

GEODETIC AND CARTOGRAPHIC EDUCATION IN ALBANIA

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Abstract

The university geodetic and cartographic education has begun relatively late in Albania. In 1954, it was created the department of Geodesy at the Polytechnic Institute in Tirana, while in 1956, for the first time, the speciality "Geodet" (geodesy branch). In the year 1957, State Tirana University was founded, comprising 7 faculties. The geodesy branch was included in the Engineering Faculty.

The recognition of cartography as a separate discipline has been achieved, but no university degree programme in the field is available in any Albanian University. In the past and presently, cartographic subject is the part of geodetic branch at the Polytechnic University of Tirana and the part of geographic branch at some others Albanian Universities.

The higher education in geodesy and cartography must face to the same challenges than the higher education of any other discipline has to do. They are a natural part of the following worldwide trends of our age: general use of information technology; mass production and globalization.

The paper describes the specific educational objectives in higher geodetic and cartographic education from Polytechnic University of Tirana and Tirana University; it offers a short presentation of the aspects of the transition in the geodetic and cartographic educational system. This paper considers education in the Albania both in the fields of Geodesy and in cartography in a comparative framework. For discussion purposes our paper pairs these two fields that have much in common and have components that appear to be in the process of becoming integrated into a new conceptual model. The paper examines the ongoing development of conceptual models in the two fields and attempts to forecast future development of these models. The status and trends of education in both fields is discussed and special attention is devoted to major problems that need to be addressed and to the identification of planning needs for the development of future programs.

Key words: education, geodesy, cartography, Albanian.

1. INTRODUCTION

One of the major scientific challenges for our community is to characterize the processes that control natural hazards within the lithosphere, cryosphere and atmosphere, including earthquakes, tsunamis, volcanic eruptions, and long term changes in climate, ice mass, global sea level, and coastal subsidence. Space geodetic technologies (positioning techniques, Global Navigation Satellite Systems (GNSS), altimetry, Interferometric Synthetic Aperture Radar (InSAR) and gravity missions) yield sub-centimeter accuracy allowing detection of small movements of the Earth's solid, hydrosphere and cryosphere surfaces. For example, the global coverage of altimetry satellites allow decadal observations of global sea level changes, complementing 100-year long terrestrial measurements, but better reflecting sea surface changes within the entire ocean basins, not limited to coastal areas where tide-gauges are located. In addition, GPS measurements help improve the terrestrial relative sea level change record by monitoring the

subsidence/uplift of gauge stations, decoupling the relative movement of sea and land. UNAVCO¹ has a program for faculty teaching general education, introductory geosciences courses and in-service teachers of Earth Science. Some departments in the Europe are further developing this program from using "traditional" solid earth data such as GPS to include other geodetic data that impact natural hazard mitigation, the effects of global warming, and optimum use of water resources, all major study areas for space geodesy.

In Europe, the fields covered by the geodetic, surveying and cartographic study programmes are diverse among the countries. Geodetic engineers, surveyors in some countries provide professional services, which are provided by different professionals in other countries. However, the list of functions carried out by them is common to most countries: land and geodetic surveying, hydrography, photogrammetry and remote sensing, cadastral surveying, land and geographical information systems, mining surveying, engineering surveying and metrology, and cartography. One of the most important and common issues of geodetic, surveying and GI higher education is to provide the theoretical and practical background on advanced technologies and methodologies for acquisition, integration, management, analysis and presentation spatial data, models and knowledge as support for applications for a number of uses (agriculture, geography, environmental science, forestry, geology, geophysics, civil engineering etc.). This embraces the knowledge on geodetic reference systems, global positioning systems, geographic information systems, photogrammetry, remote sensing and cartography, as well as traditional surveying, and relies on theories of mathematics, physics, astronomy, physical geodesy satellite technology etc. The term *geomatics* is used globally for this wide area of fields with varying connotations. The vision for the European Area of Higher Education builds up the background of the thematic network for higher education in geodesy, surveying and cartography and related fields. Under the Erasmus programme of the European Commission, the thematic network EEGECS (European Education in Geodetic Engineering, Cartography and Surveying) was established in 2002, which aims to facilitate trans-national access to educational resources in Europe and to enable the mobility of students.

