GIS IN URBAN PLANNING EDUCATION: SUPPORT FOR INTEGRATED APPROACHES TO SUSTAINABLE URBAN DEVELOPMENT

Elena Dimitrova¹, Angel Burov², Hristo Nikolov³

Based on experience within BSc and MSc programmes in Urbanism at UACG, Sofia, the paper discusses the need for broader GIS integration in planning education for meeting two challenges: (a) the integration of the sustainable development (SD) concept into the planning field; and (b) the major shift in planning from rational to communicative approaches. The increasing complexity of topics and information require interdisciplinary cooperation and careful outlining, structuring and linking of professional competences and responsibilities within the SD field. The experience gained in a couple of recent diploma works identified GIS as an appropriate instrument for linking data, visualizations, assessment of alternative scenarios to base decision-making upon. There are important barriers to overcome related to information lack or inconsistency and a major message to spread through the educational process about GIS, which should be promoted as the effective instrument to meet clearly formulated objectives of sustainable urban development.

Key words: sustainable development, planning education, GIS

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1. INTRODUCTION

The broadly acknowledged benefits of GIS implementation in planning – and, respectively, the need for its deeper integration into the educational process, is usually related to the opportunities provided for and increased efficiency of integral database development, multi-criteria analyses and assessment of spatial plans, monitoring of plan implementation, results and impacts (Drummond & French, 2008; Ferreira, 2008; Klosterman, 2008). There are however other sets of arguments to consider as well, which stem from the urgency of meeting two main challenges of today’s spatial planning practice not fully conceptualized yet in our country: (a) the required integration of the sustainable development (SD) concept into the planning field; and (b) the major shift of urban planning from rational to communicative paradigms. Sustainable development policies (both in the stages of formulation and implementation) should nowadays understandably and convincingly integrate social, economic and environmental considerations. They are to be (democratically) decided upon and put into practice into an increasingly dynamic context through the joint efforts of experts, politicians, business actors and citizens. That would require another type of relations and contacts, of structuring and linking various arguments – and that is where GIS provides an extremely valuable instrument. Planning education is therefore expected to build both the conceptual basis for GIS implementation and that of the technical knowledge and skills to put it into practice.

The paper discusses recent experience in GIS implementation inspired by the SD concept in diploma work topics within the ongoing BSc and MSc Programmes in Urbanism at UACG, Sofia. It focuses on the educational outcome as visible in two diploma works defended in 2007/2008 – one by a graduate student from the BSc programme, (summer semester); and the other – by a graduate student from the MSc programme (winter semester). The existing educational context, some common and varying aspects of the students’ motivation, efforts and results are traced and identified barriers are analyzed. Comments and recommendations are made on possible approaches and partnerships aimed at a more effective educational process linking GIS and SD aspects in spatial planning education.
2. EDUCATIONAL FRAMEWORK: THE SUSTAINABLE DEVELOPMENT CONCEPT AND GIS

The recent decade has witnessed the fast dissemination of the sustainability idea throughout the world. Since 1992 broad international acceptance has been achieved that moving towards sustainable modes of development is essentially a process of learning. Education is nowadays agreed upon as one of the important channels to create and share a new culture - in society and also in particular professional communities. It is acknowledged that ‘there is a need to refocus many existing education policies programmes and practices so that they build the concepts, skills, motivation and commitment needed for SD’ (UNESCO, 2002). Yet, as observed in the Vilnius Framework, “there are still challenges in implementing education for sustainable development effectively, including strengthening cooperation among governments and stakeholders, improving education systems to address the interdisciplinary nature of education for sustainable development” (ECE/CEP, 2005). The ongoing UNESCO World Decade of Education for Sustainable Development (2005-2014) is a global-wide effective effort in this direction. As stated in EESD Barcelona Declaration, Universities must redirect the teaching-learning process in order to become real change agents who are capable of making significant contributions by creating a new model for society (EESD, 2004).

