Managing Curriculum Development and Enhancing Quality

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Key words: curriculum development, quality enhancement

ABSTRACT

The author aims to introduce some concepts and practical tools, which were usefully applied in the curriculum development influenced by the Bologna process and successfully used in the quality enhancement practice.

The first part of the paper is dealing with the definition of education/training needs and involvement of stakeholders curriculum planning. One of the most important outcomes from these activities is the definition of skills and competences; and stakeholder management plan. The curriculum is a crucial component of any education/training activities, it is a road map to knowledge, and it builds knowledge topology. The implementation of new curricula often needs capacity building for faculty delivering education or training. Faculty of Geoinformatics (GEO) at University of West Hungary participated or managed in many relevant international projects. The author will share some good educational practices.

The second part is focusing on curriculum and learning material development methods. The competency matrix will be introduced as a tool used to document and compare the required competencies for graduates. It is used in a gap analysis for determining where critical overlaps between courses are or which skills/competencies are not taught deeply enough.

Quality is omnipresent, ubiquitous – like the cloud of computers. Understanding and evaluating the quality of education requires a comprehensive picture of the unique and complex characters of the system that produced them. The third part of the paper is dealing briefly with quality enhancement issues.

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INTRODUCTION

Surveying education has changed largely in the last decades. Spatial information management became an important element in our education and training programmes. The universities should respond to industry needs, improving the curriculum of their traditional programmes, opening new specializations and ensuring life-long-learning possibilities not only for their graduates, but also adult learners in the related fields of geoinformation technology and science. University education and continuous professional development need innovation in our curricula (Márkus, 2004).

This paper is dealing with some of the development aspects of new educational programmes in Geoinformatics. The author aims to introduce some concepts and practical tools, which were usefully applied in the curriculum development influenced by the Bologna process and successfully used in the quality enhancement practice. Examples in this article come from TEMPUS GE-UZ project (http://www.ge-uz.eu) funded by European Commission Education, Audiovisual and Culture Executive Agency EACEA); and eENVplus project (http://www.eenvplus.eu) funded by European Union under the Competitiveness and Innovation Framework Programme – Information and Communication Technologies Policy Support Programme.

The GE-UZ project aims the development and implementation of a new university program in Geoinformatics to be offered on the second level (Masters) at Uzbek partner universities. The project is coordinated by the author. The specific objectives of the project are:

- to develop a successful MSc in Geoinformatics,
- to ensure that there will be qualified staff available for course delivery by organizing train-the-teachers courses,
- to ensure the universities have adequate equipment for GIS/geodesy teaching by buying geodetic equipment and GIS laboratories,
- to ensure the sustainability of the educational environment by building a sustainable educational network.

The aim of the eENVplus project is to integrate a huge amount of environmental data put at disposal by the involved national/regional environmental agencies and other public and private environmental stakeholders. It will integrate and harmonise existing services in order to answer to the requests of environmental monitoring and reporting drafted by the European, national and local policies and actions. eENVplus provides not only the ICT infrastructure but also the description and the support to make this infrastructure operational and profitable through the provision of an organisational model and a tutored training framework. A special workpackage is dedicated to capacity building and training. Its aim to define customised, flexible Learning Paths for different profiles of stakeholders, built up upon a selection of the

portfolio of training modules offered within a training platform. The project is coordinated by Giorgio Saio at Geographical Information Systems International Group (GISIG, Italy).

1. NEEDS ANALYSIS AND STAKEHOLDER MANAGEMENT

This chapter is dealing with the definition of education/training needs and involvement of stakeholders. One of the most important outcomes from these activities is the definition of skills and competences; and the stakeholder management plan.

1.1 Needs Analysis

The first task in educational development is a needs analysis. The analysis should be designed in order to measure the needs of the academic and industrial stakeholders.

Stakeholder is a person, group, or organization that has direct or indirect stake in the development because it can affect or be affected by the organization's actions, objectives, and policies. Stakeholders in an educational programme development including

- faculty leaders, professors, teachers, administrative staff members;
- students, potential BSc students and their family, student unions;
- relevant ministries, accreditation institutes, other universities as competitors or possible partners;
- employers, government (and its agencies), suppliers, unions, and the professional community etc.

