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THEORETICAL APPROACHES AND FUTURE PROSPECTS OF SCHOOL CARTOGRAPHY IN BRAZIL

Fundamentos e Perspectivas da Cartografia Escolar no Brasil

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ABSTRACT

The main goal of this article is to present and discuss the area named School Cartography in Brazil, corresponding to Maps and Children in the International Cartographic Association - ICA. Beginning with the analysis of the scientific events related to the area and its proceedings, which begun in 1995, it was pointed out the main themes which form, nowadays, this field. The article also pays attention to theoretical issues regarding some of the researches done, it lists publications and examples related to the teaching of cartography. At the end, perspectives and future trends for school cartography in Brazil are presented.

Keywords: School Cartography; Maps and Children; Cartographic Education.

RESUMO

O propósito deste artigo é situar a formação de uma área de conhecimentos denominada “cartografia escolar” no Brasil, a qual corresponde à “Cartography and Children” na Associação Cartográfica Internacional - ACI. A partir da análise dos Anais dos eventos científicos, iniciados em 1995, sobre cartografia escolar, foram indicados os principais temas que constituem atualmente essa área de conhecimento. O artigo aborda ainda questões de ordem teórica de algumas pesquisas realizadas, apresenta algumas publicações e exemplos de práticas com ensino de cartografia. No final, apresentam-se perspectivas para o avanço da cartografia escolar em nosso país.

Palavras chaves: Cartografia Escolar; Mapas e Crianças; Ensino de Cartografia.

1. INTRODUCTION

The presence of Cartography in General Education (elementary, middle and high school) has grown considerably in the last two decades. Although the use of maps and the teaching of cartographic concepts have been part of school Geography programs for some time now. We have recently witnessed the expansion of geographical knowledge in the teaching program (curriculum) from pre-school up to primary and secondary education and even in graduate courses; there is growing interest in the topics of cartographic education.

With the aim of contextualizing this process, we are going to approach it by focusing on the factors that led to the emergence of this field of studies.

2. SCHOOL CARTOGRAPHY IN BRAZIL: SCENARIOS AND APPLICATIONS

Nowadays school cartography faces new pathways, for several reasons, one is about digital technologies, internet and innovative resources have changed everyday life and school realities, opening new worlds of teaching and learning about maps.

Figure 1 summarizes these scenarios and it leads to the question: are teachers and parents well prepared to deal with cartography and its new challenges, either at home, everyday life or in the classroom?

After several decades of research on cartographic communication process, not enough studies have applied its findings to the field of school cartography. In fact, there is a growing variety of map uses and users, a great selection of innovative products and many teachers without reasonable cartographic knowledge.

The old questions asked within communication cartography, in the 60's and 70's, have now new meanings: WHY making a map (reasons, purpose of the map), WHAT will be represented (map content) and HOW (graphic and cartographic language – design and resources), to WHOM (type of users, age, special needs), with WHICH results (efficacy evaluation of the whole process). Technology have changed the replies of those questions, from one side, but there are still some challenges to be faced, as the proper training of