2.1. Global educational context

‘The effective participation of civil society is also an essential part of the necessary foundations for the realization of social and people-centred sustainable development’ (UNGASS, 1997). Holistic thinking and an understanding of the interdependence of environmental, technological, social, cultural, economic and spiritual issues are outlined as important aspects of a necessary change in education on the built environment. (CEBE, 2000). GIS (Geographic Information Systems) has already proved to effectively meet both requirements thus answering the need in planning for techniques to promote sustainable policies and developments in both aspects – by providing spatial analyses and also possibilities for participatory mapping with a growing variety of aspects included (PP-GIS).

2.2. Educational context at the UACG, Sofia

The 4-year-long BSc in Urbanism established in 2002 at the Faculty of Architecture of UACG, Sofia, answered the urgent need in the country for a new type of professionals in the field of spatial planning, who would be capable to effectively implement EU spatial policy principles at all the levels (local, regional and national. The Programme had been developed through the international collaboration provided a successful TEMPUS project (TEMPUS-JEP 12540/97). The team involved in the process took into consideration the national educational tradition and the existing academic structures in the Bulgaria and creatively adapted advanced European practice in structuring the curriculum and the teaching modules contents. That is how two important topics – these of sustainable development and of GIS, got their relevant positions in the curriculum, each of them with two consecutive modules (a compulsory followed by an optional one (Table 1). No explicit links or coordination between the SD and GIS modules were established at the beginning and a general miss-match became later on obvious - practical aspects in the SD field are focused upon in the 3rd semester of the Programme when the (already running) compulsory GIS module is focused on general and theoretical aspects of GIS implementation in spatial planning.

The BSc in Urbanism Programme started in the autumn of 2002. Four years later, in 2006, the MSc in Urbanism Programme started as well. No explicit discipline on SD issues was included there but SD issues were addressed within two specialized modules - Integrated Coastal Zone Management (ICZM) and Integrated Planning. The optional GIS module delivered in the 2nd semester was explicitly practice-oriented and supposed to provide knowledge and skills in ESRI software application – preparing students for the diploma work (Table 2).

A system for evaluating the effectiveness of the educational process was established from the very beginning of the Programme - providing continuous feedback on students’ comments and recommendation. A most effective way, however, to estimate real educational results could be achieved through analyzing the messages and quality of the diploma works developed and defended. The BSc diploma thesis is to be developed during the final semester of both programmes - 8th semester for BSc students and 3rd semester MSc ones within a 100-day period valid for all the majors at UACG. According to the general educational methodology adopted, the diploma work is aimed at: ‘providing the students with a chance to conceptualize all the professional knowledge acquired about the nature of urban processes by applying developed skills for independent work in analyzing particular urban problems and developing a conceptual approach for an effective solution’. Depending on graduates’ individual interests and preferences and the diploma work focus could be either on: (a) practical aspects – investigation on the spatial development of a particular Bulgarian city/town, resulting in a spatial development concept addressing the identified problems in accordance with national policy and established EU principles, or (b) theoretical aspects – investigation on a contemporary urban problem, resulting in argumentation about possible approaches and instruments of professional intervention.
### Table 1: Teaching Modules in Sustainability and GIS, BSc in Urbanism Programme at UACG, Sofia

