AN EXPERIENCE IN EDUCATION USING CARTOGRAPHY TO PROMOTE CITIZENSHIP AMONG BRAZILIAN PUBLIC HIGH SCHOOL STUDENTS

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The evolution of technology during the 20th century and afterwards, particularly intense during the last decades, is transforming nearly all areas of human knowledge. The technology of remote sensing and digital cartography, which are essentially representations of the geographic space, are included in this hurricane of changing paradigms. The speed of this change, however, is not the same for all sectors of knowledge, and education is probably one of the slowest of all. This paper presents an experience in education conducted in 2004 in Volta Redonda, in the state of Rio de Janeiro, Brazil, aiming to involve high school students and teachers with the new technologies of representation of the territory. After the experience, they may be able to feel more integrated in their local territorial context and therefore act as authentic citizens, being the catalysts in the transformation of the place where they live and promoters of environmental change.
1 – INTRODUCTION

The evolution of technology during the 20th century and afterwards, particularly intense during the last decades, is transforming nearly all areas of human knowledge. The digital cartography, which is essentially information representative of the geographic space, is imbedded in this hurricane of changing paradigms. It must be added, though, that the speed of this change is not the same in all the sectors of knowledge, and education is a sector in which the change takes longer to consolidate. One could describe as large the gap between the university – and research environment and the one to which middle and high school teachers belong.

This reality leads us to reflect about an intriguing and challenging question. In which measure the knowledge acquired in the advanced research environment – and more specifically the new technologies, such as automated processes of cartographic representation – conceptually referenced to the geographic thinking, will be accessible to all and disseminated in a way to involve in its web a wider range of actors? In the same context, another question can be asked: would there be forms and ways to “include”, in the middle and high schools educational sector, specialized knowledge such as that related to the cartographic procedures? How and with which objectives? Would there be space for establishing connections between the geographic research and the teaching of Geography in middle and high schools?

Is is possible that the aggregation of Geography teaching and the technologies involved in the representation of the territory – such as the remote sensing and the digital cartography – may facilitate the reactivation of the connections that have been interrupted by the dichotomy that was established between research and teaching. Therefore, it is necessary to build a bridge for the fundamental exchange of knowledge between the two streams nowadays separated. From what Lacoste (1988) theorized, it is also necessary to change, in a certain way, the perspective of the Geography of the teachers, pulling it apart from the trends of encyclopedic repetition and enabling it to act towards the building of citizenship that makes one able to interfere under the inspiration of a proactive dynamics that aims the transformation of a certain social situation as a consequence of a greater knowledge of how the history of the construction of the territory may influence the life of each social individual.

The building of this bridge is, in a certain way, central in the study here reported, since it incorporates the procedures that take into account the deepening of the knowledge of the processes related to the analysis of the geographic names found in the cartographic documents. The geographic names carry the history, the memory, the identity of a social group. The gentle adjectives are also part of this field, which includes both toponomastics and psicosociology, since, through this language, history, memory and local identity can also be expressed and built.

The crucial point in the present proposal is that this analysis leads teachers and students of the schools located in the city of Volta Redonda, in the state of Rio de Janeiro (situated 100km from the state capital, Rio de Janeiro), inspired by an initial contact with basic concepts of cartography related to the place where they live, to reflections referring to their cultural identity. There is expectation that this experience will favor not only the intellectual openness towards the understanding of basic cartographic concepts but also the process of being more conscious about the main problems that challenge the local community, specially when it comes to environmental education, in a transverse approach that considers the multidisciplinary aspects of the socioenvironmental questions, according with the most recent recommendations of the country for public education in both the basic and the high school levels.

2 – THE IMPORTANCE OF THE TEACHING OF CARTOGRAPHY IN THE BRAZILIAN BASIC AND HIGH SCHOOLS

The people who are now the active cartographers and geographers were children in the past. And the majority among them were children that did not have the pleasure of manipulating maps at the adequate age, but it is recommended that they do it. Today, as professionals, they build maps and use them in studies about relations and processes that occur over the territory. They know, or at least should know, how to relate the singular events of any kind to the territory. Are other citizens, however, and the question also involves the decision-makers, capable of making the needed co-relations between territory and the variety of occurrences/events that it registers?

Practical experience shows us that the level of car-to-iliteracy and other factors that inform about territory reach astonishing levels in Brazil. The present situation of low investments in public policies for mapping the country and the systematic updating of charts that represent the Brazilian territory is a definite proof of this assertion. The two examples presented next, taken from real facts, illustrate the problem and may help us show the importance of the present reflection.
The first case was reported in 1989, precisely in the afternoon of the 3rd of September, when a VARIG company airplane, a Boeing 737 200, during its flight RG 254 from Marabá to Belém, got lost and, after running out of fuel, had no other choice but to land in the middle of the Amazon forest. There were 54 persons in the plane, which landed at a distance of 1,200km from its planned place of arrival after flying for 3h46m, although the flight normally lasts only one hour. Twelve people were killed and 32 carried sequels for the whole life.

