Mapping my Mangrove: New Technologies applied to cartography to support environmental education in the teaching of Geography

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Abstract. The objective of this paper aims to develop and evaluate the methodology used for the addition of new technologies applied to cartography via environmental education in the teaching of Geography. This paper, as part of the research for my Master's Degree, is developing a website to support the process of teaching and learning Geography about the mangrove areas in the city of São Gonçalo, Rio de Janeiro. New technologies used in cartography shall be used, such as Multimedia Cartography, Web Cartography and Remote Sensing, in accordance with the PCN – National Syllabus Guideline (Parâmetros Curriculares Nacionais) in Geography and the environmental transverse theme. The methodology is directed towards the creation of some digital media named MMM (Mapping My Mangrove) via the Internet and divided into three modules: Module 1 (Learning the basics of Cartography), Module 2 (Exploring the mangrove areas of São Gonçalo) and Module 3 (Socio environmental awareness of the mangrove ecosystem). The main objective of this material is to allow students to interact in an active way in the construction of their knowledge about the socio environmental importance of the mangrove areas of São Gonçalo and, thus, raising their ecologic preservation awareness of the mangrove through the cartographical activities proposed in each module; in order to achieve that the student may add photos, videos, text, audio, as well as satellite images according to each activity in the modules. This material is going to be evaluated in seventh grade classes of basic education of public schools of the city of São Gonçalo through practical tests during the first semester of 2013. After the evaluation of the results from the tests performed at the schools, adaptations and corrections of this material shall be made available and hosted at City Hall's webpage still being amendable.

Keywords: Cartography, New Technologies, Environmental Education

1. Introduction

Contemporary society punctuated by strides in technology development described as "the information age" (Castells 1999). This new reality is characterized by the easy access to modern means of mass communication and information, such as television broadcasts, telephony, school age children who use the computer a lot. The quick changes in the technology field draw in a new pace in teaching and learning (Kenski 1998).

Accordingly, the integrated introduction of new technologies applied to cartography, particularly, Multimedia Cartography, WEB Cartography and Remote Sensing in teaching has become important resources as aid to Geography classes. These technologies used in an integrated way in the teaching and learning process of Geography enable the student to analyze and participate actively in the construction of knowledge as they enter geographic information about the theme being studied into the modules from the combination of maps with assorted media: texts, pictures, videos, sounds, as well as satellite images according to the assignments.

Due to the limited production of cartographic material about the mangrove areas of São Gonçalo, as research project, the development and evaluation of a methodology to support environmental education in the teaching of Geography has been proposed for the ongoing Master's Degree.

The methodology consists on the creation of a website named MMM (Mapping My Mangrove) to support environmental education about the mangrove areas of São Gonçalo, to teach Geography to seventh grade students from the public city schools of São Gonçalo. New technologies applied to cartography to support environmental education in Geography classes shall be used, such as Web Cartography, Multimedia Cartography and remote sensing in order to teach environmental education, in particular, the mangrove ecosystem of São Gonçalo, Rio de Janeiro. According to (Wiegand 2006), at this school stage, students are able to work with maps in a more analytical way.

This meets one of the propositions of the National Syllabus Guideline (Parâmetros Curriculares Nacionais) (Brazil 1999) for Geography, which suggests the usage of different sources of information and technologic resources for the construction of geographical knowledge.

Acccording to National Syllabus Guideline – Transversal Themes (Brazil 1999)[1], the main contribution of schooling is to "contribute with the

[1] Parâmetros Curriculares Nacionais is a syllabus guide organized by subjects and grades for basic education in Brazil.

education of conscious citizens, capable of making decisions and act in the socio-environmental reality in a way that is committed to life, with the well-being of each one and society as a whole, locally and globally".

Thus, this material aims to help the student learn about the socio-environmental importance of the mangrove areas of the city from its natural dynamics and the occurred anthropic impact, in a more intense way, between 1980 to 2010, which resulted in the current state of degradation of this ecosystem, and thereafter raise their environmental awareness for the preservation of this mangrove area.

2. Theoretical considerations about new technologies applied to cartography to support environmental education in Geography classes

In the midst of the technologic innovations in Cartography, the map is increasingly more present in daily life through a large array of media, be it in books, magazines, newspapers, television newscasts or the world wide web; however many people don't have the skill to understand the geographic information presented in the maps (Elzakker 2001).

The improvement of the new technologies used in the developing of mapping has not been followed in the usage of combination of digital maps in basic education. The pedagogical practices of geography teachers, is mostly still based on analogical maps; and those, in their turn, represent an unchangeable static reality limiting the interaction of the user as a reader (Menezes 1999).

