

Cartography, spatial thinking and the study of cities in geographical education

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Abstract: *This text aims to articulate Cartography as a language and the representations as results of pedagogical practices that stimulate spatial thinking in the socio-environmental study of the city. In this point of view, in order to have a meaningful learning and a better understanding of reality, it is necessary to have a didactic intentionality that relates the relevance of the cartographic language in the teaching and learning process and its intrinsic condition to Geography to spatially think the contents, concepts and knowledge geographical features. With these discussions and in the theoretical and methodological approaches on teaching Geography, it is possible to transform the classes into more significant moments, with innovative methods that put students in a state of mobilization by spatial thinking, observing, analyzing and working with information and physical and social phenomena at different scales, contributing to the geographical reasoning.*

Keywords: *Cartographic Language; spatial thinking; city.*

Cartografia, Pensamento Espacial e estudo das cidades na educação geográfica

Resumo: *Pretende-se neste texto articular a Cartografia como linguagem e as representações como resultados de práticas pedagógicas que estimulem o pensamento espacial no estudo socioambiental da cidade. Neste sentido, para se ter uma aprendizagem significativa e melhor compreensão da realidade há que se ter uma intencionalidade didática que relacione a relevância da linguagem cartográfica no processo de ensino e de aprendizagem e sua condição intrínseca à Geografia para pensarmos espacialmente os conteúdos, conceitos e conhecimentos geográficos. Com essas discussões e nas abordagens teóricas e metodológicas no ensino de Geografia, é possível transformar as aulas em momentos mais significativos, com métodos inovadores que coloquem os alunos em estado de mobilização pelo pensamento espacial, observando, analisando e trabalhando com as informações e os fenômenos físicos e sociais de diferentes escalas, contribuindo para o raciocínio geográfico.*

Palavras-chave: *Linguagem cartográfica; pensamento espacial; cidade.*

Introduction

This article aims to analyze, based on the didactics of Geography, so that the study of the city can articulate the cartographic language and reaffirm its importance to spatialize the phenomena, objects and concepts that are very important to the School Geography. For the exhibition, I chose an approach that allows for a better understanding of the subject considering three key aspects:

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- i) Cartography connection to and inseparability from Cartographic Education and the development of students' spatial thought;
- ii) The importance of Cartography as language in the teaching-learning process in primary and secondary schools;
- iii) The study of cities as core practice, due to its direct relationship with the students' experiences, which helps establish geographical connections, concepts, methods and techniques in the classroom, as well as its importance in geographic knowledge.

Furthermore, I will use a historical narrative as reference, which, despite not being directly related to teaching Geography, is fully consistent to what I intend to show and discuss here.

The Ghost Map, by Steven Johnson, brings John Snow's work, a British doctor who researched the causes of the cholera epidemic in the Victorian London and is, therefore regarded as the father of modern epidemiology. In his book, Johnson describes how Snow gathered geographic information by associating socioeconomic and physical-natural aspects and how, from this empirical framework, the doctor could determine the initial cause of the outbreak among Londoners and question the 'miasma theory', which considered foul air to be the cause of the disease spread.

John Snow's method, based on problem investigation and solving, has had unmistakable influence on educational strategies in the classroom, since it offers strong teaching potential and gives the students an interdisciplinary view of their daily experiences. Working from the students' own reality helps significantly connect the formal geographic knowledge to the place where they live – from the block, neighbourhood and city, to regional and global phenomena. Moreover, such approach enables to integrate fragmented knowledge to the experience – as did Snow, when he connected Chemistry, Physics, Geography and Biology while searching for scientific explanation for the cholera transmission in a 19th century metropolis.

In 1854, London was a large, highly unequal, geographically segregated and dirty city – a Dickensian scenery. A city of stacked and undernourished population that drank water of unknown source and of frequent waves of cholera, whose origin nobody could explain yet. Challenged by the need to prove his own hypotheses – the source of cholera contamination to be the public water pump – and by the pressure of the rapid spread of the deadly epidemic, Snow defines research procedures according to social and physical-natural characteristics in an attempt to identify a spatial pattern. Consequently, he begins to study the neighbourhoods in London, observing, registering, correlating and analysing the weather and climate elements, the elevation

and relief, the human settlements near landslides and meadows, the course of the river Thames, the location of water supply wells and sewage pits, the distance from the houses to the river banks, the numbers and places of deaths and their connection to drinking water. To this data, he associates information about the population income, age, sex, and education.