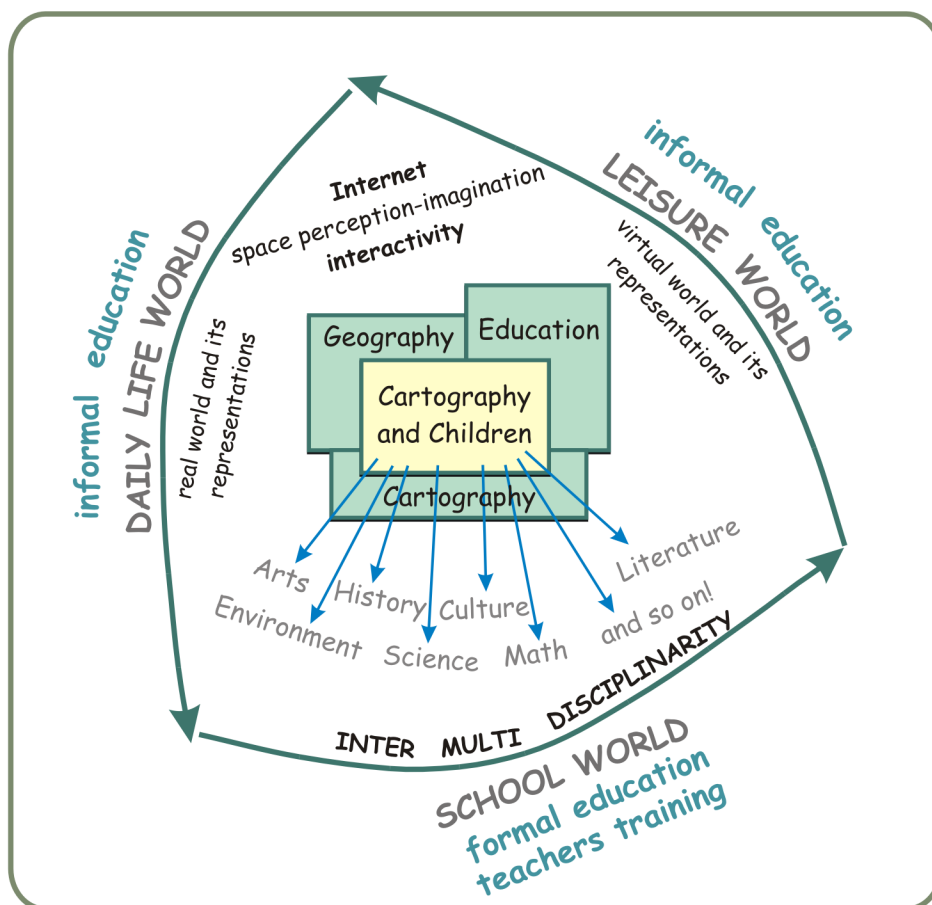


Fig. 1: Where is Cartography in the world of kids? (ALMEIDA, R.A. 2009).

school teachers to work with innovations, new cartographic products, new procedures and most important, dealing with kids who have different minds and expectations comparing to the past (Almeida, R.A., 2009).

In Brazil, there is a large and very active group of people working and doing research about maps and children, school cartography and preparation of teachers in cartography. Since the beginning of the International Cartographic Association – ICA working group in 1993 (Anderson, J. & Vasconcellos, R., 1995) there has been several conferences, meetings, publication as two books on School Cartography (Almeida, Rosângela, org. 2007, 2011). There is a research group registered in CNPq since 1995, also supported by the Brazilian Society of Cartography - SBC. These results will be presented and discussed in the following topics of this article, together with the main research areas related to maps and children which Brazilian cartographers are working on. Figure 2, summarizes the scope of school cartography and some of the actions done by those specialists during the last decade.

It is important to highlight some of these actions such as the Map Competition proposed by ICA and, in Brazil, promoted by the Brazilian Society of Cartography – SBC. This initiative has brought attention to the field of school cartography, both at the national and international levels. The national coordinator, engineer cartographer Nei Erling has done a competent work in organizing not only the competition, but also workshops with teachers and children’s map exhibitions in several cities, also during scientific events in the country. Its main goal is to promote graphic representations of the world, through drawings and other forms of art, made by children up to 15 years of age. Rules can be seen at <http://www.cartografia.org.br/> or www.icaci.org. also in the publication by Erling and Paganelli (SBC, 2007). Results and drawings collection are at <http://children.library.carleton.ca/>.

In Brasil, there is also a national competition, named Lívia de Oliveira in recognition to her work in the field of school cartography. It occurs every two years, in between ICA competitions and, in both cases, all public and private schools are invited to participate sending drawing made by their students.

