Teaching and Learning Infrastructure in Geoinformatics

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SUMMARY

Information and communication technologies (ICT) have a crucial impact on our daily life, working routine education or learning. The revolution indicated by ICT holds great promise and opens enormous challenges. It is difficult to control but impossible to defend against. We are under a pressure of continuous changes, transforming all traditional way of learning, working to prepare our learners for their future.

The author is chair of FIG Commission 2 – Professional Education. The paper is giving a synthesis of lessons learned at conferences, seminars and workshops organized by FIG Commission 2 in the last four years on curriculum development, e-Learning and educational marketing and management.

As a director of Lands and Geoinformation Knowledge Center, Faculty of Geoinformatics, University of West Hungary (GEO), the author coordinates research and development in e-Learning. The paper is sharing experiences of these activities in co-operation with the industry and universities worldwide. The outcomes support specialization, improve quality, increase choice, and lead to a better fit with changing vocational demands in Land Administration. The results of the investigations in e-Learning and future plans are presented.

1. INTRODUCTION

In the middle of the last century a new device was introduced: the computer. In the last fifty years computers changed the work of surveyors totally. First, it changed dramatically our computational habits in sixties, afterwards the mapping devices and the data processing practice as a whole, the entire way of thinking. Nowadays computers are used only for a very little percentage for computing, they are totally integrated in our workflow, serving us within data acquisition, database developments, data processing, data analysis and visualization. The introduction of Internet and the rapid changes of Information and Communication Technologies (ICT) caused fundamental transformation of our profession, which is exploring now best the ways how to serve the new e-Society.

e-Society requires a new organisational setting, optimising the links between citizens, private sector and public administration. The e-commerce business is opening completely new ways and opportunities of data acquisition, management, administration and distribution (Hawerk, 2004). The new requirements ask for a new definition of competences of all public institutions acting in a global network. e-Government has become an issue in all fields of public administration. e-Land Administration is a major part of e-Government and can be considered as a strong fundament for legal, administrative and technical structures for the whole public administration, it contributes to better transparency in the real estate market and attracts new services and new registrations. e-Cadastre data have been considered as a core of Geo-Spatial Data Infrastructure. One of the first specific events on this field was an FIG seminar on e-Land Administration, in Innsbruck, Austria (Lemmen, van der Molen, and Schennach, 2004). At the FIG Congress in Munich four technical sessions targeted the current status and new developments. During the second half of this decade e-Cadastre and e-Land Administration became a focal topic of FIG Commission 7. Many of FIG countries are implementing e-Cadastre or have already in place. Commission 3 is also dealing seriously with the technical, legal and managerial issues of SDI in e-Governance.

In ICT the "analogue to digital" shift is almost behind us. Nowadays there is an accelerating move from "wired to mobile" and beyond. The new technologies allow ubiquitous computing as a new model of human-computer interaction in which information processing has been thoroughly integrated into everyday objects and activities. Using ubiquitous computing we engage many computational devices and systems simultaneously, and may not necessarily even be aware that we are doing so. This is a significant difference from the desktop environment. In ubiquitous environment it is possible to seamlessly connect "anytime, anywhere, by anything and anyone", and to exchange a wide range of information by means of accessible, affordable and user friendly devices and services. To highlight the mentioned "ubiquitous" character "u-Society" is often used for information society or e-Society. In such a society, people will be able to share information and knowledge easily which will help them realize their full potential in supporting sustainable development and improving the quality of life (Takamara, 2005). Ensuring efficient and effective delivery of services and benefits require that progress should be continual towards "u-Cadastre".