The exclusive reason for the whole tragedy was the lack of perception by the crew of a basic cartographic information: the location of Belém is 27 degrees North of Marabá. Because of a simple error in the reading of the flight plan the pilot/commandant programmed the equipment to fly towards 270 degrees, leading the plane to fly West instead of North. The plane took off in the afternoon and, since that time until sunset, the Sun was in front of the airplane, clearly indicating that it was travelling westward. Not even once the crew related the position of the Sun and the fact that in the map the indication was that Belém was North of the initial position, the airport of Marabá, from where they left.

This is clearly an extreme case of how the ignorance of basic cartography can negatively affect the life of people. It is, however, a very clear demonstration of the invaluable waste of lives and resources that it probably involves when there is too much lack of carto-litteracy in all social levels in a country.

It is not our aim to start a “witch hunt” and search for the reasons that led the situation to this point. We just want to describe the situation and possibly bring a contribution for the establishment of methods that are capable of involving high school teachers and students and therefore possibly able to initiate a process targeted to the basis of the problem and aiming to restore the present situation. This will certainly demand a long period of time before the desired levels are reached but we believe that, targeting the roots of the problem, longer lasting results will be produced.

The suggested process is necessarily linked with the dissemination of the use and manipulation of maps in the school teaching. The maps are the most convincing synthesis of space representation and their use should therefore be disseminated in the teaching and learning of Geography in high school, according to the Brazilian National Parameters for Education concerning Geography established by the Ministry of Education (1998).

The reading of the referred parameters in the section related to education in the 4th cycle reveals an important piece that can be understood as the necessary openness to the insertion of the new technologies of digital cartography and remote sensing as valuable tools for the teaching of Geography. It says: “In the measure of possibilities and resources, the teacher may introduce the first notions of digital cartography. Another possibility, that will also depend on the resources available, are the forms of spatial records and interpretation, such as exercises using aerial photography and satellite images.” (Brasil. Ministério da Educação / Secretaria de Educação Fundamental, 1988)

The children of today will be the cartographers, geographers, decision-makers, politicians, teachers and, last but not least, the citizens of tomorrow.

In a certain way, the teaching of Cartography linked with the teaching of Geography has been underestimated during many years, probably generating a concerning gap in the education of the citizens in our country. As Vasconcellos (1995) states it: “Maps and images are auxiliary in the building of the perception of space, in the acquisition of knowledge and in the synthesis of geographic information. The importance of the role and of the use of graphic language for children development and learning has been well documented. It has been demonstrated that activities involving maps and images activate the right side of the brain and, as a result, can help increase the experiences and the connections of the neurons, which, as they do, help in the development of the multiple kinds of intelligence and the diverse abilities.”

In a country with high levels of functional illiteracy, it may sound like utopia trying to reduce carto-illiteracy. Who grants us, however, that when we are successful fighting the second, the first one wouldn’t be easier to deal with and overcome? Many punctual and non-systematic experiences related with the teaching of cartography linked with the teaching of Geography for children under the age of sixteen years show that it acts as a factor that not only increases motivation but also makes the learning of other subjects easier. It is so because the study of spatial organization of territory stimulates space reasoning, therefore establishing important neural connections, in a phase which is crucial to the maturation of knowledge.

The methodological proposal here presented considers that the creation of this bridge that links advanced research/state of art technology and the processes in use in education must involve the procedures capable of leveraging the cartographic concepts, starting with the studies of toponymy found in the cartographic documents. Toponymy is the field that studies the names of places and we are convinced that it has the potential to bring
together cartography and daily life experience of cultural aspects by citizens. The experience of reading and understanding the map of the place where he or she lives, and giving the student the chance to “redraw” it, is another attractive field for the exploration of cartography in building citizenship.

The question of building citizenship is not secondary if one considers Brazilian reality. For 21 years, until 1985, the country was ruled by a military dictatorship that tried to prohibit free thought in all fields, including education. Citizenship was not respected. In the city of Volta Redonda, where the biggest steel company of the country was located, the citizens could not vote to elect the mayor, who was then chosen by the military president, since the city was considered an area of national interest. This is the reason why even today, twenty years after the end of the military dictatorship, redemocratization must involve the surpassing of the challenge of building of citizenship, especially in places like Volta Redonda, where the democratic liberties were suspended for a very long time.