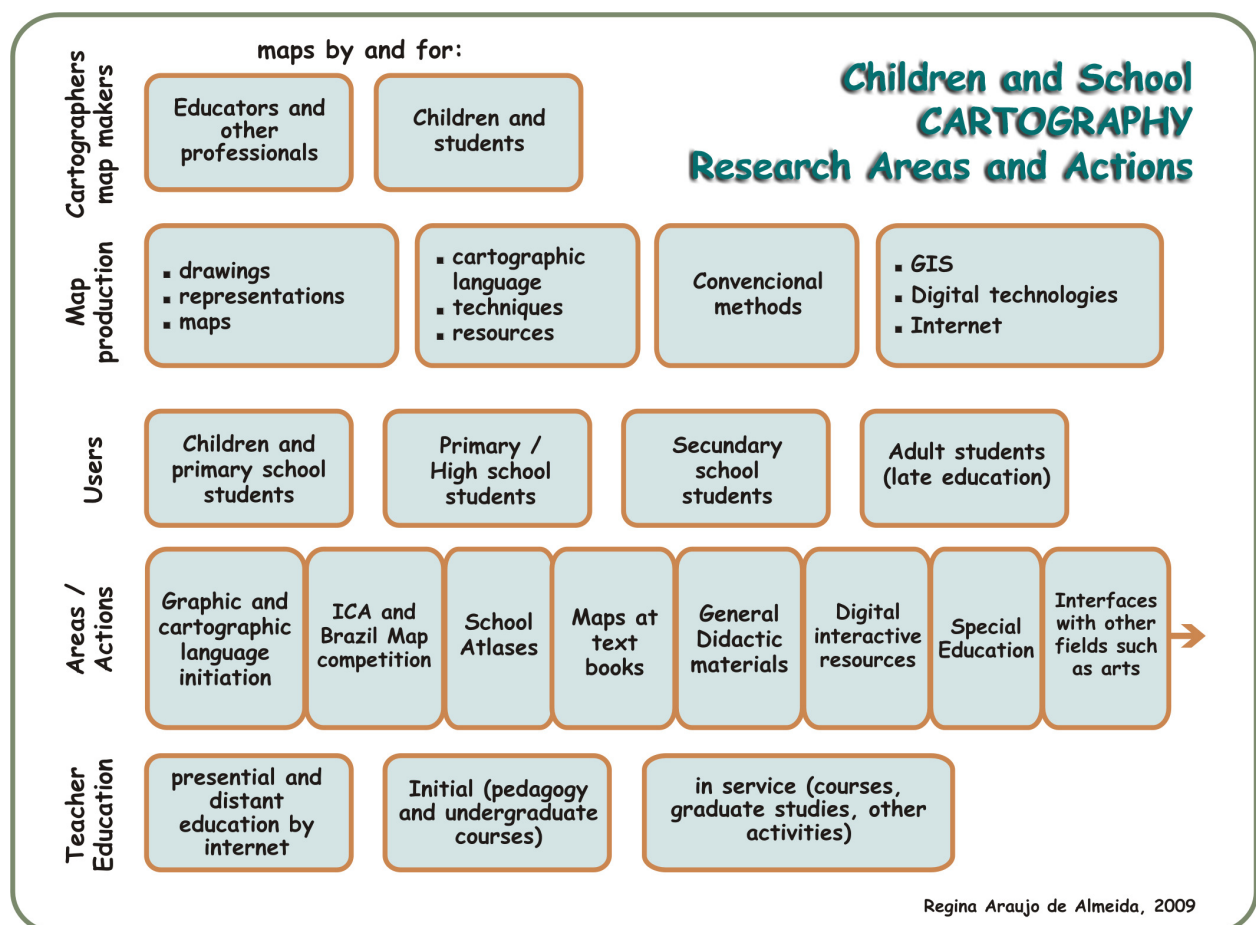


Fig. 2: Children and School Cartography – research areas and actions.

Besides de competition, SBC has given attention to the school cartography area, as one of its technical commissions named Cartography to Children and Students, which has been part of the Brazilian Conference of Cartography – CBC programme, which takes place in different Brazilian cities, each two years..

