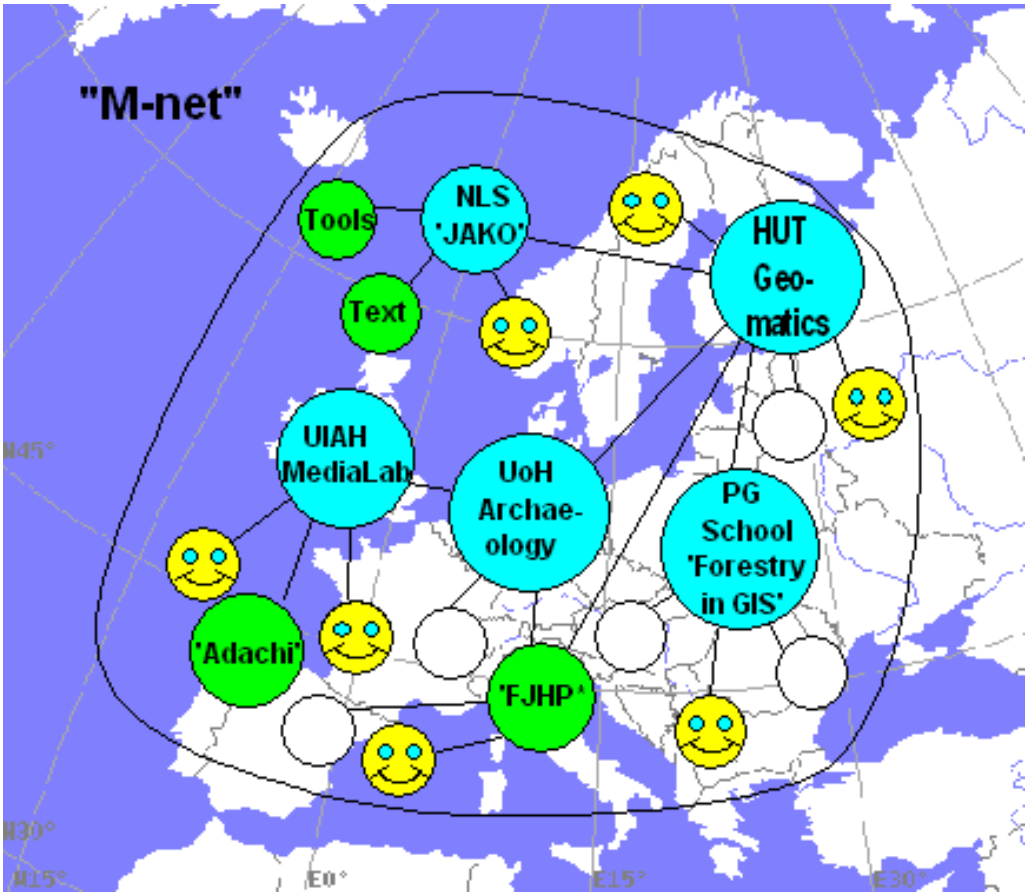
- The "RESEARCH" level deals with production of new knowledge and information. The outcome consists of theses and scientific publications. The competence is the one of postgraduates and post doctorates.

The three first levels are the ones of the educational domain. There the competence will be qualified by the profession and controlled by respective market demand. The competence of the "RESEARCH" level is qualified by the outcome of the entire process of information accumulation and controlled by the scientific community.

5. NETWORKING

As it regards the virtual academy, it will be of vital importance that the information accumulation becomes higher than compared to the outcome of physical academy alone. Therefore the key issue will be networking both internally and externally. As the history of virtual academy is short, our experiences of active networking are still minimal. However, it seems that the tokens of a positive future are ever propagating.

Internally the accumulation function becomes reactive. For example, the students are given parts of the research projects where they may exercise the new procedures developed by the researchers. Or, the researchers produce new parts of theory and algorithms to text books and manuals and the students are provided with this updated information.