The education in geodesy and cartography is carried out at the Geodesy branch, Faculty of Civil Engineering, of the Polytechnic University of Tirana. But some elementary geodetic and cartographic knowledge are carried out at Geography Department at Tirana University and at the following universities: Shkoder University, Elbasan University and Gjirokastra University. Education in the direction of geodesic practice is carried out at the Faculty of Civil Engineering, Polytechnic University of Tirana, which is the only faculty in the country that coaches geodesic engineers with an acquired master degree of Geodesy.

The education in Cartography in Albania has been and is closely connected with the cartographic activity, the foundations of which have been established with the constitution of cartographic services. The level of the development of cartography has always been conditioned mainly by the economic and defence demands for topographic maps and very little in the direction of cartographic education.

The achievements in the field of cartographic education are generally dedicated to the existence of a considerable cartographic literature and a great influence has had a series of scientific papers and articles published in scientific magazines in and out of Albania.

The study objects in the geodetic, surveying, other spatial and land related studies have changed and broadened a lot during the last decades. As the consequence, the competences of classical geodetic, surveying and cartographic university study programmes are changing and new areas are developing very rapidly

Higher education in geodesy and cartography subjects inherited a number of problems, and the system was going to have to change in a variety of ways, including: reformation of educational programs, improvement of teaching methods, improvement of equipments and technology, establishment and strengthening of relationships with European universities and others universities etc. The Bologna Declaration was a great help for Albania, as the education system was still in difficulty. The Declaration was made concrete in the academic year 2004–2005, making it possible for Albania to embrace the 3+2 system (Bachelor and Master), plus the later doctoral level.

2. THE SHORT STORY ABOUT GEODETIC AND CARTOGRAPHIC EDUCATION IN ALBANIA

The university geodetic and cartographic education has begun relatively late in Albania. In 1954, it was created the department of Geodesy at the Polytechnic Institute in Tirana, while in 1956, for the first time, the speciality "Geodet" (geodesy branch) with 18 students began to function. In the year 1957, State Tirana University was founded, comprising 7 faculties. The geodesy branch was included in the Engineering Faculty. The subject of Geodesy is wide-profiled, which allows the geodesic engineers to accomplish a great variety of activities – drawing up large and small scaled topographic plans and maps, cadastral plans and maps, projects for vertical planning, town-planning schemes, plans of extra-settlement territories, ant erosion projects for agricultural lands, valuations of lands and properties, studies of seismic and drag down processes, etc.

¹ UNAVCO – a non-profit membership-governed consortium, facilitates geoscience research and education using Geodesy

The department of Geography was attached to that of geodesy and they were again separated in 1958. The department of geography was included in the History and Philology Faculty where it continues to be. The geodetic and cartographic education in the branches of geodesy and geography has been generally done through the subjects of geodesy with all their sub subjects and cartography, which have continually existed in the teaching programs but with different assignment and orientations (the geodesy branch has had and has the specialities of geodesy and cartography and photogrammetry, so the respective programs of the subject of “geodesy” and “cartography” and “Photogrammetry” are complete) and through the usage of different cartographic products.

Geodetic and cartographic education in Albania changed in every aspect after 1990, following the alteration in political and economic systems. Education system in Geodesy and Cartography is changing all the time, meaning that the traditional original system cannot be stable especially now on globalization era, with wide open market and with full contradictions as the real world. In front of geodetic professionals in Albania there are many challenges, usually very complex. There is possibility to contribute to the advancement of the theory, practice and sharing experiences in learning and education.

Geodesy branch in Polytechnic University of Tirana has started to use information technologies about 1992 year. The first computer system was installed in 1995 in this branch. New educational plan and program is extensively turned to new technologies. It is very important for the branch staff to constantly be in touch with new technologies and to use them in education as well as possible.

The task of the department of Geography up to the year 1997 has mainly been the preparation of geography teachers for the numerous schools of our country. In the teaching plan of this period, the subject of cartography was developed with the first-year students, sometimes throughout the teaching year with an assignment 1,5/2,5 or 1,0/2,0 one term with a charge 2,0/4,0. With the students of geography the subject of cartography was simpler as compared to the students of geodesy, especially “The mathematics Cartography”, “Preparation for printing and the edition of maps”, etc.

From the academic year 1997-1998, the geography branch functions with new teaching plans that aim at the preparation of geography teachers and geography specialists. The teaching plan of “geography” speciality is more advanced and includes except the subject “Elements of Cartography”, also the subjects of “History of Cartography”, “Thematic Cartography”, etc. The subject “Elements of Cartography” with the first year students is already stabilised and it is developed with a term assignment 2,0/3,0.