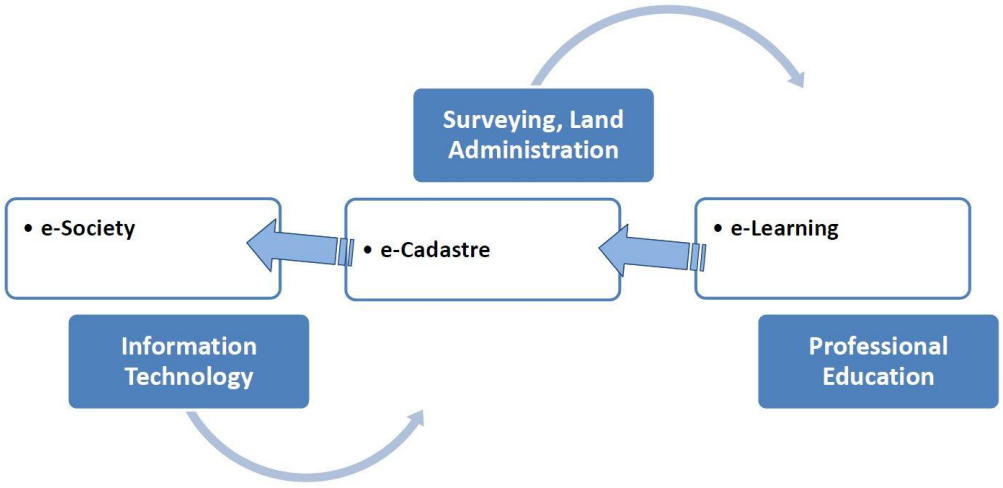

Fig.1. Professional education is essential in managing changes

Main obstacles for change are the organisations and employees themselves, being afraid to loose power and giving up old traditions. The digital divide is an important point of attention. That is why education and training is essential not only in the implementation of the new technologies and processes, but in generating the changes. On the other hand universities can benefit from the industrial trends. The cooperation between academy and industry is a necessity. FIG Commission 2 (Professional Education) is working very closely with other Commissions.

The above mentioned facts were recognized by FIG Commission on Professional Education and responded by its mission statements, which aim to promote good practices:

- Endorsing universities and other educational organisations to explore the needs of society and to manage in a pro-active way the necessary changes in the "knowledge age".
- Supporting academic institutions and industry with new methods of knowledge management, helping surveyors continuously to update their academic and professional profiles.
- Advancing educational business and curriculum tuning processes.
- Promoting content development experiences, facilitating international researches in surveying education and training and to initiate joint projects on this field (curriculum development, educational material development, joint courses, quality assurance etc.).
- Strengthening knowledge transfer between FIG Commissions, inspiring activities on knowledge networks.
- Improving dissemination of information on educational theory and practice to the members across the world.
- Reinforcing contacts to Educational Commissions of International Organisations on the related professions.

For the realization of the mission Working Groups (WG) were formed:

- WG 2.1 Curriculum development: Quality curriculum and instruction are - as they have always been - the bedrock of education and the way to developing thoughtful and competent professionals. The curriculum should ensure that the learners gain knowledge as effectively and efficiently as possible.
- WG 2.2 e-Learning: To successfully disseminate the knowledge, it is essential to have an up-to-date learning environment. Thanks to the development in information and communication technologies, there have been lots of possibilities and tools re-engineer the classical teaching methods. Because of e-Learning methods are expected to play an increasing role in professional education there is a growing need for knowledge transfer on this field.
- WG 2.3 Educational Management and Marketing: Knowledge dissemination is not only a methodological or technical problem. Institutes have to own the rights how the learning materials may be available for others, as well as taking into account commercial aspects.

The main aim of this publication is to look back into the last four years and to summarize the results of FIG Commission 2 on the field of computer uses in surveying education, to help academy, surveying industry and land administration to make the transformation from traditional teaching and learning to e-learning more quickly. In information technology infrastructure is the hardware used to

interconnect computers and users. In our interpretation e-learning infrastructure is a composition of hardware, software, knowledge base and teaching staff serving the learning society. The workshops, working weeks and conferences organized by FIG and Commission 2 cover many continents and the participants came from many countries. In the title of this paper "worldwide" reflects this feature.