Although the competition involves small children of all ages, the area of school cartography in Brazil has given little attention to maps and infancy. There is a research group called Geography of Infancy, under the coordination of Jader Lopes (UFF/Niterói). There are publications about the theme (such as Lopes 2009, 2010), but much yet to be analyzed and discussed, also during school cartography meetings and events.

Another area which has been studied is called special needs school cartography, aiming at an inclusive geography education, introducing tactile maps to students with visual impairment. In this field of tactile school cartography many researches and studies have been done in Brazil, since 1988, at the Laboratory of Geography Education and Teaching Material at the University of São Paulo – LEMADI. Several publications since them became available (Regina Vasconcellos/Almeida, Carla Sena, Waldirene do Carmo). At present, there are other academic institutions also doing research in the area, such as UNESP – Rio Claro (M.Isabel Freitas, Silvia Ventorine) and UFSC (Ruth Nogueira).

Another initiative related to cartographic education directed to minority groups is the introduction of cartography to native teachers working in schools located at Brazilian Indian lands and to school teachers at traditional communities such as fishing villages, at the Amazonian rivers or northeast Brazilian coast.

This area is called ethnocartography and it deals with maps where culture and historic elements are important, also the traditional knowledge is a relevant part of the mapping process. In the case of native people, maps are part of their lives and their work, they draw maps of the geographical space to protect their land, to make environmental assessments, to visualize their space. They need conventional maps and digital maps, but they also want to make images of their worlds - material, physical, social, cultural, spiritual - sometimes looking like a work of art.

Maps are present at all native schools and there has been published several atlases and textbooks such as R.Gavazzi,(1996, 1998). At traditional communities cartography usually have a different role, as maps can enhance the cultural identity of students and teachers. Besides conventional methodologies, there has been innovative approaches such as participatory mapping and social cartography, mainly at the Amazonian region.

School ethnocartography and tactile school cartography are examples of methodologies and initiatives working towards the rights of every citizen, including children and young people, to get education and the same opportunities even if one has special needs. Diversity in all ways must be respected and welcome at schools, differences in culture, race, experience, sensory or physical impairment must be taken in consideration, also in cartography.

To achieve these goals teachers must be prepared to understand maps, to deal with all kinds of maps, and they have to learn more about cartography to be able to teach and work with students.

In the following topic, based on the production and presentations at the Brazilian symposiums, the main themes will be summarized and discussed to show what the directions of the school cartography scientific field have been during the last 15 years, in Brazil.

3. BRAZILIAN SCIENTIFIC EVENTS ON SCHOOL CARTOGRAPHY AND AN ANALYSIS OF ITS MAIN THEMES

In the 1990s, various school cartography events took place, events, which, in part, reflected that which was occurring with the International Cartographic Association (ICA). In 1993, the ICA created the Barbara Petchnik prize, in memory of this cartographer who was vice-president of the ICA and studied and worked with maps for children. The aim of the competition was to promote creative representations of the world done by children, which was very well received.

In 1994, a joint Canada-Brazil survey conducted to investigate the international level of interest in a formal working group concerned with children's relationships with maps. At the ICA's general assembly, in 1995, the "Cartography and Children" Working Group came into existence.

The results of the work carried out led the ICA to change the group into a commission in 1999 (Cartography and Children Commission – CCC). Brazilian participation in the CCC was the catalyst that brought about the formation of a national group focused on school cartography. The first initiative was the “Cartography Symposium for Children” held in 1995, which was followed by other symposiums and publications (Almeida, R.; Vasconcellos, R., 1995).

After this date, the following events were held in Brazil. In 1996, the Second Cartography for Children Symposium, sponsored by the Federal University of Minas Gerais in Belo Horizonte (Le Sann, 1996). The III Cartography Symposium for Children was held by the Association of Brazilian Geographers (Section São Paulo), USP, in 1999 (Santos, 1999). The State University of Maringa gave rise to the I and IV Latin American Forums of Cartography for Children in 2001 (Passini, 2001). The Fluminense Federal University and the Brazilian Society of Cartography held the Ibero-American Symposium on Cartography for Children in Rio de Janeiro in 2002. That same year the VIII International Symposium on Mapping for Children was held in Diamantina (MG), which brought together several researchers from CCC, organized by J. Le Sann. The Fluminense Federal University and the Brazilian Society of Cartography held the V Symposium for Children in Niteroi in 2007, organized by Tomoko Paganelli and Nei Erling. The Sixth Symposium on Cartography and Children and the II Latin American Forum of the School of Cartography were held in 2009, organized by the Federal University of Juiz de Fora (Trevizani, 2009).

