The teaching of cartography in the context of the new technologies: Geotechnologies as a methodological proposal

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Abstract. Cartography has been used by humans since the earliest times, whereas graphic communication preceded the written. Depending on how it is discussed, cartography can be the mediator to the understanding of the world, because it works with a graphic language that may contribute to the understanding of several topics such as economy, politics, physical characteristics of a particular region, and other subjects. Thus, through a critical reading, cartography becomes an important tool for working relevant current issues. Given this, it is observed that this science is a key to teaching and researching, because it enables representations of different clippings of space and the expected scale, which added to its multidisciplinary factor, may favor the process of teaching / learning in various fields of knowledge. The mapping language has a close relationship with Geography teaching, since it is through it that this area of knowledge can represent, in a symbolic and figurative form, its various themes. However, researches developed in recent decades indicate that the teaching of cartography has been going through many difficulties and students of basic education, in most cases, cannot give meaning to the contents taught with the use of cartographic resources. In this context, recent technological innovations in information and communication (ICT), introduced from the scientific-technical revolution, brought new possibilities to work with cartographic content through sites such as Google Maps, Google Earth, IBGE, computer programs, electronic games, among others. The use of these tools in a supervised manner allows students to not only visualize the space in different scales and perspectives, but also relate in a more spontaneous and interactive way with the content involved, thus gaining a greater understanding of these themes. The current technological scenario provides very favorable resources for education and teaching of cartography in particular, still little used in the school environment. According to the Ministry of Education (MEC) (BRAZIL, 2001), the school curriculums should develop skills to obtain and use information through the computer, and making students aware of the presence of new technologies in everyday life. Given the above, this research has the general objective to present the use of geotechnology as a methodological proposal for the teaching of cartography, starting from playful approaches from different geographical contents, aiming to stimulate interest and greater participation of students

in the teaching-learning process. To prepare this work searches were conducted in books, specialized websites and scientific articles that deal with the teaching of cartography, the use of new technologies in educational contexts, as well as specific programs such as the Philcarto, I3Geo, and Spring that can be used to teach Cartography. It was found that for the application of teaching methodologies related to new technologies, it is required a specific preparation by the teacher, because improper use of this feature may compromise the formation of students.

Keywords: Cartography, Geotechnology, Education. Playfulness.

1. Introduction

The cartography has been used by man since the ancient times, and the graphic communication precedes the writing. One way of studying the ancient civilizations is through images or maps left by these people, because those records can provide us with information on how many of them lived.

Depending on how it is addressed, cartography may be a mediator to understand the world, because it works with the graphical language that can contribute to understanding of several subjects, including: economics, politics, physical characteristics of a given region, and etc. Thus, through a critical reading of cartography it becomes an important tool to work relevant issues of our time. Given this it is observed that this science is an essential resource for teaching and researching, as it allows gathering different representations of space and the desired scale, which added to its multidisciplinary aspect may favor the process of teaching / learning, in various fields of knowledge.

The Cartographic language has a close relationship with Geography Teaching, because it is through it that this area of knowledge can represent symbolically and figuratively it's various themes. However, researches conducted in recent decades indicate that the teaching of cartography has suffered many difficulties and students of basic education for the most part, cannot give meaning to the content taught.

The problems observed in the process of cartography teaching and learning reflects in the limited domain of the language of maps by the students, and is considered a negative aspect to the process of teaching and learning, because they conclude the basic education without developing this competency of big importance in the current educational context. These difficulties are due to various factors, including, poor training on the part of educators.

The recent information and communication technological (ICT) innovations, introduced from the technical-scientific revolution, emerge as an alternative to try to overcome these obstacles that permeate the teaching of cartography in Basic Education and point to new possibilities of working

cartographic content through sites like Google Maps, Google Earth, IBGE, computer software, electronic games, among others. The Geotechnologies emerge as important auxiliary tools to a better understanding of geographic space within the school context and, subsequently, should be inserted in the middle of the experiences of the students, through the development of daily activities.

