CARTOGRAPHIC VISUALIZATION AND THE TEACHING OF GEOGRAPHY

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ABSTRACT

Through the study of Geography, children and young people will be able to understand how society and nature interact and what is their role in this process. Cartography assumes a special place since it enables the representation of the social, cultural and natural phenomena.

The objective of this work is to formalize a proposal to explore the process of geoinformation visualization on the production of educational documents and, as a future objective, the production of these documents. The next stage of this work demands a nearer contact with Geography teachers, of all the teaching levels, and with the students, starting with the students in the 5th and 6th grades of the fundamental teaching. This procedure will lead us to an exchange of different backgrounds and we will be able to expose our observations and formalize our proposal illuminated by the needs of those who will be the users of the proposed documents.

1. INTRODUCTION

“The man is in the world and with the world...Relations are not only between people, they happen in the world and with the world.” (1) We live in a world where changes occur quickly and, we are in constant relation with everything that is in the world and happens in the world. So, we are able to observe and transform this observation into knowledge. The acquired knowledge leads us to do critical reflection, enabling us to find solutions for the problems that happen in our lives, because knowledge precedes the possibility of any concrete action.

As national curricular reference, the Ministry of Education – MEC, elaborated the National Curricular Parameters - PCN, for the fundamental teaching with the “intention of provoking debates concerning about the functions of school and reflections about what, when, how and why to teach and to learn, involving not only schools, but also parents, government and society.” For each area pointed, including Geography, there is a specific document that starts with the analysis of each area pointing the importance in the student’s formation in the fundamental teaching and, presenting a detailed proposal in goals, contents, evaluation and didactic orientation.” (2)

The PCN shows that through the study of Geography the students can understand the world and, from this point of view, “comprehend their own position in the interactions between society and nature.” (2) Studying Geography, children and young people will be able to understand how society and nature interact and what their roll in this relationship turning possible to comprehend the consequences of their actions either individual or collective. This comprehension is important in the citizens’ formation whose commitment can promote actions that considerate society and nature togheter.

Cartography assumes a special place since it enables the representation of the social, cultural and natural phenomena whose knowledge is essential in several levels of the decision processes in which kids can come across later, in their professional lives.

But Cartography is in a process of change, as a result of the development in computer technology. It is not possible to think of maps only as tools that show the world as something static. It is important to think of maps with other function: as tools to analyse how the world ‘works’.
“Bits are different from printed information. Bits are more attractive, more immediate, more particular and more abundant.” (3) Our world “became digital”, (4) and the cartographic production is being adapted to this world with new forms of organization, presentation, communication and use of geoinformation, that is, with the digital Cartography not only the processes but, as well, the representation, and the presentation, of its products have new format.

Many studies have been produced concerning the geoinformation visualization, so, why not incorporate this subject to the teaching of Geography, identifying its possibilities and limitations? Some questions, which need to be answered, have been identified, as follows:

- Is there any standardization for the cartographic representation as well as for the maps presentation in the educational documents?
- Which are the students' receptivity and teachers assessment considering the available cartographic educational documents?
- What contribution would the process of cartographic visualization offers in this situation?

The objective of this work is to formalize a proposal to explore the process of geoinformation visualization on the production of educational documents and, as a future objective the production of this documents. So, this evaluation is necessary to produce educational documents, printed or digital, taking advantage of the process of cartographic visualization.

Some questions will not be answered immediately. The main goal of this work is to argue the dimensions of geoinformation visualization in the teaching of Geography, identifying their limitations, possibilities and an orientation for the continuity of this research.

2. CARTOGRAPHY AS A TOOL TO GEOGRAPHIC ANALYSIS

2.1 The map as graphic representation and image of geoinformation

“From the river to the little stream, there was a great plain, in which only a small part was destined for plantation. It was an excellent place to plant and the plantation could continue developing where they were. From the little stream ahead, the terrain where the house stayed went up in a soft ascent, and, on one side, there was a hill of little inclination, extending two or three kilometers ahead. It was a big amount of land, enough to perpetuate future generations...” (5)

The text above describes an area near the city of Blumenau, in Santa Catarina State. Even those who never been there will be able to visualize the landscape described if they look for similarities with a region that they know: the plain, the hill with little inclination, the notion of a specified distance because “the reading of the world precedes the reading of the word... Language and reality are arrested dynamically”. (6) When the PCN treats cartographic literacy its proposal is to go deeper into students' knowledge in two dimensions: the critical reading of maps, involving the analysis of the geographical information, not limiting itself to locate the phenomena; and, to make the student to take part as a conscious map-maker because “the map as a visual image depends on subjective human interpretation to convey meaning.” (7)