Beginning from the academic year 1997-1998, the subject of cartography is also developed in the post-graduate school of geography, nearly the Department of Geography of Tirana University.

In the cartographic education, the laboratories basis has had its indication, although it has not been satisfactory especially that of the function of computer cartography. Efforts have been made recently for its strengthening and we hope that with our friends’ help we will soon have a contemporary computer laboratory for cartography and GIS.

The Bologna Declaration was a great help for Albania, as the education system was still in difficulty. The Declaration was made concrete in the academic year 2004–2005 by a decision of the Minister of Education and Science, making it possible for Albania to embrace the 3+2 system (Bachelor and Master), plus the later doctoral level. In the framework of global development and new entries quickly absorbed by the educational system, education continues in what is called lifelong learning and this is a new element that has recently been embedded. Although there have been a lot of innovations in the context of the Bologna Declaration, and with much commitment from the staff, it should be emphasized that the process is difficult and there are many uncertainties. The Bachelor level, now implemented, has proved in general to have been well conceived. From the results of the first courses completed at this level, there are data showing we are on the right path. The problem coming to light now concerns the new Master curricula, with the main question being: who can offer a Master? Which faculty or university? Criteria must be introduced, and it must be determined who meets these criteria and can therefore offer and cover this level of study. Of course, an important criterion is qualified staff. However, the elements of the new system have been inserted, introducing and implementing the system of credit points (ECTS). This system was introduced first in Tirana University in the framework of a TEMPUS Project. By a special act of the Ministry of Education and Science at the end of the academic year 2004–2005 the list of marks (evaluation marks) that accompanies a diploma will express not only national evaluation by marks ‘4 to 10’ but also show the evaluation in ECTS.

3. GIS EDUCATION IN ABLANIA

Geographic Information Systems (GIS) education in Albania, in true sense, started about fifteen years back. However, since then there have been discussions among academicians regarding the format and curriculum of GIS teaching. Since then GIS has evolved and come out with full vigor and implementation possibilities. The time, when there used to be talk of the great potentials of GIS, has passed.

The role of higher education is to assist students in becoming effective thinkers with the knowledge and skills that will lead them toward becoming meaningful contributions in society. Geographic Information Systems in higher education provide an integrated solution to assist faculty and students with their educational goals.

During early stages of GIS education in Albania, the irony was that no one was ready to accept GIS as its discipline. In the year 1994 Albanian Geographic Center (Science Academy of Albania), started to establish and development a GIS

system. GIS higher education in Albania started in 1998 year. In about 1999 year with the pioneering efforts at the Institute of Geography, University of Potsdam (Germany) GIS courses begin to be developed in undergraduate programs in Geography Department, Tirana University.

At the same time with these courses, Geography Department of Tirana University and Geography Institute of Potsdam began an pilot project about creation of the Albanian Demographic Atlas. Two or three year later GIS courses begin to be developed in undergraduate, graduate programs especially in geodesy, geography, computer sciences and geology departments of the universities in Albania.

The Department of Geography of Tirana University was the forerunner in pioneering of GIS education in Albania by the establishment of the first GIS Laboratory and the introduction of a graduate program at the Professional Master's level in the country. The software complement was an integration of both vector-based and raster-based software, and they are listed in Table 1.

Table 1 Installed software (1999)

Vector-based software	Comments
AtlasGIS	A vector based package that is easy for thematic mapping with good import/export and map projection capabilities
ArcCAD/Autocad	A vector based GIS software based on an integration of AutoCAD mapping capability with the analytical capabilities of Arc/Info.
ArcView 3.0	A highly user friendly and very popular GIS vector data software
Idrissi for Windows	A raster-based package with import/export capability and raster modeling strength. Idrissi bridges the interface between GIS and Remote Sensing. Also it has limited vector data processing capability, which classifies it is a hybrid GIS software.

The establishment of the GIS Laboratory at Geography Department spanned about three academic sessions. This entailed in the first instance, development advisory team workshops to raise awareness and to provide avenues for Albanian participants to identify research priorities in the areas of spatial decision support systems and environmental monitoring and management and establish a need for GIS technology as a decision-making tool in a problem-solving environment. came in stages, the last set were installed in 1999.

Currently, the GIS laboratory of about thirty (30) new computers all Pentium IV, 256 Mb RAM, 30GB HDD, CD-ROM, USB, full multimedia, networked and fully internet ready. Three of the computers have been fully activated for internet browsing for students' use. They were purchased about five years ago, and the department is putting in place a scheme whereby computers would be upgraded or renewed every three years.