<table>
<thead>
<tr>
<th>Topic</th>
<th>SUSTAINABLE DEVELOPMENT (SD)</th>
<th>GEOGRAPHIC INFORMATION SYSTEMS (GIS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Environmental Protection and Sustainability</td>
<td>Environmental Protection and Sustainability – Part II</td>
</tr>
<tr>
<td>Code</td>
<td>EPSbCBU</td>
<td>EPSbEBU</td>
</tr>
<tr>
<td>Delivery</td>
<td>2nd semester</td>
<td>3rd semester</td>
</tr>
<tr>
<td>Status</td>
<td>compulsory</td>
<td>optional</td>
</tr>
<tr>
<td>ECTS</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Teaching hours (lectures/seminars)</td>
<td>60/30</td>
<td>60/30</td>
</tr>
<tr>
<td>Type of assignment</td>
<td>Individual work oral presentation/ test 50% / 50%</td>
<td>Team work presentation/ written exam</td>
</tr>
<tr>
<td>Learning outcomes</td>
<td>Knowledge of SD &amp; environmentalism basic principles and their relationship to planning theory and practice; skills of formulating and appraising SD and environmental policy priorities.</td>
<td>Broader knowledge of SD &amp; environmental protection under specific context; skills to implement SD principles into municipal/ regional planning and governance.</td>
</tr>
</tbody>
</table>

### Table 2: Teaching Modules in Sustainability and GIS, MSc in Urbanism Programme at UACG, Sofia

<table>
<thead>
<tr>
<th>Topic</th>
<th>GEOGRAPHIC INFORMATION SYSTEMS (GIS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Geographic information systems – Part II</td>
</tr>
<tr>
<td>Code</td>
<td>GIS2bEBU_M</td>
</tr>
<tr>
<td>Delivery</td>
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<tr>
<td>Status</td>
<td>optional</td>
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<tr>
<td>ECTS</td>
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</tr>
<tr>
<td>Teaching hours (lectures/seminars)</td>
<td>60</td>
</tr>
<tr>
<td>Type of assignment</td>
<td>individual project</td>
</tr>
<tr>
<td>Learning outcomes</td>
<td>Understanding for current ESRI software application in urban, regional and landscape planning and management, and in environmental protection</td>
</tr>
</tbody>
</table>
An important peculiarity of the diploma work process is the fact that graduates are expected to provide the proposal for the diploma work topic themselves. Initial argumentation and preliminary information (on both the issue and the area regarded) should be presented at the end of the one-month pre-diploma summer practice of each student, carried out in a public, private or non-governmental organization dealing with some aspect of urban planning or management. The diploma work is therefore aimed to address and simulate situations as close as possible to the process of urban / regional / landscape planning or management, which is considered effective in integrating students’ knowledge, skills and professional values in preparation for real-life situations.

3. CASE STUDIES ANALYSIS

There is a growing number of diploma works declaring their authors’ commitment to the SD concept (although it would need another research on how many of the diploma works defended have successfully dealt with it). The two case studies analyzed hereafter properly illustrate a process of diploma work development, in which the authors have practically proved in the course of study their understanding for and commitment to the SD idea, their capacity for independent and creative professional work and their interest and motivation in implementing GIS.

3.1. BSc Degree in Urbanism Diploma Work

Title: Spatial Aspects of Mobility and Transport. Non-Motorized Transport Development in Karlovo-Sopot Commuting Region
Author: Hristo Nikolov
Supervisor/s: Assoc. Prof. Dr E. Dimitrova, Assist Prof. Dr M. Kostov

3.1.1. Diploma work topic, objective and guiding principles

The student’s pre-diploma summer practice was carried out in the EnEffect Center for Energy Efficiency, Sofia - an NGO specialized in energy management at the municipal level and municipality cooperation networks in the field. Energy efficiency is a core theme of the SD concept and the diploma work was initially intended to regard municipality cooperation policies in the energy efficiency field, considering interconnected social, cultural, economic, environmental and institutional aspects. Between the summer practice and the beginning of the diploma work term the spatial scope, the objectives and the framework of the diploma work were further developed. Its focus moved on to the issue of energy efficient transportation and improved mobility in urban-rural agglomerations, investigating the links between energy efficiency, mobility and transportation quality with their spatial aspects at the regional level.