2. LESSONS LEARNED

e-Governance is closely related to Knowledge Management and e-Learning. The smooth introduction of different services of the Information Society is unrealizable without knowledge management, which helps organisations gain insight and understanding from their own experiences. The interconnected, intelligent organisations are using shared knowledge bases. Discipline and practical aspects in the professional education cannot exist without considering the changes generated by the above two. It was a joint decision of three FIG commissions, namely Commission 2 (Professional Education), Commission 3 (Spatial Information Management) and Commission 7 (Cadastre and Land Management) to organize a joint workshop on these topics in 2006. During the workshop a "Professional Competence Model" was introduced by Stig Enemark. Professional competence relates to the status as an expert. This status cannot be achieved only through university graduation and it cannot be achieved solely through professional practice. University graduation is no longer a ticket for a lifelong professional carrier. Today one must qualify constantly just to keep up. The idea of "learning for life" is replaced by the concept of lifelong learning. E-Learning is essential in this regard (Enemark, 2006).
Learning platforms were also investigated on this workshop. Learning platforms are software-controlled learning infrastructures that attempt to replicate what teachers do in the face-to-face classroom. These platforms are normally located on a computer on the Internet (or an Intranet) and are typically accessed by means of a Web browser. Within the last decade numerous e-Learning platforms (e.g. Blackboard, Hyperwave, Ilias, Metacoon, Moodle) were developed with different concepts and supporting different operating systems. Most of them offer a wide range of functionality for the publication of documents, for promoting the interaction between lecturers and students, and for administration purposes. The systems have features, like electronic assignment submissions, virtual areas for group work, self-assessment quizzes and online testing, tracking specific student activity, poll, glossary, survey, discussion forums, and links to external web-sites (Mansberger et al, 2006).

Developers still often focus on one of the segments of the Learning environment. The platforms allow academic staff and learners to go through the processes that what we'd expect to encounter at the traditional campus (e.g: student enrolment, induction and support, ticking the class attendance roll, chalk and talk combined with class discussion, practice of skills, assessment etc.). A rigid replication of the traditional campus delivery model is an intermediate solution. Learners need to be equipped with more contemporary skills such as logic, initiative, self-directedness and online research skills. This requires a complete re-think as to how online platforms are designed. Interoperatibility should also be handled as on the most important issues in system design. For this reason a conceptual

model of an educational gateway was developed at the Faculty of Geoinformatics, University of West Hungary. The functions of the gateway are listed below (Markus, 2003):

- Marketing functions (support for needs analysis, promotion of e-Learning, enquiries from prospective learners, etc).
- Management subsystem (hardware, software, knowledge management, networking and quality management, accreditation issues, etc).
- Content development (it supports authoring, knowledge mining, uploading learning units and their metadata, maintenance and archive of the knowledge base).
- Course production (learning path definition, recognition, course calendar, course maintenance, etc).
- Administration: academic administration (enrolment, accounting, certificates, placements and alumni), course administration (content data, course backup, student's, tutor's, author's data) and financial administration (contracts, ensuring IPR for authors).
- Portal: introduction, contacts, overview, press, news, events, course offering (next course, learning advises, opportunities, achievements), "my workplace" settings, using the workplace (selecting the right PC, selecting an Internet Service Provider (ISP), solving technical problems, learning how to learn online, access to modules, assignment upload: auto path, name, marking, feedback, progress info, grades). Other typical support services of the portal are: help desk, FAQ, tutoring, mentoring, download (free software, public data, and publications), virtual library (papers, presentations, and links), communication with tutors, instructors, collaboration with other students. The portal also serves for examinations, evaluating courses, building a virtual club, collaborative learning and for job offering.

According to Russell Ackoff, the content of the human mind can be classified into five categories (Ackoff, 1989):

1. Data: facts or figures;
2. Information: data that are useful; answers to "who", "what", "where", and "when";
3. Knowledge: application of information; answers "how";
4. Understanding: appreciation of "why";
5. Wisdom: evaluated understanding.

