Review of GI Usage in the Bulgarian School System

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Abstract

"Teaching Geography at school means to build up citizens of the world that are conscious, independent, responsible, critical and able to live in consonance with the environment, changing it in a creative and sustainable way, looking at the future"[1].

This striking citation cannot be applied at all in regard to the Bulgarian school system and teaching school geography in particular. We need a dramatic change in the way we think and educate our children in order to provide creativity and adaptability, instead of a robotic memorization of facts and figures. There are number of statistics and studies showing the decrease of educational quality in the school system in Bulgaria – a recent analysis conducted by Reuters Agency shows that the permanent shortage of qualified personnel repels foreign investors and undermines the efforts to improve the economic situation[2].

We believe that geographic information systems (GIS) could be valuable addition and stimulation in several educational subjects. GIS is one of the most relevant uses of computers in school, with roots firmly in geography and geographic education, but fundamental in many other subjects.

This article will review the legal basis of the Bulgarian school system and up-to-date review of the general condition of the schools in regard to technical equipment, manuals and quality of education. We will focus on geography as a subject and will investigate the usage of GIS at school level. This article is by no means an elaborated review of the Bulgarian school system, but will try to point out some problems in regard to technical and pedagogical challenges.

1 Introduction

1.1 Legal basis of the Bulgarian school system

According to Bulgarian educational law[3], schools in Bulgarian are state, municipal and private. All state and municipal schools are free and school education is obligatory up to 16 years of age. The official policy concerning the age of entry into Primary School is 7, but on practice in many cases the age is 6.

There are two types of school education, general and professional schools. General education is based on a common core curriculum with possibilities for specialization according to state educational requirements. Professional education provides the opportunity to master a

[1] Reference: http://www.geografia-italiana.it/, accessed 25.01.2011.
[2] Reference: http://money.bg/news/id_396620823, accessed 25.01.2011.
[3] Reference: http://www.minedu.government.bg/opencms/export/sites/mon/left_menu/documents/law/zkn_prosveta.pdf, accessed 25.01.2011.

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qualification for a specific profession, again based on state standards. There are two obligatory state exams for high school graduation: one based on Bulgarian language and literature and the other a choice between "foreign language", "mathematics", "physics and astronomy", "biology and health education", "chemistry and environmental protection", "history and civilization", "philosophy" and "geography and economy". These exams are centrally managed by the Ministry of Education and Culture. All the students answer the same exam questions.

In 2010 the area "geography and economy" was the most popular subject of choice for the state exam. However the exam results produced an 18% failure rate[4]. This indicates that either the course material is outdated, or for some reason it has not successfully reached its target audience.

1.2 General condition of the Bulgarian school system

The general conditions in many schools with regard to buildings, technical equipment, books and manuals is relatively poor – we base this review on a number of newspaper articles and TV interviews showing the poor condition in many Bulgarian schools[5]. Although the situation is rapidly improving in regard to Internet connectivity and computerization, the school level in regard to the quality of education is quite uneven in different parts of Bulgaria.

An additional issue is the number of different versions of school manuals, issued by different publishing houses, which are approved by the Ministry of Education and Culture. This competitive situation was supposed to improve the content and quality of these resources, however the result has been confusing both for teachers and students, because the content provided is very dissimilar in the different versions of the manuals. In many professional schools, the technical subjects studied are based on outdated requirements, this results in the need for additional qualification courses, even after four years of education.

There has been a noticeable decrease in the quality of the educational system, which is evidenced by a number of *national and international studies, media investigations and reports, etc.* for example, research conducted by PIRLS[6] (Progress in International Reading Literacy Study) in 2006, showed that in regard to fourth-grade students' reading achievement, Bulgaria had higher achievement than the majority of other participants and was among the top 10 countries worldwide, along with Luxembourg, Italy, Sweden, Germany, Netherlands, Belgium, Hungary and others. However, research conducted by PISA 2006 for 9th grades shows that Bulgarian students" were "statistically significantly below the OECD average" among the last ones[7].

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4 Reference: http://www.uchenik.com/5141-masovo-dvojki-na-maturata-po-geografiya.html, accessed on 25.01.2011.

5 Reference: http://priziv.org/index.php?option=com_content&task=view&id=35&Itemid=57, accessed on 25.01.2011.; http://www.dnevnik.bg/analizi/2007/12/06/405157_paradoksite_na_ bulgarskoto_obrazovanie/, accessed on 25.01.2011.

6 Reference: PIRLS 2006 International report, IEA's Progress in International Reading Literacy Study in Primary Schools in 40 countries.

7 Reference: http://www.oecd.org/dataoecd/54/12/46643496.pdf, accessed on 25.01.2011.

This significant drop during the education cycle is probably due to inadequate study materials, merged and combined disciplines and the increase of study curriculum leading to lessons full of definitions and facts with no time for practical work. This situation stimulates load learning, memorization and standardization and devalues self-expression, self-exploration, questioning and creativity. *As a result, the students do not participate actively in the learning process, instead the teacher presents the lesson, and in the following study session the students are supposed to "recreate" the exact material. There is no active discussion and the students are not encouraged to share their opinion.*

Another problem is that during the years of transition after the communist regime, Bulgaria suffered from high levels of emigration and unemployment, a demographic crisis and a decrease of economic activities in many areas. This led to the closure of many schools due to lack of children and economically active population.