The diploma work emphasis was set upon energy efficient and accessible regional mobility as a precondition for sustainable regional development in the moderately developing agglomeration of Karlovo and Sopot towns and the adjacent settlements in the upstream valley of Stryama river. Due to the development of numerous small and medium-size enterprises, agriculture and tourism services, motorization in the region has considerably increased while public transport was growingly inefficient and missing. This brought about the problem of transportation quality and socially accessible mobility, in parallel with negative environmental impacts. The author looked for better urban-rural modality and for non-motorized transport meeting the needs of commuters, while expanding leisure opportunities and access to cultural and natural sites located in and around the settlements. The guiding principles of the project covered environmental, socioeconomic, cultural and institutional aspects of the issues in space: (1) Ecological: Traveling with minimized footprint and other negative impacts on global and local ecosystems; acquaintance with and preservation of the natural and cultural identity; (2) Socioeconomic: Financially and physically affordable transport modes providing variable choices for different social groups (age, gender, status, ethnical); improved access to various goods and services and provided travel for all the population; (3) Cultural: Providing opportunities for more interactive public transport and non-motorized transport means; improvement of public health by promotion of physical activities; (4) Institutional: Development of institutional capacity for management of common issues through integrated policy and cooperation; increasing the trust in local government and administration by the provision of cost efficient and equal travel opportunities for all groups; (5) Spatial: Balanced spatial distribution of infrastructure and services; Prioritization of movement axes and promotion of potential or missing hubs and connections.

3.1.2. GIS implementation

Software, data and sources: Several sets of available and freely distributed GIS database and information were used in the diploma work:

- Land use database by The Corine Land Cover 2000 Project
- Satellite images and snapshot views by Google Earth, NASA World Wind, Yahoo! Maps
Analytical stage: Using the software available at the Laboratory of the Faculty of Architecture, the diploma student was able to rectify topographic maps and to create thematic maps using the rectified topography and additional geospatial data. The additional data included land cover, elevation and ecological networks’ borders. The detailed thematic maps were provided for investigation and spatial analysis of suitable routes for non-motorized transport in the commuting region. Criteria for defining these included accessibility and safety, optimal distance and comfort, ease for adaptation and maintenance, suitability for recreation and communication at scenic and curious places, provision of good climatic conditions. At this stage GIS was very useful for the desk research in combination with photo archives, small amount of field visits and verifications, reconstruction of memory from previous visits with different purposes, also with some interviews.

Conceptual stage: GIS environment was not directly used in this stage. At some situations the Google Earth and NASA World Wind applications were appropriate tools with their 3D environment for verification and specification of choices and proposals made. They were combined with the sources of information provided by the topographic maps and other data and knowledge about certain places. The proposal of a network for non-motorized movement in the shape of greenways and its maps and figures were drawn using non-GIS based vector or raster imaging software.

3.2. MSc Degree in Urbanism Diploma Work

Title: Integrated Environment for Everyday Leisure and Rural Tourism around the Town of Pazardzhik and the Commuting Region.
Author: Angel Burov
Supervisors: Prof. Dr V. Troeva, Assoc. Prof. Dr E. Dimitrova

3.2.1. Diploma work topic, objective and guiding principles
Angel Burov’s pre-diploma summer practice was conducted in a consultancy company specialized in urban planning, urban and architectural design and real estate investment and construction process legislation. Some of the assigned
tasks and responsibilities during the practice were about urban investigation and design for mixed development including residential, recreational and commercial uses around the city of Varna. In the meantime there was also an ongoing international student project Leisure & Landscape initiated by the Dutch Government Advisor on the Landscape. Influenced by these experiences, the diploma student chose a diploma topic focused on recreational supply based on national policy principles of controlling and redistributing leisure development according to local strategies and sites. The recreational supply with its positive and negative influences is broadly discussed in the ‘sustainable development’ debate. The diploma work was intended to integrate sustainability principles in the spatial organization of the activity while considering the holistic implications of social, cultural, economic, environmental, spatial and institutional aspects. At the beginning of the diploma work semester the focus was set on to the issue of regional cooperation for promotion of alternative tourist destinations and leisure practices around the agglomerations of Plovdiv and Pazardzhik – both towns located between Maritza river and the foot of Rhodopa Mountain. The author was looking for the active mitigation of environmental degradation and loss of valuable landscapes caused by tourism with its seasonality and patterns of concentration at the national level and the surrounding regions. Emphasis was upon two main objectives: (i) The leisure and tourism resources – proposal for balanced and diverse pattern of supply in leisure and tourism at national and regional level; regional concept and integrated landscape scheme for promotion of recreational components in intensified agricultural landscapes and in neglected brownfield open spaces; and (ii) the social environment – against the current approach for transformation of the demand for leisure and tourism; guidance for sensitive treatment of landscapes with high natural and/or cultural value and the transformation of related needs, practices and the acts of use according to the recreational resources in the region;