Summarizing the concepts of maps, it is possible to consider that they represent the cultural and physical environment, at a certain period of time. They are vehicles for geoinformation transmission. The maps tend to the comprehension of the world using symbolic language, attributing global representations easy to be memorized and consulted. (8) This is verified by the fact that maps are used to the most different purposes: to plan political actions; to plan an excursion, for example. Nowadays, it is possible to see its diffusion through the media that has been intensified, showing the spatial context of the news. Reinforcing this, Cartwright and Peterson say that “the general public use maps daily as a general information source, or as a tool to find specific locations when using a street directory or an atlas. They are bombarded with spatial information on television news reports, in newspapers and magazines and as part of computer packages for gaming, education and training.” (9)

It is possible to affirm that a map is a graphic representation and also an image, that is, the concepts of graphic representation and image are ‘interlinked’. Espinosa defends the visual literacy, that in our case will be treated as cartographic literacy, because the potential of the graphic language is evident in the transmission of concepts and relations affirming that “it is a language that can facilitate the transmission of a kind of information more effectively than the verbal language”. In agree with Espinosa, Duarte affirms that (10): “all language forms brings a cognitive operation of the world.” For students use a map and its information can be read, analyzed and interpreted efficiently it is
necessary that they know what is being represented, that is, it is important that the students learn about the geographical information represented through the cartographic language.

2.2 Cartography and the teaching of Geography

“Each person starts as a child...The adult's perceptive categories are once in a while impregnated by emotions that proceed his first experiences...The geographical horizon of a child expands as he grows...His first interest and knowledge are given experienced in the small local community, then the city, passing the district; and then the city, nation and to foreign places.” (11) What Tuan said supports the proposal of the teaching of Geography, as presented in PCN, putting the “lived space” as a reference to introduce the global space.

The space treated by the Geography, that is, the geographical space, has as its most important characteristic the dynamism and interaction between natural, social, economic and political factors. Among the proposed thematic axises for the 3rd cycle of the fundamental teaching, the importance of comprehension of the geographical space is the main focus, as orientation for the actions that students come to execute in their lives as citizens committed with the life in their districts; in the relation with their cities, country and the world.

“We approach the world with information acquired through models of reality in the form of maps” (12) and, without a doubt, all the data and information contained in the geographical space are interesting considering the personal level and the world level. When we travel it is common check a map to get some information as: which highway to follow; the weather. In the same way, a subject that interests all people around the world, the carbon dioxide emission can be presented in a map identifying what it represents in each country.

Not only the concept of space, but also: region, landscape, territory and place are treated in the PCN. But, independent of describing concepts used in the geographical analysis, they are words used constantly by the media, making part of the daily activities of the students, even they are aware of them. The teaching of Geography acts to awake in the students “the feeling of belong to a reality in which the relations between society and nature occurs integrated...The study of society and nature should be of interactive form” (2), that is, valorizing the experience of the students and making them realize that Geography is present in their day by day.

The PCN identifies observation and characterization of the elements present in the landscape as the beginning of the comprehension the relations between society and nature. From this point it becomes easier to identify the interactions between the local and the global, seeking for their similarities, differences and transformation remembering that they are influenced by the factors: space and time. Considering this placement and the Cartography definition recommended by the International Cartographic Association, that is: organization, presentation, communication and utilization of the geoinformation in the visual, digital and tactile forms including the processes involved, it is possible to see that the teaching of Geography and Cartography, as instrument for the geographical analysis, are not dissociated because, the space representation, is an important tool in the domain of the space as it happened with the first forms of writing.

Although the focus of this work has been driven to the maps, any image should be taken into consideration as a effective working material and also a product as observed in PCN, “drawings, photos, tables, games, everything acquired that also represents the visual language continues to be effective working material and product that the teacher can use.” (2)

The PCN, for the 3rd cycle of the fundamental teaching, contemplates Cartography in one of their thematic axises: Cartography as an instrument in the approach of places and of the world. This axis is divided in two subjects: from the cartographic literacy to the critical reading and conscious mapping; and, the map as a possibility of comprehension and comparative studies of the different landscapes and places. The first subject emphasizing the organization, presentation and communication of the geoinformation, represented in the maps, and highlighting that the graphic representations are not limited to be an object of reproduction but, has the main goal to transmit information, and, the second, emphasizing the utilization of the geoinformation through the maps.

Cartography takes on another important roll: the map is used, in the printed educational documents, as an “illustration” for the subject being taught. Regarding this approach, we identified some questions:

- Do the maps, used as educational documents, represent the geographical information in an efficient way, according to the PCN?
- What is the receptivity of the students regarding the available cartographic documents?

These questions are important to reach our objectives but we have to remember that the answers are result of interactions with students and teachers of Geography to make possible new insights from different points of view.
3. EVALUATION OF THE EDUCATIONAL DOCUMENTS

Is there a standardization for the cartographic representation and in the maps presentation? Is this standardization necessary? This is the main question to be answered in this stage of the work. The source document used for this work were: reference class books to 6th grade of fundamental teaching (2 different authors); geographic school atlas (3 different authors); and, maps elaborated by students of both public and private schools. It is important to highlight that we only evaluate the maps presented in the documents, we did not evaluate the text associated.