We did a analysis of papers presented at the several symposiums held in Brazil with the objective of introducing a Brazilian production into school cartography. According to the themes defined at the events, we established four main themes, which we linked to the oral presentations and posters. It is worth noting that the Fifth Symposium held in Niterói in 2007, consisted only of round tables presentations and discussions, without papers being presented, and that is why it doesn't appear in Table 1. It is outlined below the themes that bind the papers published in the symposiums proceedings:

- *Representation of space*, which includes theories regarding the spacial representation in the child, cartographic language, mental

maps and representation of social-spatial concepts;

- *Teaching Methodology*, which involves theoretical-practical content aimed at finding didactic ways to teach school cartography, including cartographic initiation (cartographic literacy), special education (visually impaired) and the teaching-learning of specific cartographic skills and concepts at all three levels of basic education. (Elementary, Middle and High School).
- *Technology and the production of didactic cartographic materials*, including work related to school atlases, models, multimedia cartography, maps and internet, long-distance education, remote sensing and GIS;
- *Education of teachers and curriculum*, including research on teacher knowledge and practices, daily school life, culture, curriculum and teacher education.

We grouped the papers according to these themes/categories, so that each paper was assigned to one theme only, although some of them deals with more than one subject. We calculated the distribution of the papers in each area (relative frequency), which appears in table 1.

Through a content analysis of the papers published in the symposiums' annals, we noted that in the theme *representation of space* the psychogenic theory of Jean Piaget is the main foundation of the studies on the construction of spatial relations and on methodological proposals for teaching some concepts such as scale, projection and location. This theory is also the research foudation of the teaching of graphics and practices using quantitative representations on thematic maps. Some texts about the design of space made by children also draw upon the theory of Jean Piaget.

We believe that the predominance of this theoretical approach is due to the wide dissemination of the ideas of Jean Piaget in Brazil during the 70s and the 80s., which was supported by the translation of some of his work, which has giving rise to a considerable amount of research on school cartography even at this time. Moreover, one cannot ignore that the studies of this author on the epistemology of space (especially on space in mathematics) show strong support for the understanding of space representation in cartography, which basis is mathematical.

Table 1- Papers presented at the symposiums by themes (in percentage)

Theme	I Event	II Event	III Event	IV Event	VI Event
Representation of Space	24	14	27	28	12
Teaching Methodology	64	55	9	20	42
Technology and Didactic Material	6	28	64	48	29
Teacher Education and Curriculum	6	3	0	4	17
Total	100	100	100	100	100

Note: no papers were presented at the Fifth Symposium.

Other theoretical approaches are little studied in research conducted on the acquisition of cartographic knowledge. The proposals of Lev Vygotsky and his collaborators have emerged in more recent papers, especially in those presented at the VI symposium (2009). Interestingly, the papers do not depart from the trends in education research, which bring about a certain opposition between the ideas of these two theorists (Piaget and Vigotsky). In our view, one consequence of this is the impoverishment of the discussions regarding spatial representation in school cartography, which alienates it from the important debates in the science areas of Language, Geography and Education.

Under the title of *teaching methodology* we grouped together the studies with focus in issues like “what to teach” and “how to teach”, which develop into issues regarding content, concepts and procedures and procedures and teaching techniques appropriate for different approaches.