Johnson shows how Snow relies on the gathered and analysed information about the use of physical-natural resources as well as the living conditions of the population to establish the connection between the city and its territory, as displayed in the urban design.

(...) A drainage channel for dirty water ran alongside the front of the houses, connecting to an open sewer at the end of the courtyard. (...) During his research, Snow had amassed an archive of information about the various companies that supplied water to the city, and that study had revealed a striking fact: that Londoners living south of the Thames were far more likely to drink water that had originated in the river as it passed through Central London. (...) (JOHNSON, 2006, p. 53)

In the mid-19th century, after classifying and ordering the data, Snow georeferenced his information and concentrated himself on understanding the multiple urban interrelationships. Afterwards, he synthesized such knowledge environment in one set of maps, which would become a 'visual proof' of the correlation between drinking water and cholera infection – decisive starting point for a change in the urban sanitation policies in London (appendix 1).

In my opinion, Snow's 'Ghost Map' gives us a powerful metaphor to help us design, define and apply innovative Geography teaching methods. In each class, we must try to create 'a legion of young Snows', interested in acquiring the geographic knowledge to be applied in their communities and daily lives. However, this challenge poses a new one: graduating Geography teachers able to arouse the students' interest and ready to supply them with the necessary theory and methodology to make learning real and meaningful.

Further on, I will take up the metaphor and mention, among other things, examples of its use. Meanwhile, it remains as a lure while I digress for a moment to discuss about Cartography and the Study of the Cities, fundamental grounds of our final comments.

To thoroughly understand the reality, it is necessary to examine models, scales, clippings, conventions, and iconographic and pictorial techniques. In short, it is necessary to use what is 'unreal' (the portrayal) to represent what is real. It is essential to overcome the 'natural' to understand nature. Using abstractions to apprehend the concrete without falling into the trap of reductionism, of gross simplification, of formulaic and merely mnemonic approach in order to

effect a cognitive transition of this magnitude has been a powerful and unavoidable challenge in Geographic Education.

Conceiving a model from what is real and using abstractions and representations allows us to travel through the history of Cartography and recognize how important the maps were in geographic studies.

A small digression to provide the theoretical framework

Since the dawn of civilization, places have been represented in records and maps with pictorial symbols in order to trace paths and define territories. Maps used to reveal places and their transformation from the point of view of preconceived notions of the world, mostly depicting the culture of those who drew them in the centre of the image. The traveller's view of the world around him, the 'primeval cartographer', was biased and partial. Despite walking long distances, acknowledging, and drawing the paths, "even today, the most committed traveller can never hope to experience more than a fraction of the earth's surface area" (BROTTON, 2012, p. 11). One can call it a 'conformist cartography', an uncritical reproducer of a predetermined set of values.

Contemporary to the Protestant Reformation, Mercator's point of view was a counterpoint to the conservative thought of the time. Based on cartographic studies, he questioned the 19th century orthodox religious concepts of 'Creation' and 'Heaven' considering the "analysis of 'the disposition, dimensions and organisation of the whole machine of the world'" (Idem, p. 121). Even though his ideas were considered heresy and condemned, the map projection Mercator created offered sailors an innovative and efficient navigation method, which also proved to be safer and cheaper. Known as Mercator Sailing, his method boosted the European global expansion and represented a transformational view of cartography, overcoming contemporary mistakes and assumptions. At that time, mapping the world meant to become aware of men's place on Earth, which led to the questions "where was its natural centre? Where did the world map begin – and where did it end?" (Idem, p. 126).

Understanding and recognizing the territory is a challenge, a unique form of world projection. Over the centuries, the map has become an instrument to store knowledge about the different places on the Earth's surface and describe the different ways men conceived Earth, an essential tool for the geographer.

Carl Sauer comments about the intimate relationship between geographers and maps.