The needs assessment should cover the whole spectrum of the current situation within

- Internal environment (university, faculty, staff, students, existing courses, projects, infrastructure);
- Specific environment (labour market, other universities, companies – staff development, data infrastructure);
- External environment (legal, social, economic, technical, cultural, ethical).

The needs analysis should

- Describe the problems - What gaps exist?
- Determine the needs for training/learning.
- Find out what are driving forces of the needs.
- Evaluate existing courses/trainings by the competitors.
- Assess the potential learning possibilities.
- Discover information about logistical concerns and constraints.
- Define the expected skills and competences.

The acquisition of needs can be done in different ways through questionnaires, interviews or group meetings, where the participants are selected to represent the interests of the larger community.

Fig. 1 and 2 illustrate typical results of the needs analysis.

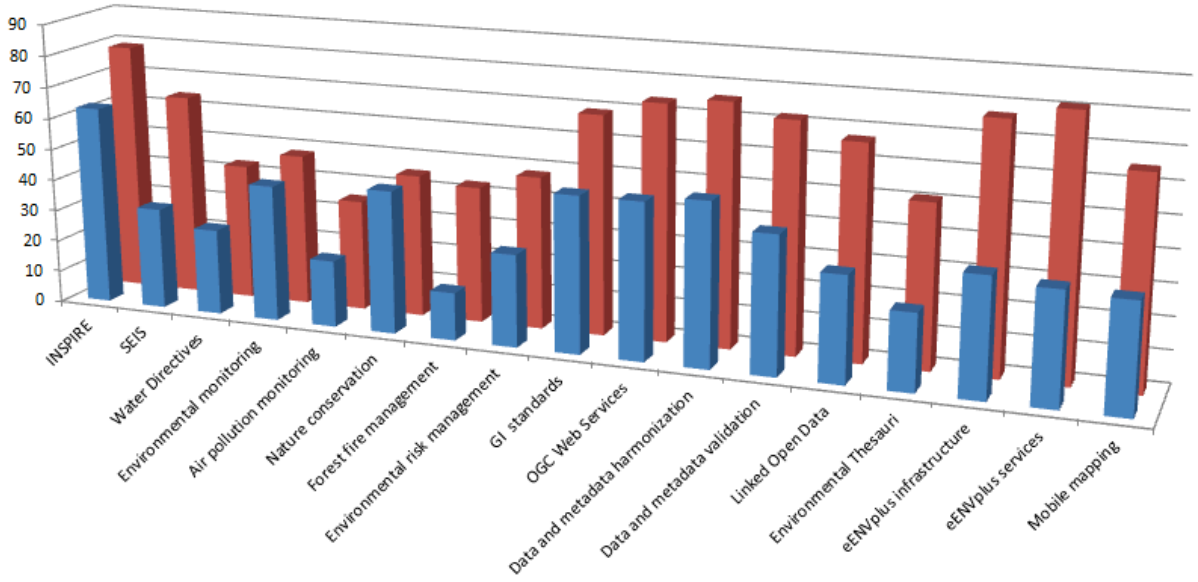


Fig. 1 Knowledge (blue)/Importance (red) diagram (%) (Source: eENVplus)