One of the possible ways to reach this goal is the strengthening of education proposals with the use of the resources of the advanced research. All citizens will benefit from the development of alliances between research based on advanced technology and high school teachers, stimulating citizenship among high school students, who will be in the future the managers of cartography, education and city administration, expanding the social and environmental impact of the project. Sustainable development involves equal access to quality of life among people living now and in the future.

3 – THE EXPERIENCE IN HIGH SCHOOLS OF THE CITY OF VOLTA REDONDA

This experience was developed in the context of a country that is still building its democratic institutions, including citizenship and social inclusion. The idea was to propose a reflection about citizenship and socioenvironmental questions and present some information about basic cartography and remote sensing for students in public high schools that were selected to participate in an animated movie workshop conducted in August of 2004 in the city of Volta Redonda, located in the state of Rio de Janeiro, in the South East region of Brazil. The experience had the support of the national Ministry of Culture and of a similar program of the municipality of Volta Redonda, through its law for the incentive of culture in the context of the commemorations of the 50th anniversary of the city. The students were selected in high schools ran by the state of Rio de Janeiro, with the support of state education authorities and administration. The project was created and produced by FanCine (http://www.fancine.org.br), a civil society organization (or non-governmental organization) involved in promoting audiovisual languages and environmental action in the education and culture fields. (Cf. Bustamante & Bustamante-Celes, 2004)

Following the invitation transmitted by their teachers in the classroom, a few hundred students applied for the workshop of movie animation that would result in a seven-minute animated film about the city. They did not hesitate to apply even after knowing that the workshop would take three weeks, which included the totality of the two weeks of their vacation time, in the middle of the school year (in Brazil it is in July). The applicants were invited to write a sentence about the anniversary of the city and to make three drawings, two of which had to depict what was suggested and the last one about any theme chosen by the student. The first theme suggested was “What I like the most in Volta Redonda”, and the second was “What I dislike the most in Volta Redonda”. The drawings were used to select the best artists for the workshops and, together with the sentences they wrote, also served as a guide for the contents of the workshop, as it had been planned, according to a methodology developed in accordance with the post-graduate studies of the EICOS Program of Interdisciplinary Studies of the Institute of Psychology of the Federal University of Rio de Janeiro. The program also represents the Chair of Sustainable Development of UNESCO in Brazil and one of the awarded programs of the UNESCO UniTwin Network of Universities.

During the animated movie workshop, there was also a series of speeches that aimed to present to the students various aspects of the history and the present situation of the city of Volta Redonda. Teachers and researchers of many fields helped in the composition of the multidisciplinary panel designed to stimulate the students while they were conducting the research necessary for the writing of the script and the drawing of the storyboards. The panel included speeches of conscious citizens and artists, such as musicians, writers and sculptors that have portrayed aspects of the city in their work, as well as researchers in botanic, environment, psicossociology and other fields, including cartography. We were invited as researchers in the field of cartography and environment.

In our speech, we proposed the presentation of some of its main concepts and of the history of the drawing of maps. The students learned how cartography depicts the spherical surface of the Earth over a two-dimension plan of representation; the importance of the geographic references such as the coordinates (latitude and longitude). We called the attention of the students to the relationship between the longitude and the west-east
movement of terrestrial rotation. They learned that, in every place, at noon, the Sun “crosses” the meridian where that place is located.

In the field of remote sensing, the students learned some fundamental concepts related with the electromagnetic spectrum and stereoscopic vision (three-dimension view), which is the basis used by cartography workers in the making of cartographic products from aerial photographs and images captured by the sensors located in the satellites orbiting the Earth. The students had their attention called to the limits of the images received by the human optical system, which are processed in the brain. In fact, the spectrum range of human vision is able to receive only a small portion of the total possibilities of the spectrum. The students learned that not all intervals in this spectrum can be seen by human vision. Infrared, for example, is the interval “seen” by the snakes, which allows these animals to see in the darkness of night, but it is not within the human vision system. We noticed that the knowledge implied in this information called the attention of the students that had never reflected about this phenomenon before.

Another activity proposed to the students was the contact with aerial images in the anaglif format. This allowed them to map a determined area starting from the interpretation of the photographs, which was possible through the use of stereoscopic vision possible with the use of special masks (or eyeglasses) designed for use with this kind of cartographic product. We found that the involvement of the students in the activity was very strong because, even when they never had been in contact with that kind of material, they were capable of, in a short time, generate interesting thematic maps as a result of the proposed activity.