The Data-Information-Knowledge-Wisdom (DIKW) hierarchy can have many dimensions. One dimension of Ackoff's hierarchy is temporal. He says that while information ages rapidly, knowledge has a longer life-span and only understanding has an aura of permanence. It is wisdom that he considers to be permanent (Bellinger et al., 2004). Based on the "Professional Competence Model" the DIKW pyramid should be extended with Competences and Decision (Fig. 2).

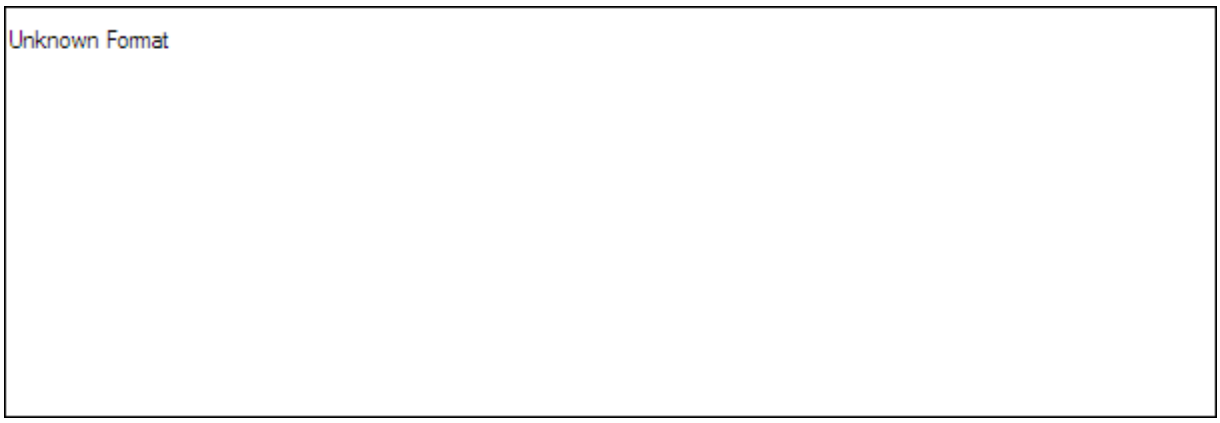

Fig. 2. Competence pyramid

Curriculum issues were always on the agenda of Commission 2. The ambitions for definition of the Core Curriculum in Surveying are failed before. The definition based on competences is probably easier. Curriculum development was discussed in our Prague workshop (Čepek, 2007). Educators and the industry are searching for the most effective way to determine what should be included in a new curriculum and what is the best method to offer that curriculum - both for entering students and for working professionals updating their skills. Ann Johnson in her presentation covered some of the work that has taken place and is ongoing to help educators and industry meet the challenge of incorporating new technologies and teaching methods into the GI curriculum to meet the current and future needs of the profession. The presented approach for building the "Geographic Information Science and Technology Body of Knowledge" (http://www.aag.org/bok/) is a useful methodological guide.

The studies on this field resulted valuable sources like "Civil Engineering Body of Knowledge" (American Society of Civil Engineers, 2004) or "Landscape architecture Body of Knowledge" (American Society of Landscape Architects, 2005). Based on these experiences an approach for Surveying Body of Knowledge was published by Joshua Greenfeld and Laramie Potts (Greenfeld and Potts, 2008). By these authors the 21st Century surveyor must demonstrate the following core competencies:

1. an ability to apply knowledge of mathematics, science and engineering/applied science/technology;
2. an ability to design and conduct experiments, as well as analyze and interpret data;
3. an ability to design a system, component, or process to meet desired needs;
4. an ability to function in multi-disciplinary teams;
5. an ability to identify, formulate and solve surveying (engineering) problems;
6. an understanding of professional and ethical responsibility;
7. an ability to communicate effectively;
8. a broad education necessary to understand the impact of surveying (engineering) solutions in a global and societal context;
9. a recognition of the need for, and an ability to engage in, life-long learning;

10. a knowledge of contemporary issues;
11. an ability to use the techniques, skills, and modern surveying (engineering) tools necessary for practice;
12. an ability to apply knowledge in a specialized area related to surveying;
13. an understanding of the elements of supervision and project management;
14. an understanding of business and public policy and administration fundamentals;
15. an understanding of the role of the leader and leadership principles.