The authors of the education documents will not be identified being treated as:
- Atlas: A1, A2, A3
- Reference class books: L1 and L2.

It was observed that a variety of scales were used in the presentation of the themes (32 different scales) specially for the map that represents Brasil. In this stage of the work, we do not have the objective of produce an educational document but this variety of scale is important to be observed because it implies generalization, independent of the format of the document (printed or digital).

Another observation is about the titles of the maps. We found maps of the same theme with two different titles, ex.: Relief and Relief Units. Besides this, we find two different themes with the same title. Why does this kind of thing happen?

Observing the maps elaborated by students of public and private schools, it is clear that they prefer pictographic symbols instead of geometric ones. The figure below shows it clearly.

Figure 1 - Maps elaborated by students of the public and private schools
4. THE CARTOGRAPHIC VISUALIZATION AND THE TEACHING OF GEOGRAPHY

Which is the contribution of the cartographic visualization process in the teaching of Geography? To answer this question we have to explain our understanding about the concept of cartographic visualization, summarized in the illustration below, fig. 2.

Geoinformation visualization is the main process that contains two others processes: cartographic visualization, and data quality visualization. Geoinformation visualization involves several disciplines and needs functions for: analysis, exploration, synthesis and presentation; using resources of animation, multimedia, www and virtual reality.

Regarding the term visualization, “it is theorized that creativity is the result of new arrangements of stored visual images in the subconscious mind. Visualization is the ability to “see” these arrangements, and is an illumination process leading to final solutions.” Adding that “the visualization process, or thinking be incorporating visual images into thought, occurs to the fullest when seeing, imaging, and graphic ideation come into active interplay.” (13)

To raise the interest of a person, specially teenagers, it is necessary that the subject becomes the most interesting as possible, showing its basic application and the possibilities for new applications. As exposed above, creativity is the results of “new arrangements” but, these “new arrangements” do not happen without knowledge increase. “The creative thought is renovating, exploratory, adventurous. Being impatient with convention, it is attracted by the uncertain unknown.” (14) Observing what is happening in the world, it is impossible not realize the influence of new technologies that are changing the relations between world and people, that is, incorporating new possibilities to compose the knowledge world. So, when we use, in the teaching of Geography, the resources available for the process of geoinformation visualization, we can say that the process of cartographic visualization can contribute with the possibility of these “new arrangements”. But “it is important to highlight that each innovation only happens if besides the decision of its adoption there is a knowledge absorption process. The absorption of knowledge is not dependent of the available technology, because it is limited by social, political, economic and cultura factors.” (15)
Multimedia resources are already being used in the production of school atlas but, talking informally with some students, they said that it is beautiful but they want more because in this kind of atlas "everything is ready", they only exhibit what is stored. They want to explore and discover, introducing information and managing the visualization of the results of their "adventurous thoughts", using tools with functions of analysis, exploration, synthesis and presentation. Their necessities are very interesting but we have to introduce a discussion: which are the limits for their "adventurous thought"? It is not possible let them follow a way to an "unreal world", we are not talking about games. So, it is important to highlight that it is necessary to evaluate the existent documents, together with students and teachers, to get a better position of the possibilities for the process of cartographic visualization in the context of the teaching of Geography.

Regarding the term visualization we highlight that it is the subject of various papers and books but, it is a common sense, that it is related with computational resources. We have no doubt that this kind of resources are very important but if we look the reality regarding the social and cultural of Brazil we can affirm that a great part of our children do not have access to this kind of resources. So, the cartographic visualization, as emphasized by the papers and books, is not applied to all the students of the fundamental teaching. What happens to the children that have no access to this kind of resources, are they enable to be benefitted by the process of cartographic visualization?

The term visualization is related to an act or effect to visualize or, related to the transformation of abstracts concepts into real images. (Aurelio) Although we have said that the authors of the evaluated documents would not be identified, we highlight the presentation of a theme in one of the school atlas evaluated in which the process of cartographic visualization was identified as one in the production of the atlas. We can see an exemplo of this product in the fig. 3.

**Figure 4** – Cartographic visualization process used for the production of a printed atlas
Source: Ferreira, G.M.L.; Martinelli, M. Atlas Geográfico

### 5. DISCUSSION AND FUTURE WORK

The next stage of this work demands a nearer contact with Geography teachers, of all the teaching levels, and with the students, starting with the students in the 5th and 6th grades of the fundamental teaching, so that we can expose our observations and formalize our proposal illuminated by the needs of those who will be the users of the proposed documents.
6. REFERENCES