The guiding principles of the diploma project were: Ecological: Integration and remediation/amelioration of biotopes; Preservation and conservation of ecological niches and “stepping stones”; Socio-economical: Incorporation of economical opportunities and benefits for the local rural communities from leisure and tourism activities; balanced level of commodification and formalization of practices; Cultural: Interaction for exchange of values, acquaintance of places and promotion of the regional identity; overcoming of exclusion from leisure and tourism through adaptation of recreational practices consistent with the characteristics of the environment; Spatial: Integration of the recreational components through the productive landscapes and emphasis of unknown and unpopular places; Extensification and balanced concentration by strengthening of intermediate spaces and alternative access; Institutional: Organization of destination, community, landscape and infrastructure management through various formal and non-formal initiatives; Guidance for sectoral and spatial integration of regional and local policies, conflict resolution, communication and cooperation.

3.2.2. GIS implementation

Software, data and sources: The GIS software used in the development of the work was Arc Map version 9.3. The following GIS databases and information sources (mostly in UTM coordinate system, WGS 34N) were used:
- Satellite images and snapshot views by Google Earth, NASA World Wind;
- Land use database by The Corine Land Cover 2000 project;
- Ecological Network Natura 2000 database provided by ‘Green Balkans’ and BSPB associations and MOEW;
- Free distributed elevation, exposure and slope data, administrative borders, roads and railroads, settlements, water bodies, protected areas from the Rodopi Project funded by GEF, UNDP and MOEW;
- Free distributed topographic maps;

Analytical phase: Using the software available at the laboratory of the Faculty of Architecture, the diploma student was able to rectify topographic maps and to create thematic maps using these rectified maps and basic geospatial data including administrative and natural conservation borders and natural features, land use, settlements, artificial networks, water bodies, slopes, aspects, relief. These thematic maps of satisfactory detail were developed for the tasks of investigation and spatial analysis of heritage sites, conflict uses, attractive and suitable environments for leisure and tourism, routes for motorized public and non-motorized individual access to recreational spots and areas. There were many categories of resources, features, conflicts, potentials and networks classified and numerous criteria applied for defining them. Considering the amount of that analysis and the lack of ready-to-use databases, most of the examinations and evaluations were conducted combining various digital environments, references, sources and content. Most of the results were presented using raster imaging software after exporting EPS files from Arc Map and AutoCAD. At this analytical phase GIS was very useful for the accurate visualization and integration of the sufficient level of data available for the chosen scales and also for simple queries of attributed characteristics. In this sense GIS was also very useful for the desk research in combination with limited field observations (due to the overlapping autumn / winter season), review of photo archives, ortho-photo images and cadastral maps (not aligned with the other geospatial sources), many conversations and interviews with respondents and the use of techniques like mental maps for the reconstruction of the real conditions and actual behaviours.
Conceptual phase: GIS environment was scarcely used in the conceptual phase of the diploma work except for some specific queries but its overall significance for the spatial evaluations was very high. The Google Earth and NASA World Wind applications were useful as supporting tools with their interactive environment for part of the visual quality evaluation, for the synthesis of current situation and future scenarios (based on land use changes in the recent 15 years). The most useful input for the choice and definition of systems in the concept and the supplementing integrated landscape management scheme was provided by the rectified topographic maps combined with the other vector and database sets. The deeper qualified knowledge about processes, culture, attitudes and projections about certain places and types of landscape was very important for the differentiation of the approaches to the various classified environments and objects, their interdependence, mutual influence and combined potential, which resulted in concrete proposals for recreational infrastructure and management regimes. The final outputs were drawn using raster imaging software. The representation was author’s graphic interpretation with its own set of symbols.