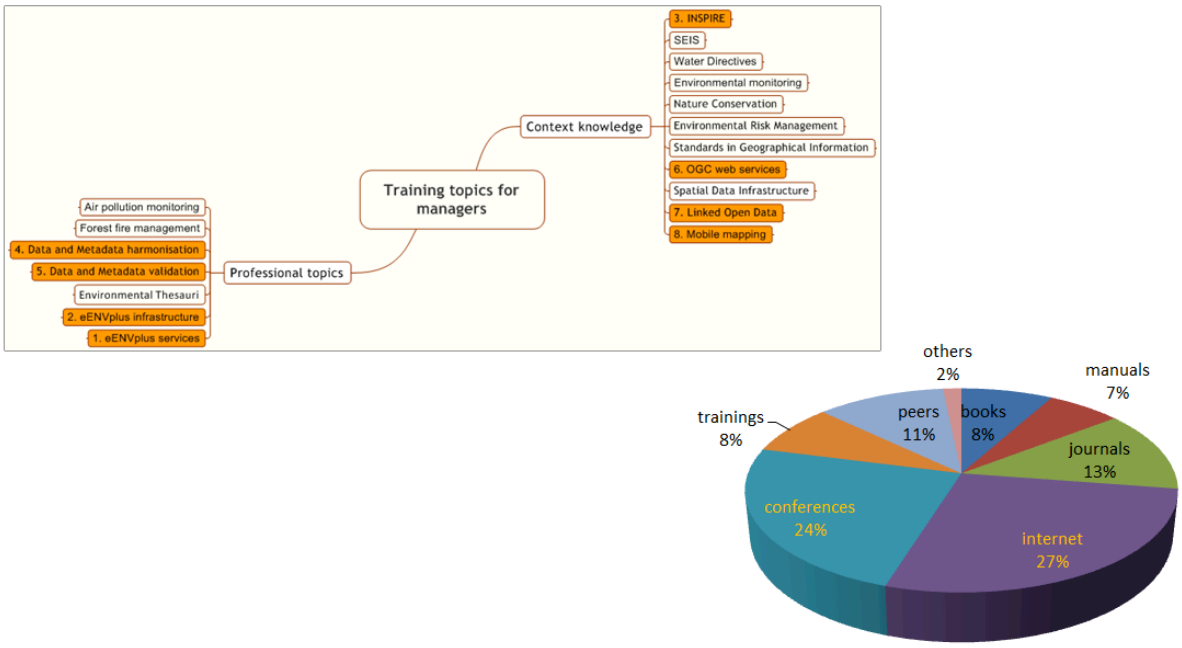


Fig. 2 The most important training topics selected by managers (orange boxes) and preferred mode of delivery in the pie-chart (Source: eENVplus)

1.2 Stakeholders Analysis and Management

Stakeholder analysis is a technique used to identify the people or organisations that have to be won over (Archer, 2003). Stakeholder analysis helps with the identification of the following:

- stakeholders' interests,
- mechanisms to influence other stakeholders,
- potential risks,
- key people to be informed about the project during the execution phase,
- negative stakeholders as well as their adverse effects on the project.

After identification, it is useful to map out the stakeholders on a Power/Interest Grid (as shown in the next figure), and classify them by their power over the project delivery and by their interest in the project.

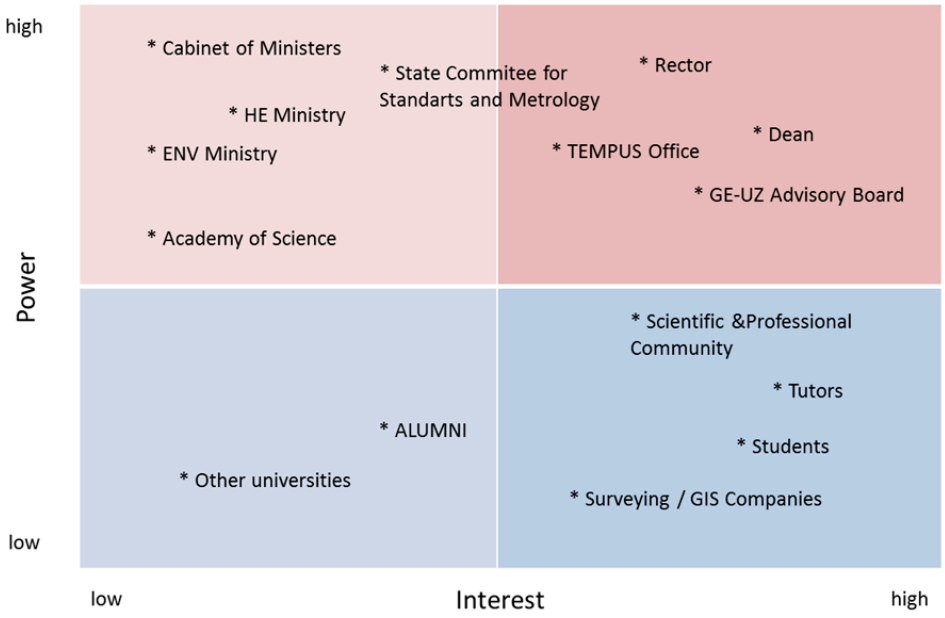


Fig. 3 Power/interest grid of stakeholders (Source: GE-UZ)