In 2008 a group of international professionals engaged in e-learning and distance education came together in ITC for the International Workshop Sharing Good Practices: e-learning in surveying, geo-information sciences and land administration. The organisation of the workshop was a combined effort of Commission 2 and Commission 7, and the International Institute for Geo-information Science and Earth Observation (ITC) in the Netherlands. During the workshop a final decision was made that Commission 2 has to support FIG members with the accumulated knowledge on e-Learning. The experiences on e-Learning form an FIG Technical Report, edited by Liza Groenendijk. The main actors were Stig Enemark, Bela Markus, Steven Frank, Reinfried Mansberger, Adrijana Car, Jim Petch and Nicholas Frunzi. The content is a summary of lessons learned in e-learning during the last FIG events, basically at the workshop in Enschede, June 2008.

The publication declares the FIG policy in this field as follows:

- FIG will stimulate e-learning by raising the awareness about the paradigm shift in education from teaching to learning, by communicating employability and life-long-learning as the new requirements for an up-to-date academic professional education, and by incentivising teaching staff (e.g. FIG award for e-learning).
- FIG will distribute information on the topic of e-learning to the surveying community, e.g. by publishing conference papers, by this booklet on e-learning, by compiling a reference book about e-learning or by a register of "good practice".
- FIG will bring experts together to share their knowledge on the topic of e-learning. This can be done physically during conferences or workshops or virtually in form of electronic discussion forums.
- FIG promotes e-learning networks starting with FIG Commission 2 as a seed. But FIG will also increase cooperation on the topic of e-learning with other organisations in the field of geosciences, like ISPRS and ICA.
- FIG will encourage their members to develop and share e-learning contents within surveying education. This can be achieved by the establishment of a database with specific learning materials, such as literature, scripts, interactive learning tools, test questions, etc; and through development of a quality assessment guide for e-learning courses.
- FIG will influence and encourage governmental and administrative bodies to support the introduction of e-learning and life-long-learning as well as to provide the political frame conditions to enhance these activities.

The Working Group 2.3 on Educational Management and Marketing and the Austrian Society for Surveying and Geoinformation (OVG) organised jointly an international workshop in 2009 led by

Mr. Gert Steinkellner and Dr. Reinfried Mansberger. The participants discussed topics on Marketing of Professional Education; Availability of Continuous Professional Development; Educational Networks – Globalisation of Surveying Education; Quality Assurance in Surveying Education and Training; New Methods for Knowledge Transfer and Scope of Competences in Professional Education. The proceedings including keynotes and papers are published as a special issue of the Austrian Journal for Surveying and Geoinformation. Results and key messages of this conference will be presented at the FIG Congress 2010 in Sydney.

3. PROJECTS

The Lands and Geoinformation Knowledge Center, Faculty of Geoinformatics, University of West Hungary (GEO) coordinates research and development activities in e-Learning in co-operation with the industry and universities worldwide. The outcomes support specialization, improve quality, increase choice, and lead to a better fit with changing vocational demands in Land Administration, in Geographical Information Systems and in educational developments in general. As an illustration four projects will be briefly introduced.

