

# Geoinformatics as an Educational Tool for the Development of the Status

## of Global Active Citizenship

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Abstract: Globalization, wars, global economic crisis and climate change have led to the need to implement strategies to ensure the viability and sustainability of human society and natural environment. In order to achieve the relevant strategic goals, it is essential to develop individuals with the status of global active citizenship. Education, which must not remain uninvolved and static across to developments, but actively participate in social processes, can take advantage of the science of Geoinformatics and its applications, which are ideal, valuable and flexible tools for all components of education, and can catalyze the fulfillment of its goals, as they offer the opportunity to study a variety of collaborative and interdisciplinary issues, enhancing students' critical thinking and actively engaging them in the decision-making and problem-solving processes at local, European and global level.

Key words: citizenship, sustainability, geoinformatics, GIS

### 1. Introduction

The modern era is characterized by rapid and violent changes in economic, political, social, technological, scientific and environmental level. Those changes are so intense and important that they finally have a global impact, bringing human civilization faced with the global economic and social crisis, as well as with the global environmental destruction. Therefore, it is very important to create, develop, implement and feedback strategies and policies so as to address these problems and to ensure the viability and sustainability of human society, but also of the natural environment, part of which is also the man. Thus, in order to achieve these strategic goals, it is essential to form democratic cosmopolitans, who are able to understand the value of peaceful coexistence and creative participation in all areas of action in social and political life, to show respect for the natural and cultural

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environment, and to perceive their global dimension, as well as to recognize, critically process and effectively address the various undesirable mechanisms of influence and manipulation (Kalogridi, 2005, pp. 188–189).

In addition, the phenomenon of globalization has dissolved the homogeneity of societies, created multicultural communities and the need for people who no longer share common blood, national, historical or cultural ties to coexist in the same space, thus, the recognition and the acceptance of the different need to be included in the qualities of the citizen of the world. The new identity of the world's citizens acquires supranational features and cooperative spirit, with a sense of solidarity, tolerance for cultural differences, recognition of common elements and differences, but also with the ability to be flexible, with independent thinking, judgment and action (Nikolaou, 2006, pp. 446–447).

Given that democracy is not only established by the commitment of citizens to its fundamental principles, but it also presupposes their active participation in socio-economic, political and cultural processes, both at local and national or international level, a responsible citizen is a citizen who actively belongs to a community, participates in developments, knows his rights, which he exercises with respect to himself and others, but also recognizes his obligations as a sense of duty to the community (Kouraki & Vorilla, 2014, p. 220).

It is noteworthy however, that the majority of citizens are not actively involved in these processes, either because they do not have the skills, or because they are not given the opportunity, or because they are reluctant to do so. Characteristic is also the low participation of young people in the electoral process worldwide.

#### 2. Education for the Development of the Status of the Global Active Citizenship

The contribution of education to strategies for the sustainable development of societies is vital and therefore it is imperative to strengthen its assistance to the protection of human rights, peace, gender equality, health, and sustainable development, as well as to locally and globally fulfillment of the status of responsible citizen (UNESCO, 2015, p. 47).

Therefore, the modern education systems of developed countries are facing a serious problem, which concerns the cultivation, development and implementation, in their context, of democratic citizenship, with the ultimate goal of creating active, democratic, global citizens capable of stand with dignity and consciousness in a context of globalization and rapid change. Thus, in order to shape the democratic personality and the active citizen, the institutional framework of the educational function and the Curricula are constantly revised, taking into account the principles and values of sustainability, such as solidarity, respect, oligarchy, integrity, justice, tolerance, democracy, etc. Moreover, modern pedagogical methods and student-centered and collaborative teaching practices are applied, encouraging the required qualities and attitudes for living in a global, participatory and democratic society of citizens, which carry out their obligations and claim their rights. In this learning environment, students have the opportunity to express their views, make decisions, participate in group projects, negotiate, collaborate and communicate, accept and respect the different, so that eventually democratic values become part of themselves and find application in their everyday life (Sakelariou, Gesiou & Tsiara, 2020, p. 49). In addition, the above horizontal social soft skills, which are interrelated, as the development of one supports or depends on the development of the other (Pedagogical Institute, 2011, p. 9), can really help students realize that their choices have an impact not only on their school and local community, but on the whole planet, only if they develop satisfactorily and gradually, throughout the educational life of students, still starting from pre-school education and only in this way in the future students could be developed into active citizens who will operate flexibly in the

various social environments in which they will be found during their lifetime. Otherwise, it would be deceptive to expect students who have never been involved in participatory processes and have not developed the relevant skills, abilities and responsibilities, to be formed in the future into responsible and active adult citizens, capable of contributing to sustainable recovery and development of societies.

Additionally, on the one hand, the benefits of the development of citizenship in the educational process operate at the socio-political level, as democracies are based on citizens who know their obligations and rights, are active in their communities and are responsible for their actions, on the other hand, they contribute decisively to the school-personal level, as the emphasis on citizenship creates people with confidence, capable to face challenges such as discrimination and bullying, and to raise their voices (Kouraki & Vorilla, 2014, p. 220).