Given the above, this research has the general objective of presenting the use of geotechnology as a methodology for the teaching of cartography through ludic approaches of different geographical subjects, aiming to stimulate the interest and greater involvement of students in the teaching-learning process. According to the Ministry of Education (BRAZIL, 2001), school curricula should develop means of obtaining and utilizing information through the computer, and sensitize students to the presence of new technologies in everyday life.

To prepare this study literature searches were conducted in books, specialized websites, and scientific articles dealing with the education of cartography, the use of new technologies in educational settings, as well as specific programs such as the Spring, and the Philcarto I3Geo, which can be used in the teaching of Cartography.

2. The cartography teaching in Brazil

For a long time, the teaching of cartography in Brazil was transmitted through the traditionalist methodology characterized by observation, description and rote memorization of pictures, maps, charts, etc. During this period, the cartographic elements were worked merely in an illustrative manner, separated from the reality of the topics presented in class because the students were not instructed to make a critical reading of what was being presented. It is noteworthy that these characteristics, although heavily questioned by researchers and teachers, are still present in the current context of Basic Education in Brazil. In Brazilian schools, is noticed that the teaching of Geography and therefore of cartography are still worked through a traditional practice rooted in Positivism Classic, both in elementary school and in the high school (Bomfim, 2006).

According Francischett (2004) the majority of teachers who work with teaching, conceive the Cartography as the technique to represent and read maps, detached from the context of Geography and other sciences. This impairs the student, because he will have difficulties to develop the cartographic language, an invaluable tool for his training as critical and reflective citizen. Almeida (2001, p.18) points out that the "training of citizens is incomplete because they do not know how to use or master the cartographic language."

According to Farias & Costa (2012, p. 39), the teaching of cartography has advanced, but in a slow and full of mistakes way. Despite the difficulties of

teaching, including basic education, it is already noticeable small advances and a few ruptures with the traditional methods, related to teaching practices in the classroom.

2.1. New technologies

Information and Communication Technologies (ICTs) are present intensely in contemporary society, a fact that is easily observed in day-to-day. These advances have developed gradually in the mid-1970s and had a big jumpfrom1990, with a larger popularization of the Internet and a reduction in costs of computers and other technologies.

This new reality experienced in recent decades resulted in considerable changes in various sectors of society, with education being one of the areas that suffered most changes on this new scenario (Pereira, 2011). In this context, these changes require teachers a renewal in their teaching practice, based on new methodologies that best enable students to the characteristics of modern society marked by the multiplicity of languages and techniques, present in the various fields of the working world (Araujo, 2014). The earlier the students have access to technological resources the more prepared they will be to adapt to the technological advances from XXI century (Costa, 2010).

In the computerized world we live in is important to broader the view about education. It is necessary to believe that new technologies can contribute substantially to improve the process of teaching and learning and incite the interest of students through differentiated methodologies (Araujo, 2014, p. 9). According to the Ministry of Education (BRAZIL, 2001), school curricula should develop the abilities of obtaining skills and using information through the computer, and sensitize students to the presence of new technologies in everyday life.

According to Belloni (1999), ICTs can be of great relevance for teaching because they offer students access to a wealth of information, moreover, according to this author, this is a global trend and not just for Basic Education, for contributing effectively to the teaching-learning process.

In the teaching of cartography, these innovations are a variety of possibilities, many of them already researched and used by many educators. Websites like Google Maps and IBGE allow a free search service on maps and satellite images, and other information related to a specific country or society. Computer programs like Google Earth, whose function is to present a three-dimension model of the globe and program specific cartographic applications such as Philcarto, SpringandI3Geo, are also possible alternatives to work with cartography in the school environment.

The use of these tools in an oriented manner allows students to not only view the space at different scales and perspectives, but also relate to a more spontaneous and interactive manner with the content in question, thus acquiring a better understanding of these issues. "As he interacts with the

information, the student is building his knowledge, he is making important connections between concepts and thus enabling significant learning" (Tavares, 2005, p 5). Thus, the current technological landscape provides very favorable resources for education and particularly for the teaching of cartography.

The problems in the current education system express the saturation of an educational model that no longer meets the time in which we live, where new ideas and values are emerging in various segments of society (Valente, 2010, p.20). Thus, the use of Geotechnology as teaching tools in the teaching of cartography could contribute to the technological integration and to the study/analysis of space, streamlining the process of teaching and learning and contributing to training critical citizens in society.