Despite these negative factors there are many programmes[8] and efforts to attempt to reorganize and improve the Bulgarian school system. For example the Ministry of Education and Culture is providing additional budget in order to stimulate obligatory pre-school preparation for 5 year olds and full day schools for first and second grade pupils. This additional school time will help create a more balanced distribution of study curriculum. There are also some long-term programs for the provision of Information and Communication Technology equipment for Bulgarian schools. One of the goals which was achieved in 2010 was to provide Internet access and computer equipment to all state and municipal schools[9].

2 School Geography in Bulgaria

The situation concerning the status of geography in Bulgaria is not as severe as in countries like Italy, Malta and others, where the term and content is substituted by other disciplines. Nonetheless, school geography in Bulgaria is underrepresented regarding the duration of classes and has been diminishing. This is despite the fact that there is recognition within society for the necessity of geographical knowledge and that geography is among the oldest and most important disciplines being taught in Bulgarian universities.

2.1 Geography and the School Curriculum

There have been a lot of changes to university curricula. The approach has developed towards examining geographically-related problems during the transition from planned to market economy and the EU accession. The effect has primarily been towards the implementation of applicable knowledge. As a result, during the past 20 years exciting subjects, such as geographic information science, remote sensing, regional planning, mobile GIS, etc. are increasingly being taught at Bulgarian universities. Academic courses nowadays focus more on analysing spatially determined problems, rather than simply describing geo-

[8] Reference: http://www.dnes.bg/obshtestvo/2010/10/30/oshte-56-miliona-triabvat-za-srednoto-obrazovanie.102518, accessed on 25.01.2011.

[9] Reference: http://www.minedu.government.bg/opencms/export/sites/mon/left_menu/projects/national_programs/2010_IKT_pl4-current.pdf, accessed on 25.01.2011.

graphic phenomena and places. As a result, the school curriculum in geography has been lagging behind these trends as it remains primarily descriptive in nature.

An interdisciplinary approach towards teaching and learning, so much appreciated during the past decades in significantly improving the learning process, is also seldom found within the school curriculum in Bulgaria. Bulgaria is the only country in the European Union to use the Cyrillic alphabet – as a result, Bulgaria lacks behind regarding any school textbooks and materials dedicated to GIS usage.

Despite the unfavourable situation of school geography there is huge potential for the introduction of digital geographical content within various disciplines. The reasons are the availability of school computer laboratories and specialist teachers of geography, the majority of who have taken a course in either GIS and geoinformatics or cartography. Another condition, which is in favour of the integration of geospatial knowledge in schools is the existence of an excellent Internet infrastructure across the country, placing Bulgaria among the top ten in the world in terms of speed and affordability of Internet uploads and downloads[10].

2.2 Survey among major GIS vendors and schools initiatives in GIS

During January 2011 an email survey was conducted with all major GIS software vendors in Bulgaria, who are representative of ESRI, Autodesk, Intergraph and Mapinfo software companies, with the purpose to identify how major players on the GIS market have supported school educational initiatives. These four GIS software product lines basically cover all GIS usage in both government, private and educational institutions. Three responses were received that cover three of four major vendors (the Autodesk representative did not reply to the survey).

Although all of the local distributors have donated some GIS lab kits to different universities, only one vendor has provided software to a high school. The ESRI Inc. distributor donated a Lab Kit Pak of 25 GIS software licenses to the National Natural-Mathematical School in Sofia, to be used in the school computer lab. The vendors comment that although they have educational programs and policies, there is no parallel support from government initiatives. An additional obstacle mentioned by the GIS vendors is that the level of education in the high schools does not allow the usage of GIS, which leads back to the comments concerning manuals, curriculum, resourcing and materials dealt with in the previous section.

2.3 Uses of GIS in classroom: a case study in NPMG

During the 2006/2007 school year a course in cartography was conducted based on the regular school curriculum in National Natural-Mathematical Secondary School in Sofia, Bulgaria. The subject was delivered as a part of the program for geography, taught every year by university lectors from the faculty of Geography and Geology at Sofia University "St. Kliment Ohridski".

[10] Reference: www.Speedtest.net .

The course in cartography consisted of 72 study hours, of which 35 hours were based on theory, 27 hours of practice and 10 hours for review and examination. The course program included a basic introduction to cartography as a science, including subject, methods and main tasks, classification of geographic maps, mathematical elements of the map, cartographic generalization and different techniques for map visualization.

There were a total of 26 students in the class. Although this school has a computer laboratory there were no GIS software licenses or GIS data available at that time. As part of the regular program several introductory lectures on the basics of GIS and remote sensing were introduced. A visit of the whole class to the lectures and exhibition held for the International GIS Day in Sofia University was scheduled. During this time the students gained a basic understanding of the main components of GIS and also reviewed the application of GIS in different areas of knowledge.