Other currently available peripheral equipments include:

1. One HP Color printer.
2. One external CD-ROM drive.

Hardware deficiencies include:

1. data backup media e.g. CD – ROM recordable and re-writing media, and Iomega ZIP drives.
2. large-format plotters e.g. HP 750 C series and above.
3. A3 scanners.
4. digital cameras.
5. hand-held GPS receivers.

Currently installed software include vector based software like ArcView 3.2a, AtlasSelect, PC Arc/INFO 3.5.1 and MapInfo 5.5 while Idrissi for Windows is the only raster based software. This mix enables students to attain proficiency and familiarity with the most number of the more popular and user friendly GIS software currently available in the market. Efforts are on-going to purchase the current versions of this software as well as to introduce new software like GRASS and Maptitude.

The course curriculum of Bachelor program includes the subject of Remote Sensing and Geographical Information Systems and Thematic of Cartography and Fundamentals of Cartography and Project in GIS.

The course curriculum of the Masters program from inception covers the functional elements of geographical information systems with courses dealing at some depth with data structures, computer programming, spatial statistics, spatial decision support systems, maps and map projections, digital image processing and GIS/remote sensing applications in different areas of the human and natural environments. Surveying concepts and techniques taught include geodesy, control establishment, GPS observation and reduction, and strategies of integration of surveying, GPS and GIS.

GIS is increasingly being used by experts to analyze the environment, natural resources, and management problems in the developing nations including Albania. Therefore, there is an urgent demand locally for professionals trained in GIS who would help to integrate these concepts and technology into the spatial decision making processes in the country. There is the need also to train and continually re-train teachers who would assist in integrating GIS concepts and applications into programs taught by disciplines concerned with spatial phenomena such as geography, land surveying, architecture, forestry and resources management.

The main problem today in using GIS in spatial modeling is first, the lack of GIS integrated modeling tools and second, the users' low level of theoretical understanding of the use of tools. On the other hand the problems still exist with data integration (standardization) and user interfaces.

The development from GIS to Geographic Information Science in university education needs development in both of the fields discussed above: spatial modeling and system development. The new scientific topics which have been introduced during the recent years like geocomputation, seem to touch both of these areas. Researchers' interest to mathematical modeling and new computation methods is raised up, approaches like cellular automata and fuzzy modeling, new programming approaches for computation like parallel programming and genetic programming are the new approaches and technologies for spatial modeling and model implementation. The vast amount of spatial and related data bases in the network require more efficient tools for queries like spatial and visual data mining technologies. Multimedia and virtual realities bring GIS to the cyber reality. And finally we are not allowed to forget the development in GIS industry – to be able to be successful among LBS and e-commerce providers GIS professionals must be very aware of the value and fundamentals of spatial thinking and behavior to be able to develop and offer the right products for service markets.

4. ALBANIAN GEODETIC AND CARTOGRAPHIC PRODUCTS

The achievement in the field of geodetic and cartographic education is generally dedicated to the existence of a considerable geodetic and cartographic literature. We can mention here certain teaching books published in our country, such as: "General Geodesy", "Higher Geodesy", "Mathematics Geodesy", "Engineering Geodesy", "Astronomy", "Photogrammetry", "Mathematics cartography", "Compiling and edition of maps", "Cartometry" (for the students of geodesy branch) that are continuously worked out by Agim Shehu and Ergjin Samimi. For the students of geography branch it has been published "Cartography" (1960) and worked out in 1965 and 1984 by Agim Shehu, Ergjin Samimi and Spiro Boçi. In 1998 Pal Nikolli published the workbook on the subject of cartography entitled "Elements of Cartography and Topography"; while in 2000 the book "Elements of Cartography" by Agim Shehu and Pal Nikolli was published. After year 2000 are published the books "Cartography", "Geographic Information Systems", "Remote Sensing", "Applied Geodesy", "Photogrammetry and Distant Methods", "Cadastre and Land Management" etc. In the publications of the '60's the eastern literature had the greatest influence; in those of the '70's gradually began the influence of western literature, especially American, French, Swiss and Italian. While in the textbooks of the recent years is present the western-European and American literature.