The number of papers submitted expressing this concern has been considerable at all of the symposiums, adding up to 42% of the papers presented at the last symposium, which in different research categories on cartographic literacy, education of the visually impaired (tactile cartography), content cartography in teaching Geography, methods and procedures aimed at the teaching-learning of skills and geographic and cartographic concepts. These papers look at more profound questions regarding the curriculum, culture and language, although many authors do not achieve this level of detail.

The increasing frequency of papers on technology and production of teaching materials may indicate that it is getting difficult to supply teachers and students with educational and technological resources. Those that stand out are papers on digital mapping and school atlases.

The influence of digital mapping is opening an increasing range of possibilities in education. However, there is need for further development of concepts related to technology, such as multimedia, hypermedia, hyper map, since the use of such products for teaching has proved inadequate, requiring the creation of more specific methodologies for school situations.

During the IV symposium, discussion came up about the need of developing new products that meet the specific requirements of digital media or network, for some authors there is a change in the concept map when it becomes a digital interface, as the user can create and manipulate the map, which is no longer just a means of communicating information, but can also be used as a tool for visual analyses.

Studies of multimedia cartography have advanced considerably, but the demand for a revision of cartography after the development of these resources requires a constant research updates. For Peterson (2008), cartography is a process of change, which should begin by the use of new concepts, he said: “The word “map”, for example, should perhaps be redefined to refer to an interactive map display. If the presentation of the information is not controlled by the user – it’s not a map. If there is no interaction – it’s not a map. If there is no potential for animation – it’s not a map. We may eventually realize that what we call maps today are simply static map elements – as much a piece of the puzzle as a single symbol on a map “(2007: 71).

Today, when someone wants to know where a place is or want more information about what is there, they enter one of the Web search engines, such that the Internet has become the main means of access to spatial information. With greater power to transmute information than discrete media, projects and sites of spatial information over the

Internet have created a huge community of map producers and users. At the same time, researchers attempt to find out what kind of maps on the Internet should be like and what kind of interactivity is desirable in online maps. However, there is a lack of research that allows for further development of geographical knowledge through the resources on the Internet and multimedia cartography.

When a multimedia project is intended for education, didactic issues result in those inherent to digital media: do interactive maps interfere with the learning process? How? How can we produce interactive maps that are suitable for schools and the curriculum? New information and communication technology (ICT) capture the attention of educators when it comes to improving education, inclusion and public policy. It is therefore urgent to undertake some research on multimedia cartography in teaching, in order to overcome the tendency to transfer experiences from other contexts to achieve educational objectives.

School atlases have occupied a prominent place among the papers presented at the symposiums. The number of papers on technology and production of didactic materials was 100% at the I Symposium, 38% at the Second Symposium, 30% at the III Symposium, 43% at the IV Colloquium 41% at the VI Symposium. Most of these presentations have reported about the production of a municipal atlas for teaching Geography in the 4th and 5th years of elementary and middle school.

In the latter event, there was a roundtable discussion about the topic “school atlases”. Valeria Trevizani Burla de Aguiar (1996), who was at that table, looked at the Atlas of the Empire of Brazil by Candido Mendes de Almeida, which was the first atlas published with maps of Brazil, dated 1868, and was intended for public school students at the time. Aguiar analyzes this cartographical production as a fundamental document for the consolidation of nationalism at the time of the Empire.

The historical approach adopted by Aguiar introduced the discussion of the political role that atlases play in giving shape to the views and interests of those who promote its creation. Indeed, the production of an atlas requires the participation of well qualified professionals, taking a long time to both collect and process the information, both for the production of the maps and the full pages,

including text, photographs and other elements. It is very expensive to produce this and consumption of such a product is lower than that of the textbooks, as it is used all the way through primary school, whereas students need a new textbook every year.

Local atlases were the subject of most of the oral presentations at all of the symposiums. The points raised in the papers related to the design of the Atlas and how it was produced. The best way to make a local atlas and what would be cartographically most appropriate for this atlas is a discussion that comes up in all of these studies, however, in little depth.