Externally the accumulation function becomes supportive by outsourcing. The outsourcing is the way by which both scientific and professional communities may cooperate in producing common material for "TEXTS" and "TOOLS" levels, or in organizing interdisciplinary campaigns on "PROJECT" and "RESEARCH" levels. Within M-net we have currently such actions with several institutions already. The abbreviations are: HUT for Helsinki University of Technology, PG for post graduate, UoH for University of Helsinki, UIAH for University of Art and Design Helsinki, and NLS for National Land Survey of Finland. The 'JAKO', 'Adachi' and 'FJHP' are examples of project names.

6. EXAMPLES IN PHOTOGRAMMETRY

Within HUT photogrammetry we started to develop our own virtual academy in 1993 (Haggrén, 1996). At that time we built the necessary framework like the home pages for all our courses. They consisted the necessary information on the goal and contents of each course, the schedules for lectures and exercises plus the reference information for the literature. The mode was for all passive. Since then the courses have proceeded individually. Most of the courses are now on the "TEXTS" level. Some have reached already the "TOOLS" level and one even "PROJECT" level.

The basic course in photogrammetry can be given as an example of the "TEXTS" level. It consists of 13 chapters corresponding to 13 lectures. The lecture material contains the necessary theory parts and for some parts "TOOLS" for demonstrations. The "TOOLS" can be activated within lectures showing functional behavior of some photogrammetric

principles or procedures. The same "TOOLS" are available through network and can be activated by students while learning the theory.

Categories	**Classes**
Object's action	stable, moving, standby
Measuring task	orientation, geometry, motion, deformation
Measuring dimensions	partial (1D, 2D or 3D), total (2D or 3D), volumetric (3D), photometry (2D or 3D)
Object size	very small, small, large, very large, extra large
Measuring accuracy	moderate, good, high, very high, extreme high
Measuring principle	digital photogrammetry, analog photogrammetry, range imaging, microscopic imaging, theodolites, CMM's, mechanical or optical gauging, other optical techniques
Number of measured points	few points, tens of points, hundreds, thousands, tens of thousands, hundreds of thousands (or unlimited)
Recording site	on site, in laboratory, existing documents
Processing site	on line, off line

The course of close range applications is an example of the activity on the "PROJECTS" level. There we have a data base consisting classified information of published measurement cases and their procedures. For each case we have nine categories according to which the case are to be classified. The categories are object's action, measuring task, measuring dimensions, object size, measuring accuracy, measuring principle, number of measured points, recording site and processing time. Each category is further divided to classes like "SMALL", "LARGE", "VERY LARGE", and "EXTRA LARGE" for the category of object's size, or "GEOMETRY", "ORIENTATION", "MOTION", or "DEFORMATION" for the category of measuring task. The publications are reviewed and the cases classified by the students as well. This data is then revised by the teacher together with the students and added to the data base.

This production of data base functionally belongs to literature research and represents thus the "PROJECTS" level. While performing this kind of literature research the students become to understand measuring problems, their solutions and selected procedures.

7. PLANS FOR FIG

The FIG Working group 2.2 on "Virtual academy - distance learning" is specifically projected for information dissemination concerning the virtual academy issues relevant to FIG, by collecting hyper links to web sites relevant for distance learning in surveying education, and by creating an educational database on Internet as it regards respective tools and experiences (Artimo, 1999). We are also establishing contacts with the Internet and multimedia experts outside FIG. Results will be reported to the XXII FIG Congress in Washington in 2002.

The WG aims to organize an FIG Workshop on "Virtual academy - distance learning" where current activities within the topic will be presented. The workshop will be held in Finland, Espoo in June 2001. According to the main theme of the workshop, we try to

accomplish it by organizing at least one special session for online "distance learning" together with some remotely locating group. As it regards the content of this special session and the selection of co-organizing counterparts we will be happy to have any response.

In order to prepare the program for the workshop we will meet during the FIG Working Week in Prague.

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