In geodetic and cartographic education in the Albanian universities, a great influence has had a series of scientific papers and articles in the field of geodesy and cartography published in scientific magazines in and out of Albania. Today, more than 300 papers on geodesy and cartography are enumerated. So only Agim Shehu has published 52 scientific articles and bulletins (10 of which abroad during 1992-1997). The particularity of these publications stands on the efforts to pass from the simple terminology of information purpose to synthetically publications such as the national complex atlases, which deal with the society-nature system.

The geodetic and cartographic education has been and is closely connected with the geodetic and cartographic activity in our country, the foundations of which have been established with the constitution of cartographic services in Albanian Republic. So in 1945, the Military Cartographic service was established, while in 1946 a workshop was organised, which, in 1958 would be the basis of the cartographic ward of the enterprise of teaching, cultural and sports implements in Tirana.

In the period 1959-1970 there were published many maps, among which the physical map of Albania in scale 1:300000, the first geographic school atlas of Albania, the first geographic globe, etc. The progress is evident with the establishment of the Military Topographic Institute (MTI-1975) where began to be carried out a number of astronomic-geodesic, topographic, photogrammetric and cartographic editions.

During 1976-1992 there have been published and republished, with photogrammetric methods, many topographic maps on scale 1:25000 and 1:50000 up to 1:100000 that involve the whole Albanian territory. In topographic maps of the scale 1:10000 it is included mainly the western lowland.

Of great importance are also the cadastral maps of scale 1:2500 created by the geodesic service of the Ministry of Agriculture since 1946 and those of topographic with scales 1:10000, 1:5000, 1:2000 created by geodesic service of the Ministry of Mining and Industry. Good work has been done by the geodesic service of the Ministry of Construction on the topographic survey of scales 1:2000, 1:1000, 1:500. The preparation of the high cadres in the field of cartography made it possible the extension of thematic specter with the publication of tectonic maps (1969), geological (1983), hydro geological (1984), then those of economic, agricultural and physical-political of Albania.

An important step in the field of education and cartographic production was the creation of the ex-enterprise of teaching and sports implements "Hamid Shijaku" in Tirana, where was a sector of the production of thematic maps connected with teaching in our schools. The closing of this unite of cartographic production at the beginning of this decade, marks the total interruption of the productive activity of thematic maps in our country, which can't help the negative indication on the cartographic education in our schools too.

A serious damage in the direction of cartographic education in the last decade is the fact of the weakening of the department of Geodesy at Tirana Polytechnic University (where cartographic specialists were prepared during the previous decades) and the decrease of the activity of the Military Topographic Institute (MTI).

During this decade, alongside with the drastic decrease or closing of the traditional cartographic activity in the state sector, represented by the above mentioned institutions, there also made efforts for the generation of the cartographic activity through contemporary modern ways. So, it is to be stressed the creation, in 1994, of the sector Cartography-GIS in the Centre of Geographic Studies (CGS) at the Academy of Sciences of Albania. The creation of this sector, with its equipment and general orientation, was considered of an advanced and contemporary level. Following the going on of the activity and cartographic products of CGS, we regret to admit that it is not in those levels we expected to be with the creation of the sector of cartography-GIS either in the scientific level of studies or in that of production, notwithstanding the great capacities and abilities of its equipment.

The fact that the high technological possibility and ability of this centre don't go in the same level with its cartographic studies and products, makes one think that the scientific, cartographic and technological education of the working personnel is still far from the technology in use.

There have been undertaken efforts in the thematic cartographic production in the private sector as well. You find in the market thematic cartographic products by different private firms. If you glance the quality of the products of these firms, you notice amateur cartographic level of their technicians and equipment.

5. ACTUAL PROBLEMS ABOUT GEODETIC AND CARTOGRAPHIC EDUCATION

Based on the above description, it is easily understood that the level of the development of geodesy and cartography has always been conditioned mainly by the economic and defence demands for topographic maps and very little in the direction of cartographic education. This fact tells about a limited group of users of maps and, as a result, for a minimum level of the system of cartographic education, which has not transmitted to the people the advantage of the usage of cartographic products. The cartography and cartographer have been considered nearly as map producers and not as supervisors or advisers of governmental bodies, of government and society itself.

Today world geodetic and cartographic development is of great advance, which is quite impressive, and it seems almost unachievable for us. Studying different periodicals, magazines and bulletins of the developed world we get in touch with geodetic and cartographic productions in paper shape and especially in information shape of CD-ROOM-s, which for the expressive level, the great amount of information they transmit and the great variety of themes are considered important carriers and transmitters of useful information in favour of human activity.