Someone's position on the grid shows the actions how to manage them. The aim of stakeholder management is to enhance their interest and to use their support within the project implementation:

- High power, highly interested stakeholder: we must fully engage them and make the greatest efforts to satisfy their expectations.
- High power, less interested group: inform them about the project aims and progress; keep them satisfied.
- Low power, highly interested group: keep them well informed. The efforts of these people or organizations can be very helpful.
- Low power, less interested group: monitor them as needed.

The benefits of using a stakeholder-based project implementation are that:

- We can use the opinions of the powerful stakeholders to shape our projects at an early stage. Their input can also improve the quality of our project.
- Gaining support from stakeholders can help us to win more resources – this makes it more likely that the project will be successful.
- By communicating with stakeholders early and frequently, we can ensure that they understand the benefits of the project – this means they can support us actively when necessary.
- We can anticipate what people's reaction to our project may be, and build into our plan the actions that will win stakeholders' support.

We can summarize the understanding gained on the stakeholder map, so that we can easily see which stakeholders are expected to be blockers or critics, and which stakeholders are likely to be advocates and supporters or your project. A good way of doing this is by colour coding: showing advocates and supporters in green, blockers and critics in red, and others who are neutral in orange.

Based on the careful analysis a strategy can be composed for engagement of stakeholders. Stakeholder management supports the course planners by interpreting and influencing any person or organization who can be positively or negatively impacted by, or cause an impact on the course and by creating positive relationships through the appropriate management of their expectations.

Students	What to do?	When to do?	How to do?	Where to do?	Whom to do?
To create a student society	To organize student unions and assign leaders	Starting from September	Organizing meetings for students to communicate with each others	National Partner universities	Coordinators and teachers
Include in research and applied activity	Include in research and applied activity	During project implementation and after	Promote international projects and international cooperation, including study abroad	In all partner universities	Partner participants, teachers and developers. EU Partners

Fig. 4 Stakeholder management plan (Source: GE-UZ, fragment from stakeholder strategy by Uzbek course developers)

2 CURRICULUM DEVELOPMENT

The second part of the paper is focusing on curriculum development methods. The competency matrix will be introduced as a tool used to document and compare the required competencies for graduates. It is used in a gap analysis for determining where critical overlaps between courses are or which skills/competencies are not taught deeply enough.

2.1 Learning Outcomes vs. Competences

We should make distinction between learning outcomes and knowledge, skills, competences to distinguish the different roles of the most relevant players: educational development staff, learners and other stakeholders (iCOPER, 2011).

Learning outcomes are categorized as: knowledge, skill, and competence. Depending on the level of understanding the learner is obtaining.

- Knowledge: the outcome of learning. Knowledge is the body of facts, principles, theories and practices that is related to a field of study. It's being able to discuss the specific field with a peer, or read technical papers about it.
- Skills: means the ability to apply knowledge and use know-how to complete tasks and solve problems. Skill is all about being useful; it's only about being able to do things.
- Competencies: means the proven ability to use knowledge and skills in work or study situations and in professional and personal development.

In a sense, knowledge is the absence of skill and skill is the absence of knowledge. They are complementary. Regarding competences: the university education is only the starting phase in the professional carrier.

Desired learning outcomes of a process of learning are formulated by the educational development staff, preferably involving project representatives in the process, on the basis of input of internal and external stakeholders.

Professional competences will be reached by life-long learning (LLL) and life-long experiencing. Universities should support their graduates in LLL with different kind of education and training.