#### 3. The Geoinformatics as an Educational Tool

The science of Geoinformatics and its applications are ideal, valuable and flexible educational tools, which could play an important role in the development of global citizenship and sustainable development, as they offer the opportunity to study collaboratively and interdisciplinary, environmental, political, economic and social issues, both at local and global level.

Geoinformatics is the science that utilizes geographical information and modern technologies developed by the ICT sector, in order to be able to collect, store, inform, manage, process, analyze, visualize and present proposals on problems to related sciences (Tzotzakis, 2016, p. 9). It is the science that connects spatial, temporal and descriptive information, offers the ability to process and analyze data, and assist to the properly manage of various important and complex issues and to the solution of problems with environmental, socio-economic and political dimensions.

The science of Geoinformatics has universal appeal and is used in academic but also in professional environments. Its applications are used for a variety of purposes by the military, but also by the civil protection services, such as the police, the port and the fire brigade (for the registration of traffic accidents, fires, earthquakes and in general emergency situations, with main purpose the preventing and early treatment of them), by the forestry departments, the meteorological service, the cadastral service, the urban planning service, during the survey of the correct location of both public constructions, such as roads, ports, schools, parks, hospitals, etc., and commercial stores or private enterprises, as well as when locating and managing utility networks. Moreover, nowadays, it is used systematically for the proper management of environmental issues, such as water management, the greenhouse effect, and environmental impact studies as a consequence of socio-economic, anthropogenic activities, such as major constructional projects, intensive agriculture and over-exploitation of the earth's natural resources. In addition, it has applications in financial research, polls, and demographic analyzes, but also in the everyday life of the citizen, as new technologies, such as digital thematic maps and navigation systems, are nowadays necessary means of informing the modern western citizen on a variety of topics, such as cultural, recreational, consumer, informative, etc.

The most important tools used in the science of Geoinformatics are G.I.S (Geographic Information Systems), G.P.S. (Global Position Systems), but also the techniques and special instruments of Photogrammetry and Remote Sensing, which are able to acquire, analyze, process and interpret information from aerial photographs and satellite images of entities located on the earth's surface.

Nowadays, the science of Geoinformatics is the dominant method of mapping, visible and non-visible,

entities, on both the earth's surface and its interior, as well as on its atmosphere. The science of cartography is inseparable with the science of geography. Its goal is to project, on a scale, a portion of the earth's surface in a horizontal plane, which will also include the graphic representation of natural or anthropogenic information, depending on the use of the map (Tzortzakis, Striliga-Pistolla & Leounaki, 2015, p. 8).

The GIS, aided by the other Geoinformatics tools, is a smart map tool that enable users to capture spatial information, create interactive spatial or descriptive questions, edit and analyze spatial data, and then present them either in classic analog format, such as printed maps and diagrams, or in digital format of spatial data files, or in digital interactive maps (Tzortzakis, 2016, p. 9).

In general, Geoinformatics tools are designed to be accessible to the general public and provide quality solutions to spatial problems in a fast and understandable way (Tzortzakis, 2016, p. 10). Nowadays, it is systematically used in Higher Education, while there are free and reliable software such as Quantum G.I.S. or QGIS, with friendly and pleasant graphical environment, which is an excellent choice for educational and professional applications, and which has been used since 2016 as a basic educational tool of Vocational Secondary Education, in Greece, in the courses a. "Topographic Design-Digital Mapping" of the 2nd class, of the Department of "Structural Engineering, Built Environment and Architectural Design" of the Vocational High School, and b. "Geoinformatics Applications in Engineering" of the 3nd class, of the professional specialty "Technician of Structural Engineering and Geoinformatics", of the Department of "Structural Engineering, Built Environment and High School. Since 2017, it is also taught in Post-secondary Education, in the learning unit "Geographic Information Systems (GIS)", of the Curriculum of the "Post-Secondary Year-Apprenticeship Class", of the professional specialty "Technician of Structural Engineering unit "Geographic Information Systems (GIS)", of the Curriculum of the "Post-Secondary Year-Apprenticeship Class", of the professional specialty "Technician of Structural Engineering of the Department of "Structural Engineering of Structural Engineering of the Post-Secondary Year-Apprenticeship Class", of the professional specialty "Technician of Structural Engineering" of the Department of "Structural Engineering of Structural Engineering and Geoinformatics", of the professional specialty "Technician of Structural Engineering and Geoinformatics", of the professional specialty "Technician of Structural Engineering and Geoinformatics", of the professional specialty "Technician of Structural Engineering and Geoinformatics", of the Department of "Structural Engineering, Built Environmen

However, Geoinformatics could also be an important educational tool for more students of Secondary Education, and could be used in courses such as the Project and the Creative Activities Zone of High School, as in the future most of these students may use it in their personal or professional lives, but also because it is a dynamic, interdisciplinary tool that can utilize scientifically diverse fields of study, such as geography, physics, mathematics, biology, history, culture, etc., whose issues could be correlated and projected in many different ways. The common use of diverse scientific fields and the interdisciplinary organization of teaching are expected to cultivate in students complicated thought, which is essential for the study and analysis of global issues.