Aiming the University cartographic education in conformity with the present demands, except the duty of automation of the compiling and usage of maps, Albanian Cartography faces many other tasks to solve in the future.

- It must be worked to arrange the organisation of elements of the map contents in conformity with graphic theory and laws, because in most of the teaching, technique or scientific maps there is a casual arrangement of the graphics of component parts. Frequently, the contents, the frameworks, annexes, cartographic signs, longitude and numeric scales don't have an avange as graphic, colour and perseptation order.
- It must be worked in the direction of accuracy of the introductions in the maps, because there are found many mistakes in different denominations in them. On the other hand, it must be increased the lingual accuracy and orthography in denominations. This needs the co-operation of specialists in respective fields, etc.
- It must be analysed the density of contents elements of topographic and thematic maps, with the purpose of determining the quantity of information they carry, etc.

Would it be possible for us to be participants and contributors in the world cartographic development in the new millennium?

Although the present possibilities are small, we must not lose hope. The efforts of those few cartographic specialists, who traditionally have contributed and continue to contribute in the fields of cartographic education and that of cartography, have been uninterrupted, although from general confusion created in different fields of our life. Let us try to co-operate with the world geodetic and cartographic community by participating in its numerous activities. Let us sensibilities the governmental and decision making bodies for the great advantage of cartographic information. These should be aware that the cartographic and the cartographer are not only mapmakers but also useful advisers for decision making on their part. We must continuously try to help, first of all ourselves, so that to have the right to ask for helps to others who are more advanced and powerful than us.

The topics about geodetic and cartographic education in Albania are: use of modern technologies in geodesy and cartography (Methods and technologies in geodesy; National, engineering, geodynamic and other applied aspects;

Processing of geodetic measurements and data bases), photogrammetry (Digital photogrammetry; Surface reconstruction; 3D reconstruction of historic buildings and monuments; Multi-media visualization (Visualization and Animation of Landscape), cartography (Innovative technologies for design and production of maps; Web Cartography; Thematic cartography), satellite technologies (GNSS -Global Navigation Satellite Systems; Remote Sensing; SAR technologies), urban and rural planning (Planning of territories, Rural planning, Modeling, Territories' protection – Natural disasters and catastrophes), cadastre (Cadastral basis and cadastral systems, 3D cadastre, Application of cadastre, GIS, GIS requirements – concepts, modeling and structuring of data, GIS applications)

6. CONCLUSIONS

Technical development and globalization, as a process and a condition of the space for higher education, dictate the guidelines for development of geodetic and cartographic study programs all over the world. It is widely recognized that the adequate management of information on study programmes is crucial not only to the renovation of study programs but also to the future of international mobility of students, researchers and teachers in every profession. The professions such as surveying, geodesy, cartography, photogrammetry, remote sensing, GIS etc. are not the exception. In the European higher education area, the adoption of the Bologna Declaration brought additional challenges. The European Commission complements its policy work in the field of education and training with a variety of funding programmes. One of the project relating to higher education in the fields of GI sciences, supported by the European Commission, is the thematic network EEGECS (European Education in Geodetic Engineering, Cartography and Surveying). Geodesy and cartography in Albania are taught in Polytechnic University of Tirana since year 1954. Furthermore, cartography is taught as a part of undergraduate geography and as area of specialization at post-graduate level in Tirana University. Cartography has developed so rapidly that it ultimately achieved general recognition as an independent discipline.

The recognition of cartography as a separate discipline has long been achieved, but no bachelor degree programme in the field is available in any Albanian University. However, department of geography in Tirana University, is presently running post- graduate (M.Sc.) programmes with specialization in Cartography.

Tendencies for perfecting the education in Geodesy and cartography are: keeping the credit system, this includes introduction of European principles in the educational system, development of specializations into master programs, establishing a better base for practical education of the students by buying up modern apparatuses, expanding the collaboration with firms that are leading in modern technologies, taking part in joint practical projects (both national and international), specializations of students, development of PhDs, etc.

The new technologies and methodologies are inevitably entering the everyday practice. Regular reforms of higher educational programmes attempt to adjust curricula to the new conditions of science and society and GI-profession is not the exception. The nature of GI-profession, including surveying, geodesy and cartography, is changing and new areas are developing very rapidly. New technologies and the extension of the field of the profession require new concepts and structures in education. On the other side, scientific work and its connection with the teaching process have influenced the introduction of new cognitions into the teaching activity.

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