2.2 Curriculum

The curriculum is a crucial component of any education/training activities, it is a road map to knowledge, and it builds knowledge topology. Curriculum design includes consideration of aims, intended learning outcomes, concise content, learning and teaching methods, and assessment. The curriculum must be based on the needs of stakeholders, founded on clearly defined skills and competences. The outcome will be a complex material about the new curriculum. It will contain all the required and necessary information for the accreditation.

The syllabus is the detailed content of the programme; the topics, issues or subjects that will be covered as it proceeds (UM, 2013). In selecting content for inclusion, we should bear the following principles in mind:

- It should be relevant to the programme. An effective curriculum is clearly focused on the planned competences. The inclusion of irrelevant topics, however interesting in themselves, may confuse students.
- It should be appropriate to the level of the programme. An efficient curriculum is progressive, leading students onward and building on what has gone before. Material which is too basic or too advanced for the student in current stage erodes motivation to learn.
- It should be up to date and should reflect current trends.

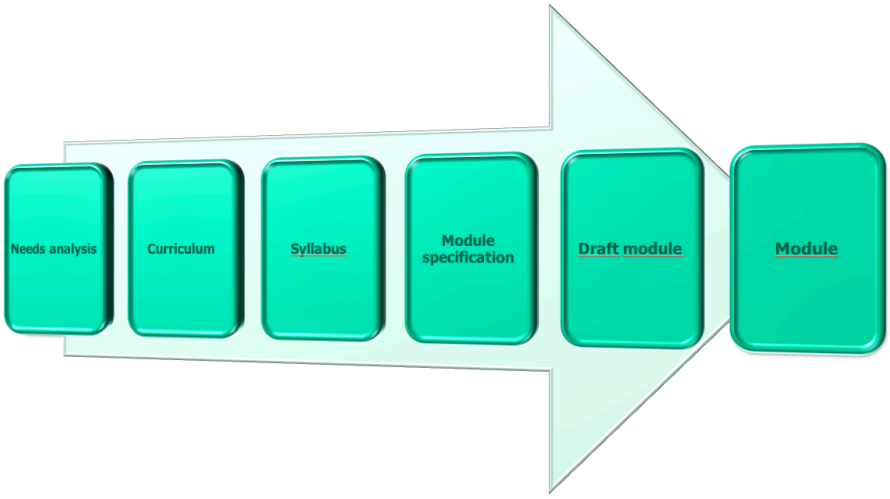
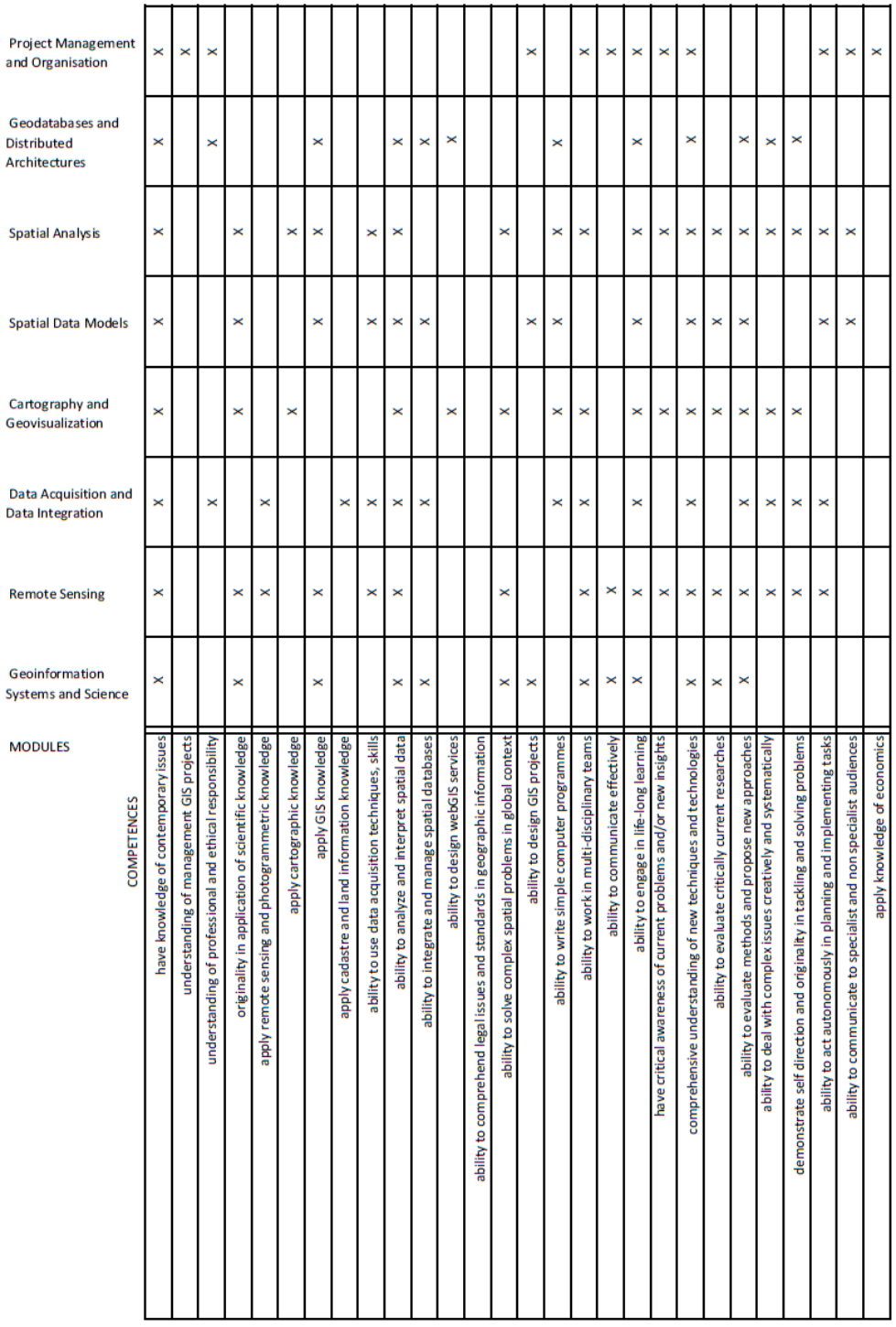