The workshop allowed us to see that there is a considerable potential for learning and entrepreneuring among these young public high school students. There is, however, a lack of necessary opportunities for them to develop their ability to apprehend knowledge and find applications for it. We believe that it is our duty, as teachers and/or researchers, to create the opportunity to channel these developments. This is our aim when we suggest to bring together the most advanced Geography researchers and teachers of all levels and areas.

If this initiative wins the support of private partners, it may be possible to multiply it in many ways but always through the use of cartography in the promotion of citizenship and socioenvironmental action. The contents of this presentation would certainly be much richer if it counted with teaching tools such as satellite images and detailed maps of the area of the municipality of Volta Redonda and of neighbor municipalities. The students would then learn about the available technology for studying, analyzing and planning each local reality. Material resources, however, can not be so determinant of the success of an initiative.

When accurate maps, satellite images or any advanced spatial means of representation of the terrestrial surface are not available, the teacher can always count with the support of the field of the geographical names research and standardization, even without the actual use of maps. There are many possible approaches. A brief survey showed that 100% of the students were able to link the name of the city with the bend described by the South Paraiba River in the heart of the territory of Volta Redonda (in the Portuguese language spoken in Brazil, the expression “volta redonda” means “circle bend”). In fact, geographical names can serve as the supporting network for multidisciplinary approaches of socioenvironmental questions by teachers, students, researchers, and all citizens. One possible approach can be observed in the results of the geographical names activities we proposed.

Among activities related to geographical names, there was a “field research” in which most students accepted the invitation to interview elder inhabitants of their neighborhood about the toponymy, or the names of the places and of the city itself. The objective was to draw their attention to aspects of the social transformation as it is registered in the territory after a certain period of time. In the interview, the students had to ask the elder for three things: (1) mention names of places that existed earlier and still exist; (2) mention names of places that didn’t exist earlier but that exist now; and (3) mention names of places that existed earlier and do not exist now. Here are some of the answers: (1) the Cicuta Forest existed earlier and still exists; (2) the police department exclusive for crimes against women; (3) the movie theater Santa Cecilia, in the old workers village, which gave place to a shopping-center.

The interviews conducted by the students with elder people that share their environment showed them, in a practical way, how the transformation of both the territory and of the social environment takes place. The proposal could be deepened in a later moment in order to stimulate the students to reflect more broadly about the causes underlying the changes. However, not only time constraints did not allow that extension, but also the deepening on that theme was too specific for the objectives of the animated movie workshop. A book about the whole experience was published in order to give the minimum conditions for the idea to be multiplied in all education environments. Teachers of all areas can benefit from this method and count on a supporting cartographic net and concepts of socioenvironmental Geography applied to the observation by students and teachers of the place where the school is and where they all live.
One of the most interesting results of the speeches about cartographic concepts was obtained in the activity, proposed in the beginning of the workshop, two weeks earlier, of drawing the map of the city the way they see it. We covered a map of the urban part of the city of Volta Redonda with a sheet of transparent paper. Using the same material available for the drawing of the scenes for the animated movie, the students started drawing their favorite places in the map. The resulting map is reproduced below and in the poster selected for exhibition at the International Cartography Congress in July 2005, in La Coruña. It is a pictoric map that shows great creativity in the ways they represent aspects of their daily life in the city.

First, the students copied from the map behind the transparent paper just the two lines that represented the margins of the river Paraíba do Sul, clearly showing the round curve that gives the city its name since long ago, when the rivers were the best means of transport of people and goods. After that, they recreated in their drawings other types of information such as themselves, their neighborhood, their schools, their places of experience.

The map depicts, for instance, the workshop coordinator and the hotel he was staying at, near the shopping center, the movie theater, the library, the stadium, churches and monuments, the countryside, the university, the town hall, the slums, the cemetery, the neighbor cities of Barra Mansa and Pinheiral, antennas and chimneys. The pollution of waters is represented by drawings of garbage and dead fish floating in the river and along its curve. Toponyms such as Pinheiral (which means “area of pine trees”) and Vila Americana (meaning “American Village”) received literal representation, with drawings of a pine tree and of the flag of the United States of America. A place that received their special attention, because of its environmental value, was the Forest of Cicuta, which was also portrayed in detail in their film.

With a total area of 182,3 square kilometers, Volta Redonda is a city nationally known because it was totally planned and built together with the first big steel company of Brazil. Created in the middle of the 20th century, the Companhia Siderúrgica Nacional was ran by the federal government until 1993, when it was sold to a private owner, in the context of a big program of privatization of the national steel plants conducted by the Brazilian government between 1991 and 1993. The area in which the steel plant and the residential village for the steelworkers were built was formerly a big farm of which there is still the main house and some buildings, besides the Cicuta Forest, all actually in use by the private owner of the steel company.