3.1. Re.ViCa

Through the experience of past and present projects that have been exploring and refining the concepts of Virtual Campus and Virtual Mobility a gradual shift of concepts is noticed: from the "well-defined" clear, 100% online Virtual Campus to Virtual Mobility, whereby the more traditional universities open their borders, collaborate supra/intra institutionally and often (inter)nationally, and/or involve non-traditional students through e-learning. Actually, there is no strict definition of Virtual Campus or Virtual Mobility anymore. Every campus becomes a Virtual Campus, and every mobility has some form of Virtual Mobility included. “Blended models” gain more and more interest and attention. All in all, there seems to be a common feeling that a redefinition of the “Virtual Campus” concept is necessary, in order for it to be applicable to the educational needs of today. The Re.ViCa (Reviewing traces of European Virtual Campuses) project has exactly been set up with this aim (http://revica.europace.org/).
The Re.ViCa project ran from October 2007 until October 2009, coordinated by EuroPACE (www.europace.org). The project has been funded with support from the European Commission ERASMUS programme. Its general aim was to make an inventory and to carry out a systematic review of cross-institutional Virtual Campus initiatives of the past decade within higher education at European, national and regional levels. The main objective of the Re.ViCa project was to identify relevant parameters and success factors for evaluating and comparing Virtual Campuses, based on thorough research and expert input.

As a direct outcome a handbook was edited. In this handbook, the project partners tried to provide a glimpse into this complex world and how all institutions are experimenting with the set-up of what the handbook refers to as virtual campuses. In particular, the handbook gathers the outcomes and experiences of the Re.ViCa project. Without a doubt, the internet, open-source software, the OER (Open Educational Resources) movement and – on the other hand – the global economic crisis are

all stimulating the reform of the European Higher Education Area (EHEA). Policymakers, international organisations, higher education institutions and researchers in the field of education agree that Information and Communication Technologies (ICT) have the potential to stimulate international collaboration, to create flexible learning paths and to open the borders of the university. The handbook is useful for the FIG academic community, working for many years on a Virtual Academy in Surveying. It is downloadable from http://revica.europace.org/Re.ViCa Online Handbook.pdf.

3.2. VESTA-GIS

In the last years, the need for rational and functional management of geo-information within the European Community, as well as the need for a EU dimension to education and training, have been more than once stressed by the European policies. On the one hand, the main EU directive concerning spatial information is the INSPIRE Directive. The purpose of this directive is to lay down general rules aimed at the establishment of the Infrastructure for Spatial Information in the European Community, for the purposes of the Community environmental policies and policies or activities, which may have an impact on the environment. INSPIRE measures will ensure that the infrastructures for spatial information created by the Member States are compatible and usable within the whole community and in transboundary contexts. Shifting to more sectoral issues, Member States are asked for example by the Water Framework Directive 2000/60/EC and the Habitat Directive 92/43/EEC to provide the Commission with information on the state of the waters and of the sites of community importance in a GIS-compatible format and submit maps in GIS format.

As stated in several studies, to cope with the new European challenges there is a strong need to build the technological, political and human capacity at all levels necessary for the effective and widespread use of geo-information (e.g. see the European GI strategy of the GINIE project). This is particularly important in the implementation of INSPIRE that implies high profile skills on metadata, interoperability of spatial datasets and services, network services, geo-data sharing. On the other hand, the Copenhagen declaration, starting from the Lisbon strategy pillars that recognise the important role of education as an integral part of economic and social EU policies, aims to enhance the cooperation in vocational education and training (VET) in Europe.

An assessment survey was undertaken in 2005/2006 to identify the training needs of European GI users (GI-INDEED project - Geo-Information in the Implementation of Net-based Distance Education for Environmental Decision-making). The results defined the levels and role of the possible users, indicated their GIS skills and competences, the importance and characteristics of GIS use in their daily work and provided input for the course content.

The main aim of VESTA-GIS project is to create a network operating on a comprehensive framework "a clearing house" devoted to combine access to training courses (mostly throughout distance learning facilities and organisation) and mobility opportunities. The VESTA-GIS project is coordinated by GISIG (www.gisig.it) and supported by European Commission Lifelong Learning

Programme. The project is then developed according to two parallel objective streams (http://www.vesta-gis.eu).