At the end of the school year, all students had to implement a final project, based on cartographic methodology and principles and using modern GIS sources of data, such as Bulgarian online GIS portals, municipal parcel data, cartographic agency, etc. The basic feedback from the leading geography teacher was that all students had been much more interested in the courses, when compared to previous years, when the method of collecting and presenting data on the map was done using more tradition methods and manual cartographic techniques.

3 Challenges in Regard to Situation in Bulgaria (digital-earth.eu and the Situation in Bulgaria)

The shortage of resources, partly related to the national curriculum in place, is one of the most serious obstacles preventing the introduction of GIS-based education for schools. The situation has been improving with the availability of the deliverables of the iGuess project[11] which was accomplished by a wide range of partners from EU countries, including the Department of GIS and Cartography at the Sofia University “St. Kliment Ohridski”, Bulgaria. The iGuess Project produced freely available materials and teacher guidance have been provided, together with European data for a range of different curriculum subjects. However further sharing of ideas and materials is desirable in the future

Since the problems of school geography are presumably the same across Europe, an integrated approach towards problem solving, addressed by the digital-earth.eu project team, should be able to serve all European countries. The successful implementation of the digital-earth.eu project can initiate the creation of the necessary state-of-the-art infrastructure of data and knowledge which will serve as an invaluable toolbox for school teachers, in the provision of GIScience knowledge to students.

The following major issues concerning school geography could be addressed through the successful implementation of the digital-earth.eu project. These have been classified into two major groups, pedagogical and technological challenges.

[11] Integrating GIS Use in Education in Several Subjects, Project implemented within the Lifelong learning programme of the European Commission; www.iguess.eu.

3.1 Pedagogical challenges

- Elaboration of realistic and applicable guidelines for curriculum improvement, introducing concepts about GIS and for teaching with GIS for both primary and secondary levels of education;
- Focus on problem oriented teaching and learning and spatial thinking, instead of the mechanical use of GIS software interface without understanding the principles behind it. All outcomes of the project must lead to raising the awareness about geographically related problems and spatial thinking. We expect that abstract theoretical concepts should be in any case accompanied by real world examples.
- Resources targeted at disciplines other than geography. At present GIS teaching is only found in geographical classes, despite the potential for use within different classes (biology, informatics, economics, mathematics, etc.), thus integrating spatial knowledge throughout the whole curriculum.
- Resources with translation in all languages of the community. Preservation of language diversity across Europe, which is an invaluable and inseparable part of European cultural heritage, requires the allocation within the digital-earth.eu project of significant resources for translation of all products.
- Sustainability of the results through provision of all resources to EUROGEO. As with any European-funded project, digital-earth.eu is limited by the time available and a shortage of resources. The sustainability of the resources produced should be ensured, potentially through making all resources available for an unlimited time through the European Association of Geographers – EUROGEO – once the project ends.

3.2 Technological challenges

- Provision of interoperable geobased educational services around the specifications of the Open Geospatial Consortium (WMS, WFS, WFS-T, WCS, etc.[12]) and the INSPIRE data specifications, as defined by the European Commission Regulation[13]. The implementation of interoperable data and services will ensure the independence of the project results from specific software products and processes.
- Use of affordable or free of charge software products. A well-known problem of teaching with and about GIS in schools is the expensive commercial GIS software, which even being provided at reduced rates for schools can hardly be considered affordable by schools with their limited budgets. There are however readily available free and open source products whose potential is very far from being utilized
- Regularly updated educational portal resources for teachers and students. The online mechanisms for exchange of ideas, know-how, materials and generally speaking geographically related knowledge among teachers and students from across Europe would be valuable for ensuring sustainability of the project results
- Ready to use exercises and teacher materials. The project can provide an exhaustive set of ready to use course material, organized in an online repository. It would be invaluable for teachers in Bulgaria, since the availability of course materials to be used in the classroom is more than limited. Examples of similar approaches towards provision of

[12] www.opengeospatial.org.
[13] Additional information about INSPIRE at http://inspire.jrc.ec.europa.eu/.

teaching material are the ESRI educational portal[14] and the exercises, created within the iGuess project.

4 Conclusion and Outlook

Several tasks have emerged based on the review in this article, mainly towards improvement of the quality of the Bulgarian school system as a whole and of geography education and usage of GIS in particular.

First is the change of student motivation, educational methods and curriculum, by introducing new techniques, corresponding to modern requirements. The problems of today require creative and innovative people. Secondly, spatial thinking and the application of GIS as a scientific instrument can help develop and improve the quality of education in different subjects.

To summarize our expectations, the ideal outcome of the digital-earth.eu project should be the formulation of a European-wide Educational Spatial Data Infrastructure – ESDI. This would ensure the availability of all necessary resources for implementation of geographical knowledge within the curriculum, not only for geographical disciplines, but also throughout the curriculum within an interdisciplinary environment. The outcomes of the project should be of strong support for national geographical associations and should be used for the successful promotion of geography.

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