According to the methodological guide written by the Ministry of Education of Brazil named National Syllabus Guideline (Brazil 1999) of Geography, the process of teaching and learning of this subject must contemplate “the usage of different sources of information and technological resources for the construction of geographic knowledge (Brazil 1999)”.

It is necessary to demystify the idea that technology is something that does not belong in basic education. Therefore, the use of Multimedia Cartography, WEB Cartography and Remote Sensing inserted into Geography classes allow for the teaching of environmental themes aiming to raise awareness in the student about the importance of the preservation through behavioral changes defended by (Leff 2005) as environmental rationality which is characterized as a new positioning of human beings in harmony with nature.

These technologies applied to cartography in environmental education have, as a primary role, to make classes more dynamic and interactive, as in virtual learning environments, the students are not only able to spot and identify, but they can also take a reflexive posture and a participative initiative about the importance of the mangrove preservation and that benefits both the quality of life of São Gonçalo and the local environment, contributing to the biodiversity of this ecosystem.

2.1. New cartographic technologies as environmental education aids in the teaching of Geography

The development and improvement of cartographic techniques, via the internet, has increasingly made the understanding of geographic space dynamics easier, creating a brand new environment for mapping: interactivity, real time and a dynamic environment (Kraak 2001). According to (Elzakker 2001) the use of maps on the internet offers the possibility of easily checking up places, use pan tools to move around the maps according to the needs of the research and also use hyperlinks integrated to multimedia (pictures, sound and video) and, it mainly presents the advantage of updating geographic information.

Even though it has become increasingly more common in the student's daily life to use digital maps, many of them still do not have basic notions of Cartography to interpret the geographical information presented by those maps (Peterson 2007).

Schooling becomes a key element in the construction of a society based on information, in knowledge and learning (Takahashi 2000). It is up to the school to create an environment through which the new technologies allow for an interdisciplinary interactive teaching, set to prepare students to become subjects capable of thinking, creating and expressing themselves via different languages.

Thus, the proposition of this investigation is to allow the student to handle the map according to the pedagogic assignment in each module, such as the pan resource to move the map or through the paintbrush tool they will be able to create the proper symbols for the map information and insert information about the studied subject following the teacher's instructions, among others.

Therefore, Multimedia Cartography based on the combination of maps and other medias (text, pictures and video) supported by the computer (Peterson 2007) becomes an important tool to identify, understand and develop a mental representation of their local space; ergo, it is important to offer this technology to basic education. The use of the World Wide Web can make multimedia resources a potential tool for learning, as it permits collaboration, interaction and exchange of ideas between students and teacher; besides, the internet is a tool to gather, select geographical data. Wherefore, students would become involved in their own construction of maps according to their needs (Wiegand 2005).

According to (Peterson 2007) other benefits would be gathered from using Multimedia Cartography via the internet in geography education, among those interactivity and dynamics: the student would take an active participation in the construction of knowledge, greater motivation and flexibility in learning, once one works with the student's contemporary technology.

Didactic-pedagogical practices in Geography must meet the use of maps in Geography classes not being limited to the location of determined spots that are ready and made for the students, but leading students to become active and participative in the mapping process, in the selection and insertion of spatial data from their living space and, consequently, in other spatial scaling.

2.2. Remote Sensing in Environmental Education

In geographic science, remote sensing has become an important tool for "recognizing" Earth in different spatial and time scales (Santos 2002); that allows men to better recognize their living space, as they visualize the dynamics of geographic space. Didactical procedures used in Geography classes must follow this new culture in the teaching universe (Di Maio 2004).

According to (Carvalho & Cruz 2001) this new technology helps students understand geographic space in a less abstract way if compared to a map. In accordance (Santos 2002), the introduction of Remote Sensing technology in schools allows students to identify, relate and understand environments and their transformation, such the impact caused by natural phenomena and anthropic alike, in particular the mangrove ecosystem of São Gonçalo (Florenzano 2005).

3. Objectives

The hereby paper proposes a methodology to support environmental education in the teaching of Geography. The dynamics of the mangrove ecosystem of São Gonçalo is approached between 1980 and 2010 using new Technologies applied to cartography, involving basic notions of Cartography, Multimedia Cartography, Web Cartography and Remote Sensing. In order to achieve that, the research aims to survey seventh grade Geography teachers to gather data about the didactic-pedagogical practices focused on environmental education in public city schools, to create a teaching methodology to support environmental education, namely, the mangrove areas of São Gonçalo, evaluate the use of new technology applied to cartography (media, internet, satellite images), via practical tests, in seventh grade classes of basic education in public schools from the city of São Gonçalo. Lastly, the main goal is to evaluate how these new technologies applied to cartography may contribute to the construction of environmental awareness in students about the mangrove ecosystem in the teaching and learning process.