Marcello Martinelli, at the roundtable discussion mentioned above, talked about geographical atlases for schools, emphasizing the importance of thematic maps. He added that: “In the idealization of geographic Atlases for schools, one must consider the practical work involved in the maps, which will be carried out by the teacher as moderator and who will be teaching the geographical content as well. This means that the representations will reveal the content of the information, promoting the understanding of reality, in the pursuit of knowledge in the world in which we live” (Martinelli, 2009).

Other concerns were raised when discussing school atlases. We would like to consider Amanda Regina Gonçalves presentation on “municipal school atlases: between the maps of conquerors and disruptions at the roundtable discussion on teacher training”. She believes that the increased production of local atlases forms part of the issue of “place” and that it’s central to the understanding of current social conflicts. She discusses the role of these atlases in the maintenance of power relations, where those who produce them convey a vision of the conquerors, and proposes that there be openings for other identities of the local population. Her proposal is aligned to that of others, although some express themselves in a less radical way, or in a more poststructuralist manner, that set out new directions for school cartography.

There were few papers presented at the earlier Symposiums on the theme of Teacher training and curriculum however by the VI Symposium 17% of the papers dealt with this theme. There were roundtable talks, however the discussions occurred in other sessions as well. We identified some of its focal points without, however, claiming to exhaust

the proposals presented in the Annals of the VI Symposium:

1. The training of geography teachers is strongly linked to the structure of the bachelor's course, in such a way that the pedagogical disciplines have little (if any) connection to the specific disciplines (subjects). The final assignments may allow for a better-integrated education, especially in getting better acquainted with the environment at schools during the Teaching Practice activities and student teaching. These activities include a major focus on teacher training and conducting experiments in the teaching of geography and cartography.
2. It is necessary to expand the cultural dimension of cartography in teacher training, considering mapping in virtual environments, diverse concepts about language and the links between cartography and art.
3. The continuing education programs for teachers are an opportunity to conduct research on teacher knowledge and practices in terms of teaching maps, use of models, production of school atlases, how to work with maps on the Internet etc.
4. Other forms and interfaces of cartography should be considered in teacher training such as cultural mapping, tactile cartography, ethnocartography and tourist cartography.

4. RESEARCH AND PUBLICATIONS ON SCHOOL CARTOGRAPHY

Research and publications in school cartography have increased recently. About the research we are not able to gather and present them, since we would have to consult all graduate programs in Geography and Cartography, which is not the purpose of this article. Let us mention some that have become reference books and theses.

We should start with the thesis "Methodological and Cognitive Study of the Map", written by Livia de Oliveira, published in 1978, in the series Monographs and Theses (n.32) IG - USP. This thesis is the oldest work, we found among Brazilian researchers. It is an important contribution because it analyzes a bibliography of American and European authors who were not available for Brazilian teachers. At the end of her thesis, the author emphasized the need to organize a cartography for

children as "a natural consequence of a map methodology."

Following the work of Livia de Oliveira, under the same theoretical and methodological approach, Tomoko Iyda Paganelli (1982) conducted an investigation named "For the construction of geographical space in the child." Her goal was to analyze the role of perception and movement in the local geographic space, related to the process of spatial relationships operationalization. The author did a comprehensive review of Piaget's contribution on the representation of space and conducted experiments on the displacement with elementary students. In the results, Paganelli said that the lack, at school, of experiences in urban local space and location activities, as well as the use of city plan did not help student performance.

Janine Le Sann Gisele carried out the research "Development of a teaching material for learning basic geographic concepts in elementary school in Brazil: a proposal based on theories of Geography, Pedagogy, Psychology and Graphic Semiology", defended in 1989. From observations on the conditions of teaching in public schools, the assumptions of Jean Piaget, and Jacques Bertin's Graphic Semiology, the author has developed a chain of 182 cards containing interactive exercises on the map elements, which were applied in three schools. The results provide contributions to school practical activities with maps.

With the same theoretical, R. D. Almeida developed the study, "A methodology for the understanding of maps," in 1994., Which was partially published (2001, 2007). With the same theoretical line, Elza Yasuko Passini (1996) conducted a study on "The graphics in geography textbooks for 5th grade: its meaning for students and teachers", defended in 1996. When dealing with teaching graphics, expanded the range of school mapping in addition to the maps.