Show me a geographer who does not need them [the maps] constantly and want them about him, and I shall have my doubts as to whether he has made the right choice of life. (...) Maps break down our inhibitions, stimulate our glands, stir our imagination, loosen our tongues. The map speaks across the barriers of language; it is sometimes claimed as the language of geography. (SAUER, 1956, p. 288)

Despite the considerable support of maps for the geographers, it is surprisingly uncommon to see them being used as an educational tool. Frequent classroom problems could be discussed and solved through map analysis. The maps “stir our imagination” and decisively contribute to our spatial perception. Metaphorically, the map can be a mirror that projects places, their forms and relationships, onto the memory and reflects an image we make of the world.

Brotton (2012) reminds us that

The urge to map is a basic, enduring human instinct. Where would we be without maps? The obvious answer is, of course, ‘lost’, but maps provide answers to many more questions than simply how to get from one place to another. From early childhood onwards, we make sense of ourselves in relation to the wider physical world by processing information spatially. Psychologists call this activity ‘cognitive mapping’, the mental device by which individuals acquire, order and recall information about their spatial environment, in the process of which they distinguish and define themselves spatially in relation to a vast, terrifying, unknowable world ‘out there’ (BROTTON, 2012, p. 12).

Undoubtedly, maps, like any other representation model of reality, result from clippings, syntheses, selections, classifications, correlations and previous conceptions – as those drawn up by John Snow to place the causes and the reasons for the spread of cholera. Hence, it is a matter of integrating creatively this efficient resource to minimize the effects of the criteria used for the thematic selection or map drawing.

Moreover, it is important to acknowledge the cognitive maps as not only mental representations of people’s perceptions of where they live, its abstractions and metaphors, but also the relevance it demonstrates from the cognition standpoint. The 2014 Nobel Prize in Medicine, Edvar Moser, May-Britt Moser and John O’Keefe, introduced the hippocampus – cells that constitute a positioning system in the brain – as the brain’s GPS.

In the book *The hippocampus as a cognitive map* (1978), the authors discuss cognitive mapping and the importance of neural connections do develop cognitive maps. Using georeferenced data – the location of objects, people, and reference points in general through cartographic representation – helps develop the hippocampus, considered by Medicine as the memory center.

The authors associate their study with Alzheimer's disease and relate the brain structure to memory, a prerequisite to find your way and, consequently, recognize the space and yourself in it.

The history of Cartography brings several examples of constant changes in techniques, methods and criteria in order to connect more closely to the reality and its diversity and richness. An interesting example is the definition of the observer's place in relation to the world map – their *location* and their *spatial orientation*. To solve this problem, several coordinate system innovations were used and different map projections were created in accordance to the objectives of each system. In other words, instead of disposing of the maps due to the method difficulties, cartographic design and implementation were modified.

Studying Geography implies thinking about space, understanding the landscape arrangements, establishing analogies about territory occupation and developing the spatial thought. Limiting the subject to a mnemonic discourse, emphasizing the toponymy, is to deny this journey. From the misuse of Cartography at school, there came the mistaken association of maps to an 'inevitable' reductionism, naturalization and 'mathematization' of cartographic teaching in geographic education.

On the contrary, the demand is to recover the scientific tradition of spatial thought, of Geography concepts and principles, of continuous and creative change of maps and their use as educational tools for the accurate explanation of the reality.

Cartography as language to access geographic knowledge and spatial thought

In Geography teaching, there has been a discussion, since the 1980's, about the classical ways of seeing and thinking Geography. The old school dichotomizes man/environment and analyzes each term separately; the space, as an analytical category, and the understanding of its organization are neglected. In that approach, Geography is treated poorly, the categories develop in parallel and disconnectedly, without concept support (MOREIRA, 2007, p. 112), and Cartography is considered a list of static and isolated content – time zones, map projections and geographic coordinates, for example, are introduced disjointedly and meaninglessly.

The Critical Geography, on the other hand, stems from a historical materialist conception and, since it is based on the Theory of Space, appreciates the threefold character of geographic analysis approaches – landscape, territory and space (id, ibidem, p.114).

To conceive the space approach, it is necessary to start on the landscape. Observing closely and attentively, it is possible to see the spatial arrangements and its configuration. In the landscape, ideological, cultural, economic, legal and political relations are interwoven and define the territory. To understand it correctly, it is necessary to select, classify and codify its elements, determining the way one sees the geographic space. Maps have proven to be an effective tool in this matter and a powerful argument for the revalorization of Cartography teaching.