Fig. 5 The module development process

The learning material developers are working on their own module specification. This process needs of course a cross-functional implementation. In the design of detailed content the competency matrix can help to harmonize the work of the development team. The first column of competency matrix contains the name of modules; the competences are listed in the header. Identifying competencies was one of the most important issues in needs analysis. Filling the matrix needs a group meeting of module developers. The first step is to build a draft competency matrix revising and completing competencies. It can be done in many ways – by mind-mapping all skills in detail on the wall, identifying them on sticky notes and grouping, simply brainstorming on the whiteboard.

After that each development team has to check their module against the competences and mark the relevant table cell. Creating the competency matrix will enable the development team to see at a glance, what competences their graduates will possess. The matrix is functioning as a gap analysis tool, and as a discovery instrument of unnecessary overlaps. Any development team can reconstruct their own row in competency matrix to increase cross-functionality and include competencies it might be lacking.



COMPETENCES / MODULES	Geoinformation Systems and Science	Remote Sensing	Data Acquisition and Data Integration	Cartography and Geovisualization	Spatial Data Models	Spatial Analysis	Geodatabases and Distributed Architectures	Project Management and Organisation
have knowledge of contemporary issues	X	X	X	X	X	X	X	X
understanding of management GIS projects								X
understanding of professional and ethical responsibility			X				X	X
originality in application of scientific knowledge	X	X		X	X	X		
apply remote sensing and photogrammetric knowledge		X	X					
apply cartographic knowledge				X		X		
apply GIS knowledge	X	X			X	X	X	
apply cadastre and land information knowledge			X					
ability to use data acquisition techniques, skills		X	X		X	X		
ability to analyze and interpret spatial data	X	X	X	X	X	X	X	
ability to integrate and manage spatial databases	X		X		X		X	
ability to design webGIS services				X			X	
ability to comprehend legal issues and standards in geographic information								
ability to solve complex spatial problems in global context	X	X		X		X		
ability to design GIS projects	X				X			X
ability to write simple computer programmes			X	X	X	X	X	
ability to work in multi-disciplinary teams	X	X	X	X		X		X
ability to communicate effectively	X	X						X
ability to engage in life-long learning	X	X	X	X	X	X	X	X
have critical awareness of current problems and/or new insights		X		X		X		X
comprehensive understanding of new techniques and technologies	X	X	X	X	X	X	X	X
ability to evaluate critically current researches	X	X		X	X	X		
ability to evaluate methods and propose new approaches	X	X	X	X	X	X	X	
ability to deal with complex issues creatively and systematically		X	X	X		X	X	
demonstrate self direction and originality in tackling and solving problems		X	X	X		X	X	
ability to act autonomously in planning and implementing tasks		X	X		X	X		X
ability to communicate to specialist and non specialist audiences					X	X		X
apply knowledge of economics								X