3.3. Comparative analysis of GIS implementation in case-studies

The comparative analysis undertaken of the two case studies reveal a number of common approaches and needs in the process of addressing the sustainable development idea as well as common barriers to GIS implementation.

3.3.1. Identified common approaches and needs

The two case studies are exemplar diploma works with actual SD topics covering current issues at local and regional level. They are driven by holistic objectives sensitive to social and spatial phenomena. Both of them are based on
combination of approaches evolving from the specific characteristics of space and structures, environment and resources, activities and behavior. They are interdisciplinary in spirit and integrate different analytical and planning approaches. The ambitious guiding principals intended to be incorporated in their final results required commitment and comprehensive investigation of broad number of sources and enormous piles of information, largely not structured well for their purposes. The structuring of the final representations was a real challenge with regard to the variety of categories, the need for clear explanation of the innovative approaches, the delicate impressions and positive messages addressed.

3.3.2. Estimated difficulties in implementing GIS

Similar difficulties in implementing GIS were estimated by teachers and students in both cases: (1) Insufficient or costly place specific information for the diploma work purposes at the defined spatial scope, not available for students in the faculty, nor in municipalities and state agencies; (2) Not all the data compatible in between and with the GIS environment's requirements and the transformation of it is more often time consuming and demands deeper understanding and additional skills for structuring a useful geodatabase; (3) Not enough experience for conducting deeper spatial analysis in GIS environment developed during the education at the Bachelor's program and no essential progress during the Master's program due to lack of stimuli or self motivation for integration with project oriented disciplines aimed at preparation of spatial plans at different levels and scales; (4) Lack of self-confidence to develop and complete more tasks in GIS environment at the analytical and synthesis stages along with more appropriate easily accessible methods and techniques in conceptual representation for educational tasks; (5) Obstacles for integration of field research place specific information because of no GPS availability for students at the faculty; (6) No affordable access to software for personal use.

4. GIS AND SD EDUCATION FOR URBAN PLANNERS: SOME CONSIDERATIONS

The further and broader integration of GIS in the education for urban planners is surely to provide a lot of positive effects with regard to providing broader chances to address the complex issue of sustainable development in space. The various aspects to take into consideration in future development of the educational program in urban planning comprise both technical and educational ones, as well as issues of motivation and stimuli, markets and partnerships.

4.1. Aspects to consider in integrating SD and GIS in planning education

Technical aspects: As GIS are not the only possible digital environment in urban planning and design professional field, they are usually substituted with CAD (vector) or illustrative (vector-raster) environments, which are more easily approachable and found more universal and time-efficient by students for the implementation in various educational tasks. This is the reason why many of GIS core advantages still remain underestimated and only partially applied.

Educational culture: Education is nowadays increasingly regarded as an open-ended process and educational approaches as a whole are to be explicitly aimed at developing students’ positive attitude to and capacity for long life learning. With regard to GIS and SD this would be a fully relevant approach as they are both dynamically developing fields. The structure and contents of existing SD teaching modules in the BSc in Urbnaism programme are continually updated with an explicit focus on a broader range of interactive educational activities and persistent search for integrated and holistic approaches. There is however a strong need - not adequately met yet - for re-formulating tasks and course works in a way much more insistent and encouraging on GIS implementation. Explicit focus on quality assessment of teaching / learning in GIS environment could be the way to identify barriers and support the search and efforts for innovative approaches.