The interdisciplinarity of digital maps of geoinformatics is due to the fact that they are capable of providing a range of overlapping levels of categorized information, such as, for example, one level with the administrative boundaries of an area of interest, one with its road network, one with its hydrographic network, one with its topography, one with the agricultural parcels of the area and one with the land use, which could be partially or totally combined, placed one over the other and create a dynamic, smart, digital map that could be analyzed, edited, highlight new aspects of a phenomenon and provide answers to spatial and temporal questions and concerns of students, utilizing their knowledge, while, at the same time, enhancing their critical thinking and their active participation in the public and in global developments.



Figure 1 Example of Information Levels Used in Combination in GIS (Fperegrine, 2014)

Furthermore, the science of Geoinformatics and its applications are ideal, valuable and flexible tools for all components of education, such as environmental education, intercultural education, health education, citizenship education, etc., as they contribute to the study of environmental, economic, political, cultural and social issues, both at local and global level, influencing the way students perceive themselves within the global community and helping them understand the economic, social and cultural interaction and interdependence of the local with the global. Teachers, taking into account the special interests, values and attitudes of their students, their cognitive level, as well as the peculiarities of the local community, could implement various themed activities, such as:

- Climate change and its effects. Spatio-temporal study, where aerial photographs, or related thematic, digital or not, maps from different time periods are compared with other data, such as statistics or testimonials.
- Population movements. The causes and their spatial and temporal consequences, through the comparison of population movement maps, financial data, immigration reasons etc.
- Modern epidemiology. Which factors could shape or affect it? Spatial analysis of incidents and performance of a geographical dimension to the problem.
- Urban development planning, restoration and consolidation projects of urban green areas. Research on the social and environmental impacts of anarchic urban development, and proposals for landscape restoration of degraded urban and industrial areas, with the creation of digital maps and spatial databases.

 Fundamentalism and human rights. Spatial presentation of the areas of influence of nationalist or religious groups, which lead to violent conflicts and violation of human rights, and correlation of economic, political and religious interests.

in which students will no longer be passive knowledge receivers, but through active learning methods such as field study, role-playing and consultation, will learn to recognize problems and treat them with the help of geographical approaches and analyzes. Children will learn to act as a team and take strong action against the centers of power. They will also develop empathy, understand cause-effect relationships and, above all, understand their responsibilities as members of a community and citizens (Kouraki & Vorilla, 2014, p. 222).

Issues, related to the sustainable development of the local community or the school environment, are also particularly attractive, as the learning process acquires personal interesting and a strong incentive for students to engage. For example, a problem associated with the school environment, which concerns students, parents and teachers on a daily basis, and which could be studied and sought ways to solve it, is the safe access of students to the school. Initially, students explore, analyze, and exchange views and queries that they consider important in relation to the issue they are studying. Then, they are divided into groups and take on roles to work in the field by photographing and recording, using GPS applications and cameras, or by noting on a printed map of the area adjacent to the school, or even just in a simple drawing by hand, the traffic marking that exists around the school (pedestrian crossings, traffic lights and signs), but also the dangerous points due to incomplete or damaged marking, limited pavement, damaged road surface, illegal parking of vehicles, etc.

Subsequently, the student groups may initially draw the maps on rice paper and place the information levels of each group, one above the other, so that they could visually combine the collected information. Then, they may digitize the data that they have collected, in order to be able to process and adapt them more easily and quickly, and to determine empirically the benefits and advantages of the application of modern GPS technology in comparison with the traditional mapping methods.

In this way, students visualize and locate the issue they study, combine and correlate information and knowledge, and form a complete view of the subject, through the production of digital interactive maps, pictures, graphs and 3D representations. They also extract useful conclusions and they become able to assess the risks of human activities and propose solutions to ensure the safe movement of students and citizens in general, in their urban environment.

#### 4. Conclusion

Therefore, citizenship could be cultivated in the students through the active and collaborative teaching method and the holistic view of reality, with the help of Geoinformatics, as they are actively involved in decision-making and problem-solving, develop their critical thinking and creativity, acquire tolerance, responsibility, political interest, respect for other cultures, sense of global identity (Voudrislis & Labrinos, 2014, p. 4), and become able to envision the development of viable societies, and propose sustainable management plans and measures, contributing to the fulfillment of the goals for sustainable development.

In conclusion, it is imperative for modern children to be educated as global citizens, so that they can raise their voices and oppose at injustice and inequality, contribute to the confrontation of the current political, social, economic and environmental problems and in ensuring democracy and social cohesion. Continuous evaluation, adaptation and feedback of curricula is very important to achieve this goal, so that the new technological means and the abundance of data that they provide could be fully exploited, but also very important are the necessary knowledge, skills and abilities of democratic cooperation and participation of teachers (Nikolaou, 2006, p. 449), who in collaboration with parents and society have to shape those citizens who will be capable and worthy to deliver them our world (Vasiliadis & Tsioumis, 2015, p. 2).

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