In the 16th century, the area of the state of Rio de Janeiro and of Volta Redonda was almost totally covered by a dense and continuous area of forest now reduced to less than 16% of the original area. This original Atlantic Forest was almost completely destroyed by farming activities and the development of urban areas. During the 19th century, when coffee was an important Brazilian export product, the destruction was particularly intense due to the spread of coffee plantations in the region. In this context, only a few small areas of forest were preserved. This is why the Cicuta Forest constitutes an island that can provide the seeds for the reconstitution of degraded areas. With an area of almost 744 thousand square kilometers, Cicuta is still part of the Santa Cecília Farm, which still belongs to the steel company.

Being one of these islands of original forest, in 1983, after being the object of a detailed report (Monçores et al., 1982), Cicuta Forest was declared by the mayor of Volta Redonda an Area of Ecological Relevant Interest, the first step to turn into a national Area of Permanent Preservation of the environment. The report gave details of the forest and listed the ecosystem, the animal species and plants that were observed in the Cicuta Forest during the field research. Two biologists (Denise Monçores e Maria Teresa de Jesus Gouveia) and two veterinarians (José Guilherme Goulart Bustamante e Luís Paulo Luzes Fedullo) composed the team that stayed in the field during (continuous) five days. They included in the report a brief story of the latest uses of the forest, including its illegal use by hunters and the authorized use by the Brazilian Army in training activities. Fortunately, both activities were soon suspended, allowing the preservation of endemic species such as the Phrynops hogeii (turtle only found in that region).

The students learned about the importance of the forest for their quality of life and therefore decided not only to include the forest in their map, but also to tell its history in their script, “Arigó”. Arigó is the name of a migratory bird. It is also the name given to the workers who came to the city of Volta Redonda during the 1940s to construct the National Steelworks Company, the first large steel industry of Brazil. The animated movie shows the story of a couple of birds that moved to Volta Redonda during the first years of the construction of the steel plant and of the city. Among other places, they try to make their nest in the Cicuta Forest but the Army training activities turns the experience into a disaster not only for them, but also for the turtles, monkeys and
parrots. This sequence is also understood to be a metaphor of the period when the military kept a strong dictatorship in Brazil from 1964 to 1985.

The results of this experience include a book and an animated movie written, drawn and produced by the students about the socioenvironmental situation of the city. The cartographic product that resulted from the workshop, a map of the city totally drawn by the students, representing their vision of the city, is also printed in the book, together with some comments on its contents. We intend to spread this experience among other actors in the education scenery, hoping that more students and teachers get acquainted with and reflect about the technologies of representation of their territory, and being closer to them, be able to act to promote citizenship.

It becomes, therefore, fundamental to work in school the representation of space. The sooner the children are able to perceive and represent space, the sooner they start to understand the sociospatial organization of the real world, building their capacity to grow into adults conscious of their status as citizens and much more prepared to carry interference and interpretations of the relations that are established in the territory, and in a much more conscious way.

5 –FINAL CONSIDERATIONS

We believe this experience was extremely rich for both the students and the teachers. This work and the possibilities it opens can take the knowledge in cartography to new heights in terms of diversity of social actors, which will undoubtfully act in a more mature way in territorial questions and promoting social inclusion.

With the experience related, it was shown that the involvement of high school teachers and students with activities of representation of the territory stimulates inclusion the local context. From this perception, the students and teachers can act as catalysers in the transformation of the place where they live, as the Education Ministry recommends.

We observe that the geographic names, as do all their attributes of location and physical and human characteristics, offer a good example of opportunity to reflect about the territory even when there are no new technologies available. Through this study, it is possible to start to spread the basic knowledge of cartography and, eventually, also work the questions around social reality. We plan, eventually, to generate thematic maps showing historical evolution of the city of Volta Redonda starting from the changes in the place names. It is also interesting to plan a visit to the Cicuta Forest with the students.
References:


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Cláudio João Barreto dos Santos was the President of the Technical Committee of Cartography of the Brazilian Society of Cartography (1990-1997) and is the general secretary of the Organizing Committee of the Contest of Cartography for Children, promoted yearly by the Brazilian Society of Cartography (2005).

As representative of IBGE and of Brazil, Cláudio João Barreto dos Santos participated in international events, among them the VI International Cartographic Conference for the Americas, promoted by the United Nations, in New York (1997), and in the III Conference of the Global Mapping Project, in Gifu, Japan (1997), sponsored by the Geographical Survey Institute of Japan. He was a professional visitor in the Canadian Center of Mapping of the Ministry of Mines and Natural Resources of Canada, in Ottawa (1991).

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