4. Methodology

The city of São Gonçalo is nestled in the metropolitan area of Rio de Janeiro, more precisely on the east shore of Guanabara Bay and has a mangrove ecosystem on its shoreline characterized as a coastal ecosystem of transition between marine and earth, subject to tidal changes and adapted to salinity fluctuation (Novelli 1995). However, in the last few decades, the swift population growth in the city spiked from a total of 1980 635. 351 thousand inhabitants in the 80's to 999.978 thousand inhabitants (IBGE 2012) and it has not been followed by specific urbanization laws and regulations, which favored irregular erections with none or very little infrastructure of sanitation and, moreover, deforestation and embankments literally "crossed out" this ecosystem for the construction of the BR-101 highway, Niterói-Manilha stretch. That has resulted in the degradation of great part of the mangrove areas of São Gonçalo which now have their biodiversity deeply compromised, with the exception of the surroundings of ilha de Itaoca, where there is a reservation named mangrove fringe, area that belongs to the Área de Proteção Ambiental de Guapimirim since 1984 (Pires 1986).

Due to the importance of the subject and the current situation of environmental degradation of the mangrove area of São Gonçalo - Rio de Janeiro, this environmental theme has been chosen because of the limited works in Environmental Education performed in the public schools of the city according to the City's Environmental Education Sub Secretary. Therefore, the ongoing research aims to develop and evaluate methodology in seventh grade classes of basic education through the use of new technologies applied to cartography to support environmental education in Geography classes, such as Multimedia Cartography, Web Cartography and Remote Sensing, in accordance with the Parâmetros Curriculares Nacionais (PCN) of Geography and the transversal theme of Environment.

This research is creating a digital material about the "mangrove ecosystem" of São Gonçalo, Rio de Janeiro as transversal theme regarding Environmental Education named Mapeando Meu Mangue (MMM – Mapping My Mangrove). This website has been developed with XML files (texts, images and exercises) on WordPress, besides activities proposed on the Google Earth software. The MMM is a methodological proposition, developed in a Master's degree course to support environmental education, via the internet, structured into modules, texts, exercises, curiosities, further reading and website suggestions for interaction. The research website can be found at www.mmm.com.br, but it is not yet available for the World Wide Web. After the implementation of this instrument and future adaptations and corrections, this material shall be made available for free on the São Gonçalo's City Hall website[2].

Table 1 summarises the content of MMM.

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[2] São Gonçalo's City Hall is available at: http://www.saogoncalo.rj.gov.br.

	CONTENT	OBJECTIVES	ACTIVITIES
MODULE 1 Learning the basics of Cartography	Orientation Geographic Coordenates Scale Projection	-Identify the basic elements of cartography; -Reinforce the basic notions of cartography and fill in possible gaps from previous school years;	Exercises Websites for interaction Curiosities Further reading
MODULE 2 Exploring the mangrove areas of São Gonçalo	The mangrove ecosystem and its envoronmental degradation	- learn about the mangrove ecosystem and understand in time-space scale the environmental causes and impact over this ecosystem between 1980 and 2010 via several medias, such as drawings, pictures, texts, sound, video, and satellite images.	
MODULE 3 Socio environmental awareness of the mangrove ecosystem	Preservation and conservation of the mangrove	- understand the importance and the role of this coastal ecosystem for the environment attempting to develop environmental awareness in students about the mangrove.	

Table 1. Structure of the MMM website

This material shall be evaluated in seventh grade classes of basic education in the public city schools of São Gonçalo. The schools participating in the tests shall be defined by the end of the current year with the City of São Gonçalo Education Secretary.

5. Final Comments

The ongoing research investigates the introduction of new technologies to basic education, as is creating means for evaluation on the website, *Mapeando Meu Mangue* (MMM – Mapping my Mangrove) that has as methodological proposition the usage of Multimedia Cartography, Web Cartography and Remote Sensing in environmental education in the teaching of Geography for the study of the mangrove ecosystem in the city of São Gonçalo – Rio de Janeiro and shall create evaluation means for it.

It is expected that the evaluations of this website to support environmental education indicate positive perspectives promoting environmental awareness in students about the mangrove areas from the presence of this ecosystem in their city. To sum it up, we seek to contribute to the improvement of the quality of Geography classes, creating a bigger interest in students and teachers for science and technology.

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