Max Sorre (1967) discusses in detail about the connectivity between the elements of space. According to him, the geographers cannot be satisfied only with the description of fact distribution on Earth's surface; on the contrary, they need to understand those facts according to the interactions where they were produced and developed. This analysis involves closer connections between the local interaction elements, broader connections of a given element (relief, weather, vegetation, human activities etc.) as well as the interdependence of all regions on the planet.

However, it is not possible to overcome the most descriptive level of geographic research without developing a space theory able to reach understanding of the largest existent structures in a constantly moving and transforming world. Those are the spatial structures determined by the mode of production or the political organization of countries, comprising what Pierre George called the principles of spatial order. According to him,

(...) the humanized space is the organized space, the order can be the effect of an empirical evolution or the will of a past or present organization (...) which projects itself in several scales: local scale within a village or an urban conglomeration, regional scale within a small region or part of a continent, international and international scale in that the distinct community lives depend on an exchange system in long distances (GEORGE, 1969, p. 41-42).

Geography studies the space organization and production, the relationship between society and physical-natural environment. One way to realize the spatial organization is to explore thematic maps that identify territorial information. In other words, to understand spatially a phenomenon, the student must learn to accurately and rationally describe, interpret and sort it (FERREIRA, 2014, p.43). Consequently, students will have enough elements to analyses and synthesize a representation, improving their analytical skills about the geographic space and mobilizing not only the classification and combination procedures, but also map reading skills, in which the explanation about the facts and phenomena will be expressed in logically organized subtitles (QUEIROZ FILHO; MARTINELLI, 2007, p.12).

Bringing Cartography into use again enables the geographic community to deal with the semiology of graphics by applying the Theory of Communication as part of the method to devise the codes that will help with map and reality reading, giving more information to the readers.

J. Bertin's (1967), A. Kolaecny's (1977) and K. Salichtchev's (1988) studies have brought new approaches to Cartography, including applying the Information and Communication Theories to the tripod *cartographer-maps-users*. At the same time, the semiology of graphics has contributed to the debate provoked by Gimeno (1980, p. 11). He claims that using the Theory of Communication in School Geography leads to facing knowledge with a scientific attitude, inasmuch as the problems must be posed in an accurate and well-defined form when choosing the representation and spot reduction.

For a proficient reading, the reader needs to understand the relationship between signifier and signified and master the codes, the visual variables and the concepts of area, points and lines present in all maps.

A geographical map is a representation of the arrangement of elements on the surface of the earth. (...) The map supplies *intrinsic information as to topographical proximity*, which only it can transcribe completely. The map constructs a constant and universal reference shape, constituting the most powerful means of introducing into the problem *the extrinsic information necessary for interpretation and decision-making* (BERTIN, 1981, p. 119-120).

The images (aerial photographs, satellite images etc.) and the cartographic representations or mental maps contribute to the spatial thought and concept development – location (reference point), representation, proximity, influence, hierarchy, transition, analogy, association, spatial pattern (extension and area), subtitles (hierarchy and selection), line (boundary, proximity, influence), situation (housing and surroundings) and history (time and space relationship). Furthermore, they broaden the geographic knowledge present in the representations and activities associated with the Geography principles – location, distribution, distance, extension, position, scale, region, network, place, arrangement, connection and configuration –, which support the understanding of space, territory and landscape categories.

Cartographic representation enables to improve understanding to a major level of complexity, e.g., the phenomena spatialization, their organization in the territory and in their territoriality. Recognizing the place of living, locating objects, knowing how to move and navigate around several places are basic learning content students must meet in the early years of schooling.

Bednarz (2006) claims that

Learning to think geographically is learning to think spatially – to consider objects in terms of their location in space, to question why objects are located where they are, and to visualize relationships between and among these objects. One of the key differences between expert and novice geographers is the ability to think spatially (BEDNARZ, 2006, p.03).

When students draw a certain place, they are designing their maps, their way of representing space, and during their observation and data gathering process, students gradually face location, scale and symbol problems. The importance of Cartography in geographic studies becomes clear after using it to solve those problems – it enables students to acquire spatial knowledge, understand and read maps, and figure out the different ways of spatial organization present in the world.