2.2. Geotechnologies in cartography education - application of specific programs

In the constant process of transformation in the world today, there is a clear need to expand the learning opportunities within the classroom. However, it is understandable that advances in basic education don't always accompany the technological advances. However, one of the key roles of the educators is to bring the students didactic proposals that promote their integral and constructivist development.

Within the educational proposals in the teaching of geography, Geotechnology emerge as a significant step to expand the teacher's job possibilities, contributing significantly in teaching. The use of this tool in schools should foster meaningful learning of geographic phenomena in digital cartography. It is essential that teachers be prepared and understand the use of software applied in this area.

The Geotechnologies cover information technologies used in the collection, storage and analysis of geographic information. Therefore includes the Digital Cartography, Remote Sensing, Global Positioning System- GPS and Geographic Information System - GIS (Matias, 2001). Thus, techniques and technologies related to spatial information are called Geotechnologies, including the software used on computers for GIS. The so-called GIS is the part of the Geotechnologies involving the cartography and the construction of thematic maps with the use of specific programs and hardware that perform their function and well qualified people to deal with these features.

The use of Geotechnologies in teaching is fundamental in order to allow the monitoring of technological advances in the world today with the classroom. In Brazil, the Ministry of Education supports and encourages the use of technological resources highlighting the use of computers to research in geography procedures as a learning tool, as well as reading and construction of basic spatial representations for understanding and use of graphic reading in building maps (BRAZIL, 1999).

Thus, some specific computer programs are used as software of Geographic Information Systems (GIS), such as the Spring, or applied in cartography, even if it is not rated to GIS, such as the Philcarto and I3Geo, the latter being used for web applications only. The aid of these tools in the implementation of work on the school mapping is critical, requiring from the teacher, therefore, a change of attitude towards these new technologies and their pedagogical use.

Spring is a software developed by Brazilians for Geographic Information Systems(GIS). The project was developed by the Image Processing Division (DPI) of the National Institute for Space Research (INPE) in partnership with other institutions. The DPI defines the Spring's GIS with image processing functions, spatial analysis, numerical modeling of terrain and querying spatial databases (BRAZIL, 2012). The project was initially thought in order to obtain a geographic information system applied in several areas, such as Geography, Geology and Urban and Regional Planning, and to provide for the Brazilian community a simple and understandable GIS software.

Created in mid-1991, the program was designed far short of what it is today, already successfully applied in many countries besides Brazil. Medeiros (2012) explains that the program name means Georeferenced Information Processing System, in addition, the program can also be considered as a design consists of several modules with specific functions. In this sense, SCARTA is the module with purpose in the production of cartographic products (maps and charts, for example) in various graphic formats, ready for printing (Medeiros, 2012,p. 48).

In mid-2010, the *Spring* became a free software (SL) available for multiple platforms like MicroSoft (MS) and Windows, further facilitating their use at school. The Image Processing Division (DPI) provides on their official website (http://www.dpi.inpe.br/) quick access to bases of Georeferenced Information Processing System (http: // www. dpi.inpe.br/spring/portugues/index.html) where important information about the program is, as well as operational support, data and publications, and a version (5.2) of the software in CDROM through requests.

Due to their availability, the *Spring is* accessible and a reference in GIS technology. It is an important program, purely Brazilian, that supports different geographic databases. In school mapping, *Spring* assists in the training of students with assistance in the composition of geographical databases.

Pinho (2011) explains the importance of these programs for GIS forcefully, highlighting how're fundamental to the formation of citizens more knowledgeable of geography and aware of the importance of knowing the geographic space in which we live. Complications encountered by teachers in the implementation of programs such as *Spring* must be overcome in order to increasingly value these tools.

Another auxiliary software in cartography is the Philcarto, a free program used in thematic mapping, but it is not a GIS software. It is a computer program developed by Philippe Waniez, a French teacher. Due to its origin, the program is not widespread in Brazil and part of this factor is due to the language used in most user manuals, French or English.