Fig. 6 Competency matrix (Source: GE-UZ, edited by Uzbek course developers). Core competences adapted from Greenfeld, 2010).

The resulting matrix (Fig. 6) contains a consensus between module developers. After creating it requires refinement of module specifications, which support the developers in writing harmonized learning materials. During the development phase the competency matrix may need periodical updating.

To regularize the workflow of the module development general guidelines are useful to ensure that all the partners are following the same schemes and ease the monitoring of the module development activity. In addition to the rules, templates can provide the common schemes for module description.

2.3 Continuing Professional Development

As it was mentioned earlier, the university education is only the starting phase in the professional carrier. Now we should seek to build towards a more flexible programme of short cycle staff development activities. New programmes should be delivered for the management and a set of programmes for all levels of engineering and operative staff in on organisational issues, on skills and on matters pertinent to new challenges.

For strategies to promote a learning-for-all culture, direct measures are needed to motivate potential learners and increase overall participation levels by making learning more attractive in terms of active citizenship, personal performance and employability. Schools, universities and training centres are urged to become local knowledge acquisition centres which are versatile and accessible to everyone.

The urgent task for educational institutions is to reorganise resources for professional development services. In extending existing education and training programmes, the main objectives should be:

- to develop still further the corporate dimension of education;
- to improve the quality of training and foster innovation in education by increasing exchanges of experience and information on good practice;
- to establish an area of training by obtaining recognition of its qualification;
- to promote the virtual mobility, which was made possible by new communication technologies;
- to develop common databases and other sources of knowledge on skills needs;
- to conduct comparative research on methodologies used and policies implemented;
- to improve the interoperability of systems of distance learning and increase the level of standardisation.

The development of electronic learning resources is particularly expensive and often produces course materials that are platform or operating system dependent. This situation has led to discussion of the creation of standardized learning objects that can operate across hardware platforms and software systems.

Metadata will be fundamental in implementing such systems. Whilst learning units form the building blocks of a networked and inter-connected environment, metadata is required to bind

the units together and allow them to interoperate. Metadata is required to describe what learning units look like, how to build a learning route from them, what if any refinements or value adding operations have been carried out on a unit, and in a networked environment what services a tutor/learner can request from a server and what parameters the teacher/student should send to the server to request the service (Márkus, 2000).

3 QUALITY

Quality is omnipresent, ubiquitous – like the cloud of computers. Understanding and evaluating the quality of education requires a comprehensive picture of the unique and complex characters of the system that produced them. The third part of the paper is dealing briefly with quality enhancement issues.

Quality management has four main components: quality planning, quality control, quality assurance and quality improvement. Quality management uses quality assurance and control of processes as well as products to achieve more consistent quality.

- Quality planning is a systematic process that translates quality policy into Measurable objectives and requirements, and lays down a sequence of steps for realizing them within a specified timeframe.
- Quality control means the detection of defects. It is a process that is used to ensure a certain level of quality in a product or service.
- Quality assurance is the prevention of defects. It is the systematic measurement, comparison with a standard, monitoring of processes and an associated feedback loop that confers error prevention. This can be contrasted with quality control, which is focused on process outputs.
- Quality improvement is a formal approach to the analysis of performance and systematic efforts to improve it. Total quality management is an integrative philosophy of management for continuously improving the quality of products, services and processes.