1. The "Training Framework" aims to collect, organise and deliver vocational training content on the GIS technology and tools as well as on their sectoral applications. The trainee should access such tool to check his/her knowledge and to find the most suitable training path to follow according the individuated needs. This first objective will be achieved, among others, also setting-up a Training Catalogue and an e-Learning distributed Platform, where the relevant courses and other training content available by the network partners are accessible by a course builder, able to guide a motivated choice of the best learning path a trainee should undertake. To ensure quality and consistence, the courses to be published on the VESTA Platform are selected according to the outcomes of the analysis of the training course offer and demand and adjusted to conform with course metadata.

2. The "Mobility Framework" aims to create procedures and a context for promoting people mobility both placements into a working GI environment of new graduates and short visits to increase the sharing of knowledge and the exchange of experiences.

The target of VESTA-GIS is also an operational training network between experts of Geo-information and GI users in the Application domains with the aim of favouring/stimulating the involvement of sectoral stakeholders both as course-providers and ways to get a qualified and larger audience. VESTA-GIS is then structured in thematic sub-streams inside the above mentioned Training and Mobility Frameworks. Being VESTA-GIS an open network the training wish to be addressed both to external trainees and to “internal” trainees from organisations included within the network, so that the partners can also take advantage from the experience of the other ones, compare their knowledge and improve their education in GIS application domains.

3.3. GIT4SD and DUPinGIS

Kazakhstan is the largest country in Central Asia. The challenge that Kazakhstan faces today is how to achieve and maintain a sustainable development in both political and economic areas. For sustainable development, Kazakhstan needs to modernize and diversify its economy and integrate more with the world community. One of the important reforms that Kazakhstan has been implementing is land privatization and land registration. This reform will lay a legal foundation for land tenure and land transactions in the future. Due to the lack of competent local experts, Land registration and Cadastre in Kazakhstan has not been based on modern information technology. This situation has seriously delayed the progress of land registration programme.

Tajikistan is also in the early stage of political and economic transitions. It faces the challenges of mass unemployment, insufficient food supply, a collapse of the social welfare system and a majority of population living below the poverty line. To overcome the above mentioned severe difficulties, it is

necessary to implement social and economic reforms. One of the reforms that the Tajik government is now implementing is privatization and registration of land and real properties. This reform has received financial and technical support from the Swedish government via the Swedish International Development Agency (SIDA). After the implementation of this reform, Tajik households will have a greater degree of self-determination over land and a better investment climate can be created to develop more effectively Tajikistan's agriculture and land-based resources.

The two countries have similar needs regarding educational needs in geomatics and GIS. Therefore, Royal Institute of Technology (KTH) in Stockholm and University of West Hungary (UWH) proposed very similar joint European projects within the EU TEMPUS Programme to improve higher education both in Kazakhstan and Tajikistan in the field of surveying, geodesy and geographic information technology. After carefully evaluating Kazakh and Tajik universities with surveying education, we have chosen as partners the Kazakh Leading Academy of Architecture and Civil Engineering (KazGASA, Almaty) and Tajik Agrarian University (TAU, Dushanbe).

The projects (GIT4SD in Kazakhstan and DUPinGIS in Tajikistan) created new master programmes "Geodesy and Geoinformatics". The programmes combined traditional geodesy and cartography education with advanced training in geographic information technology. After finishing this programme students will be able to:
- define and maintain geodetic reference systems,
- perform positioning and mapping using modern surveying and photogrammetric methods,
- manage and visualize digital geographic information,
- develop and apply Geographic Information Systems (GIS).

The new master programmes will significantly raise the academic level of higher education in Kazakhstan and Tajikistan. Upgrading of teaching staff's competence and equipment at both universities will hopefully promote improvement in other surveying education institutions in Central Asia.

4. OUTLOOK

When we plan any educational development activities, we should look carefully into the future. As changes are accelerating in the information age, FIG Commission 2 is also facing with many new challenges. Finally we would like to highlight two of them.