Motivation and Stimuli: Students’ interest and motivation for working in GIS environment should be more strongly encouraged throughout the whole educational process. Both formal and informal ‘good practice’ dissemination and sharing experience among students from different courses have already proved to be a strongly efficient means to increase interest and motivation in undergraduates. It would be of even greater importance to provide relevant stimuli for teaching and technical staff to get more broadly involved in interdisciplinary dialogue and collaboration in order to conceptualize and use emerging opportunities. Focus on real-life case studies and close links with on-going applied research topics would be particularly helpful in this respect.

Markets – existing, emerging and potential: It seems there is no sufficiently differentiated current approach to students as GIS software users - current or potential, customers or developers. Limited availability of appropriate and diverse software (open source / freeware / shareware / commercial) at the University or at personal workstations (mobile or stationary) and limited availability of specialized literature at the library provides further barriers on
students’ path to GIS, which provides an unfavorable context for their future professional motivation and capacity for GIS implementation in urban analyses and planning.

**Partnerships to build:** Partnerships are crucially important in order to provide the needed access to appropriate (in both scale and content) information. Databases (especially at large scales) could be provided through the effective communication of priorities between governments, business, NGOs and academics. Partnerships are also mutually beneficial with regard to interdisciplinary and continual education.

### 4.2 Approaches and possible actions

There seems to be an urgent need for a broader debate on the effectiveness of current educational approaches with regard to conceptualizing and applying SD principles and on the ways for their further development with regard to the broader integration of SD and GIS issues. A number of practical steps could prove relevant and also possible to undertake in the short and middle term.

**Deeper research on current situation:** students’ awareness of GIS as an efficient tool in the field of SD and motivation to implement it in their own work should be more closely scrutinized through direct observation and examination, through interviews and inquiries, and through organizing thematic focus groups bringing together undergraduate and diploma students and already graduated students from the BSc / MSc programs in Urbanism. Relevant questions would be the motivation for and the level of GIS application: interpretation of data / combination of different programs / analysis in the course works (in teams) and diploma works (individually).

**Development of quality evaluation criteria:** Evaluation criteria more precisely focused for course projects, course works and course exercises; An adaptation of the current ECTS credit system could be also considered in the longer term in order to provide broader opportunities for more effectively involving GIS teaching staff in the teaching process in urbanism with technical and methodological support (for both course and diploma works).

**Early acquaintance of students with GIS:** Introducing simple GIS techniques (non or semi digital) at an early phase in the beginning of the BSc Program (the Urban Analysis module in the 1st semester) could be a particularly good opportunity to raise students interest and to demonstrate GIS philosophy and possible approaches to spatial analyses integrating various types of criteria and data.

**Development of case study databases:** These could be continually developed through the partnership and data input by ministries, agencies, municipalities, business, NGOs and citizens groups, with the participation of research teams and students as part of an. It would provide continuity in database accumulation in space and time and would moreover develop the basis and the means for integrated educational approaches effectively applied for long-life learning as well. This could be further developed on a broader level to support the provision of Internet resources (open source software and data bases) and Internet based interactive platforms and an Integrated Consultation Centre (supported by universities, institutions, municipalities, business and NGOs) with reglamented access for students educated in urban, landscape and regional planning, water, transport and other infrastructure engineering, agriculture, forestry and ecology, geography, etc;

### 5. CONCLUSION

There is still a major message to spread through urban education about the aims and the means of sustainable development and about GIS as the effective instrument to support urban planning and governance facing the objectives of sustainable urban development. It needs strategic thinking, interdisciplinary dialogue and the joint efforts of people and institutions. It also needs to broadly promote positive results and carefully analyze emerging barriers and persistently support and encourage students’ intellectual interest and professional motivation for using GIS as an efficient tool on the path to sustainable development.

**References**


UNGASS (United Nations general assembly special session) (1997) Special Session of the General Assembly to review and appraise the implementation of Agenda 21 ‘Earth Summit II’.

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