As for publications, we have a school atlas significant production. Stand out in the publication of school geographical atlases Marcello Martinelli, Maria Elena Simielli and Regina Araujo de Almeida (Vasconcellos). The quality of the atlas maps, in our view, established a high level of cartographic communication in other educational publications.

There is a considerable production of local school atlas, although most municipalities still do not have a specific atlas. Janine G. Le Sann (1997), a

pioneer in the production of Municipal School Atlas, suggests that the atlas should be interactive, so that the student can construct tables, charts, maps, analytic and synthetic texts, in order to get the student to build the knowledge himself.

Based on the approach of collaborative research with school teachers, Rosângela D. Almeida has developed Atlases for municipalities in São Paulo State, which deals, in an interdisciplinary way, with geographical, historical and environmental themes. The production of the atlas starts with teacher's knowledge and practices, facing new curricular requirements. In this way, the author proposes a methodology for producing atlases and for teacher training (Almeida, R.D. 2001, 2003, pp. 149-168).

There are other areas related to school cartography covered by research projects and publications. One of them is all digital mapping applications, multimedia and internet mapping such as the work done by Cristiane Ramos (2005) and Carla Sena (2008); also several articles and practical activities for geography teaching have been designed using Google Maps for instance (Almeida R.A., 2006). Although, in this area, there is much to be explored yet. Methodological and theoretical studies in Cartography have been done over the years and helped to set a framework for the area, as Katuta e Souza (2001) among many others. Archela (2002) has organized a bibliography about cartography in a digital base which still is an important contribution.

5. FINAL REMARKS

After 15 years of positive initiatives and impressive results, such as the number of publications and scientific events organized, the area of school cartography in Brazil faces great challenges for the future. One of them is to find innovative ways to direct its actions and achievements. In general, research and publications should address both theoretical and applied issues in school cartography.

In this respect, the VII National Symposium to be held in Vitória, Espírito Santo state (October, 26 to 28, 2011), organized by Gisele Girardi at the UFES, certainly will bring opportunities to relevant discussions and future plans. Its title, *Imagination and Innovation: challenges for school cartography*, already denotes the goals of the conference, summarized in five topics:

1. to evaluate progress in different areas of research in school cartography;
2. to propose strategies for research in the next years;
3. to promote exchange between specialists and research groups;
4. to encourage the presentation and discussion of papers/researches;
5. to produce texts and reference publications for the area.

One of the pathways for school cartography, should be inter/multidisciplinary, which means a continuous exchange between areas and research groups. It will be relevant to look for bridges and interfaces between cartography and other fields of knowledge, such as art, mathematics, science, psychology, linguistics and so on.

Cartography as a communication process should be brought back to scene and discussed in face of the new technologies and resources such as Internet, which is changing the world, including the way how we make, use, reproduce and evaluate maps.

Nowadays maps are everywhere, anywhere, at classroom, home, inside cellular phones. Children have to learn about graphic and cartographic language from an early age, basic concepts should be introduced as a preparation program, in order to be able to properly work with maps later on as adults. Map content and design should address users needs and interests.

Teachers do not doubt the importance of maps, but they have to be better prepared to learn about cartography and then to be able to deal with maps at the classroom. Initiatives on teacher training, including continuing education, should be offered to everyone involved in primary and secondary education.

On the other hand, maps should be available to all children and youngster, culture has to be taken into account as well as minority groups of users. We should aim at an inclusive school cartography, being open to differences and special needs. Maps should be multisensory and multicultural as much as possible. They have to involve digital technologies and all sorts of new possibilities to depict the geographical space, to involve the user in all stages of the cartographic process. Maps could also represent children's imagination and spatial thoughts. Even dreams or ancient traditions can be mapped,

as the native people have done in Acre. In this way, maps could be again works of art or they could be saved as virtual files in clouds of data.

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