As we mentioned in the introduction the citizens of the information society are supported now with ubiquitous computing. Land professionals are working on the development of ubiquitous cadastre. The academic community is forced to invest in ubiquitous learning (or u-learning), which is beyond e-learning, it has similarities to some form of simple mobile learning, but opens lots of new possibilities. In the ubiquitous learning environment students can become totally absorbed in the learning process. Ubiquitous learning environment allows students to access education flexibly, calmly and seamlessly (Jones, 2004). Learning is happening all around the student but the student

may not even be conscious of the learning process. Source data is present in the embedded objects and students do not have to do anything in order to learn. "They just have to be there" (Wikipedia: ubiquitous learning). Is it a dream or back to the past? The method was used for centuries in the ancient schools and it is used when the family teaches the children, or by pre-school education. The loop is closed.

U-learning in the future will revolutionise education and remove many of the physical constraints of traditional learning. Moreover, the integration of adaptive learning with ubiquitous computing and u-learning may offer great innovation in the delivery of education, allow advanced personalisation and customisation to student needs. A ubiquitous learning environment enables people to learn at any time and any place, but of course, the fundamental issue is how to provide learners with the right information at the right time in the right way (Ogata, 2004).

The other challenge is open education. Information technology was reached by the idea of open systems in early 1980's. It arrived to our profession in the mid-90's in the initiatives of OpenGIS Consortium (http://www.opengeospatial.org/). The academic institutions during that time started to change the term "distance education" and to use "open learning" instead. The openness responded the need for lifelong learning, and reflected that the courses are open for everybody. "Open education" is a different issue.

"Open education is a collective term that refers to forms of education in which knowledge, ideas or important aspects of teaching methodology or infrastructure are shared freely over the internet. It was inspired by related concepts like Creative Commons, open source, open data and open access, and expands them to include lectures and other courseware" (Wikipedia: open education). Progress on the challenge of sustainability is critically important to the open education movement. A number of 'next generation' open education projects are emerging that take new approaches to sustainability and open education. Although open education initiatives young, and not without its pressing problems, but the movement is growing in impetus and maturity, and promises to greatly help the lives of people (Wiley, 2009).

5. CONCLUSIONS

Curriculum development, e-Learning methods and tools, and Educational Management are strongly intertwined key issues for handling changes in professional education. Curriculum issues were always on the agenda of Commission 2. The ambitions for definition of the Core Curriculum in Surveying are failed before. The definition based on competences will be easier probably. Curriculum development was deeply discussed in our Prague workshop (Cepek, 2007) and the discussion should continue.

In 2008 at ITC (Enschede) a successful International Workshop on "Sharing Good Practices: e-learning in surveying, geo-information sciences and land administration" was held. Its results and Commission 2 experiences on e-Learning form an FIG Technical Report, edited by Liza

Groenendijk. It will be published during the FIG Congress in Sydney. The publication declares the FIG policy in this field.

We need e-Learning infrastructure in our education that:

- easy and fast to develop, on low costs,
- allow high interactivity with quick response time,
- require short timeslots from learners without leaving their workplace,
- increasing effectiveness.

Therefore, there is a strong demand for international cooperation in educational developments, however, contrary to the field of Geoinformation Technologies in our profession there are only few examples of these international co-operations, there is a lack of collaborations in networked education.

The Vienna workshop in 2009 was dedicated to Educational Marketing and Management. The participants discussed topics on Marketing of Professional Education; Availability of Continuous Professional Development; Educational Networks – Globalisation of Surveying Education; Quality Assurance in Surveying Education and Training; New Methods for Knowledge Transfer and Scope of Competences in Professional Education. International programmes often sponsor Spatial Data Infrastructure developments, but the communication about the essential role of surveyors within SDI is not satisfactory. Strong marketing of the surveying profession is needed at an international level targeting both our clients and the wider community. As a consequence our education and training activities should target not only the surveying professionals, but also our potential users. They should cover a wide range from awareness building to advanced skills for scientific researches.

When we plan any educational development activities, we should look carefully into the future. As changes are accelerating in the information age, FIG Commission 2 is also facing with many challenges. The community of land professionals both academy and industry is invited to join the Commission 2 events to promote universal access to education and training.

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