The European Network for Quality Assurance in Higher Education was established in 2000 to promote European co-operation in the field of quality assurance. In November 2004 the General Assembly transformed the Network into the European Association for Quality Assurance in Higher Education (ENQA). The idea for the association originates from the European Pilot Project for Evaluating Quality in Higher Education (1994 – 95), which demonstrated the value of sharing and developing experience in the area of quality assurance. ENQA fulfils its mission by adhering to the following principles:

- ENQA respects the diversity of European higher education a major cultural heritage and strength of the emerging European Higher Education Area (EHEA), the diversity of quality assurance and enhancement approaches.

- ENQA acknowledges that the primary responsibility for quality rests with higher education institutions. External quality assurance, for which QA agencies are responsible, fulfils a different need: at its best it combines both accountability for the reassurance of the public and an objective and developmental role for enhancing

quality in institutions. The role of national authorities is to define the given national QA setup and to ensure that the national QA system operates in harmony with the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG).
- ENQA is committed to respect the fitness for purpose principle (purpose-process alignment) that is at the core of the European dimension of quality assurance.
- ENQA considers the autonomy of institutions and independence of quality assurance agencies within national HE systems as a necessary condition to ensure the full exercise of their responsibilities, notably with regard to the provision of accurate and consistent information to the general public.

The quality of higher education has proven to be at the heart of the setting up of a European Higher Education Area. Therefore, the Berlin Communiqué proposed that by 2005 national quality assurance systems should include:
- A definition of the responsibilities of the bodies and institutions involved.
- Evaluation of programmes or institutions, including internal assessment, external review, participation of students and the publication of results.
- A system of accreditation, certification or comparable procedures.
- International participation, co-operation and networking.

Bergen Communiqués (2005) underlined the quality of research and education. As a consequence the quality management systems were improved at the universities based on re-engineered quality manuals. The quality manual is an official document produced by the university that details how its quality management system operates. A typical quality manual includes:
- Quality policy
- Mission statement
- Quality Management System Architecture
- Quality improvement program
- Course initiation, regular internal monitoring and evaluation
- Consumer protection
- Teachers evaluation
- Self-assessment process
- Feedback forms

For the same reason ENQA published in 2005 its report on ESG. The recommendations of the report resulted in many universities an additional document called „Quality improvement plan". It is for internal quality assurance, targeting continuous refinement of educational processes.

The „Quality improvement plan" consists of the following seven key areas:
- Policy and procedures for quality assurance
- Approval, monitoring and periodic review of programmes and awards
- Assessment of students
- Quality assurance of teaching staff

- Learning resources and student support
- Information systems
- Public information

The standards are in three parts covering internal quality assurance of higher education institutions, external quality assurance of higher education, and quality assurance of external quality assurance agencies (ENQA, 2009).

4 CONCLUSIONS

The job market in general will become much more dynamic, complex and heterogeneous. Information and communication technologies as driving forces in the network revolution will have a dramatic impact on our daily life, working routine and education. We must transform educational institutions in order to prepare students for their future.

Finally we would like to highlight the following key issues:

- When we plan any educational development, we should look carefully the current needs of the society, but look into the future too.
- The curriculum must be based on the needs of stakeholders, founded on clearly defined skills and competences.
- In the design of detailed content the competence matrix can help to harmonize the work of the development team.
- Our education and training activities should target not only the professionals, but also our potential users.
- Quality is omnipresent, ubiquitous – like the cloud of computers.
- Quality improvement should be part of our everyday life.

ACKNOWLEDGEMENT

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BIOGRAPHICAL NOTES

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Prof. Markus has over hundred publications on various aspects of using computers in surveying, spatial information sciences and educational developments. He is actively involved in many national and international academic programmes, is chairman of the Hungarian UNIGIS Course Board, chairman of the Geoinformation Section of Association of Hungarian Surveyors and Cartographers.

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