One of the most complete manuals in Portuguese was developed by Eduardo Paul Girardi in order to collaborate to the use of version 4.xxin Windows. As the author of the manual presents, Philcarto is one of the most versatile and complete programs to work in cartomatic, especially for presenting "total freedom and versatility in the development/adaptation of cartographic databases and data; variety of mapping functions and data analysis, and quality of the final map" (Girardi, 2007, p. 4).

The variety of map production in Philcarto is huge, because the program has two modules available that complement everything needed to produce maps: a basic (BASIC) and advanced (PRO). In the basic module choropleth maps, with proportional circles, isopleth, contoured and links are designed. The advanced module provides further analysis through the exploitation of the variables and the cartographic base (Girardi, 2007).

The work with Philcarto in the educational context is of fundamental importance because the program is simpler compared to the others available and, in case of limited availability of computers, all the work could be developed in groups. The activities with Philcarto enable a comprehensive spatial analysis, since it transforms into images the databases found in many studies, including those related to education, social status, urban space, sanitation, deforestation, among many others. The use of maps is essential in the process of analysis and understanding of geographical space, as well as a development tool of Brazilian cartography and here Philcarto contributes significantly.

The third program presented is I3Geo, a Internet software based on a set of other free software, especially MapServer. The main focus is the provision of spatial data and a set of navigation tools, analysis, sharing and generation of maps through a friendly interface. Medeiros (2011) explains that this is the program connected to the most outstanding Geoprocessing, whose name is a synthesis of Integrated Interface for Internet Geoprocessing tools.

The I3Geo is freely available on the Internet and is used by many Brazilian institutions such as the Ministry of Environment (MMA) and the National Institute of Colonization and Agrarian Reform (INCRA). The Ministry of Environment uses the I3Geo to provide data on the monitoring of the Amazon forest, satellite images of river basins, biomes and regional mapping, and plenty more information.

Also provided by the MMA, a cartographic base of the Legal Amazon, whose goal is to provide the base map for use in the I3Geo and other information systems (BRAZIL, 2015), in order to provide geographic data with tools for

navigation, sharing, and creation of maps the I3Geo was the first software to compose the public Software Portal (SPB), a foundation established in 2007 that provides access to public interest software for all stakeholders for free. (Medeiros, 2011).

The I3Geois a very broad and accessible tool, although a web browser with internet access is needed. This problem is easily overcome by its advantages, such as fast learning and the mobile version, which makes it fully usable in the classroom where the students have compatible devices. The program itself provides the I3 GeoMobile version appropriate to mobile devices.

3. Conclusion

Cartography is a multidisciplinary science and relates constantly with modern society in different scales. It is predominant in the current training process, students develop skills that enable the development of cartographic language, because this ability added to other formation processes allow a more complete reading of the geographic space, given that the maps, charts and images relate socially, culturally and economically with the world.

However, it was observed throughout this work that despite the invaluable importance of the cartographic language, the teaching/ learning process goes through several difficulties that impair the absorption of cartographic knowledge by the students, as they have a gap in know ledge related to their cartographic literacy. Thus, for the application of teaching methods related to new technologies, a specific preparation by the teacher is required, because if poorly used this resource may compromise the formation of students.

Thus, the complexity of the teaching of Cartography needs significant changes in the classroom. These transformations can be presented through new teaching methods, which based in the socio-constructivist theory offer possibilities for the formation of an active, critical and reflective subject. In this context, Geotechnologies emerge as a new horizon in relation to the teaching of this science; therefore bring with them a number of possibilities to work cartographic contents in a critical and interactive way. This approach also contributes to an improvement in the enhancing of the cartographic language in Basic Education, a recurring problem in the current cartography-teaching environment.

It is important that technological innovations come into the teaching process a disciplined way, with a process of school structuring and, especially, of teacher education. GIS technologies presented in the paper - Google Maps, Google Earth, Spring, Philcarto, I3Geo- have gradual level of complexity in handling and interpretation of data. Thus, it's essential that

teachers are prepared, so the final result of the teaching-learning process isn't compromised.

The basic education schools must support students to develop the capacity of interpretation of the cartographic language, so the technology should be combined with this process. Is worth mentioning the fundamental role of the teacher in this process because, as a mediator of these new practices, he has a crucial role in this movement, which demands a qualified teacher training.

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