International research, notably Americans, Canadians, British and Japanese², excel in using Cartography as an essential language to understand the space. The authors emphasize its relevance for the spatial thought and the efficient Geography teaching.

Spatial thought is an interdisciplinary field of study that interacts with areas of interest of different subjects, mainly Cognitive Psychology, Mathematics, Public Health, Medicine and Geography. From the past years, this has become a significantly expanding research area.³

The Cartographic teaching counts with the contribution of the Commission on Cartography and Children in association with the International Cartographic Association (ICA). The Commission gathers researchers from several countries and, puts emphasis on the growing international importance of Cartography and spatial thought. This approach contributes to the design of Geography syllabus in different countries, such as the United States of America, Canada, England, Japan, Chile, Portugal, Australia and Brazil.

² Liz Taylor (2013) and Scholz M., Huynh N., Brysch C. and Scholz, R., (2014) point out studies about spatial abilities. Gersmehl (2008, 2007) focuses on students' spatial skills and concepts since early years of schooling. Toru Ishikawa, from the University of Tokyo, has published the article *Why some Students Have Trouble with Maps and Other Spatial Representations* (2005). Philip Gersmehl (2007, 2008) has discussed the importance of spatial representation and cartographic knowledge in the North American context.

³ In Brazil and Chile, that topic has been systematically discussed by some researchers from the Latin American Network of Researchers in Geography Education (REDLADGEO): Fabián Araya from University of La Serena (Chile), Andoni Arenas from the Geography and Education Lab at Pontifical Catholic University of Valparaíso (Chile) and Sonia Castellar from the Research and Study Group in Geography Education – interdisciplinary practices (GEPED) at School of Education in University of São Paulo (Brazil). In Brazil, other professors involved in the discussion are: Alfredo Queiroz Neto and Marcelo Martinelli from the Department of Geography in the University of São Paulo, and Lindon Fonseca, coordinator of the Geotechnologies Applied to Territory Management Group (GEOGET) at Institute of Geosciences and Geography in the University of Campinas (UNICAMP).

Integrating cognitive dimension and spatial thought in the teaching-learning activities – representing a route (cognitive or mental map) or reading a thematic map – may guide the student to use their own experience to recognize and apprehend the space and represent it. These activities focus on the capacity to use information as scientific knowledge in relation to the development of the spatial thought and aim to connect the three elements: *the concept of space, tools of representation, and processes of reasoning*.⁴

Cartography as language in the teaching-learning process

Discussing the role of Cartography in Geography teaching and learning demands reviewing educational change proposals, as those supported by the research presented in several forums organized by the Latin American Network of Researchers in Geography Education (REDLADGEO). Those debates have focused on Geography learning process by means of cartographic language, and the baseline studies have associated geographic content and categories – such as *city, location, land use, and urban* – to reading and designing of mental thematic maps, which helps acquiring scientific knowledge.

The members of the forum are concerned about “how the students learn” and how they overcome epistemological obstacles that hinder the teaching-learning process. That leads us to the need of selecting or recreating geographic knowledge, where “recreate” means a creative and updated return to the geographic traditions of “learning with/by maps”.

The concept of learning with maps or by maps has appeared prominently in professors Livia de Oliveira’s (1978), Tomoko Paganelli’s (1982, 1985), Rosângela Doin de Almeida’s (2002, 2007, 2011), Maria Elena Simielli’s (1986, 1996, 2007) and Marcelo Martinelli’s (2003, 2011) investigations. These authors lead the way to a new discussion about Geography teaching and learning inasmuch as they use Genetic Epistemology theoretical framework and formalize the conception of process – *cartographic initiation* for some, *cartographic literacy* for others – as a visual communication product that spreads spatial information based on symbols and signs.

In that regard, Cartography and Geography are seen as *inseparable knowledges* for reading the world. Such inseparability appears clearly in the research undertaken. We have observed that, when children draw mental maps, they can better perceive the spatial relations in people’s

⁴ The core of the definition of the concept “spatial thought” is in the document that represents an important reference pillar on this topic – the National Research Council report, published in 2006.

everyday lives, such as daily routes and urban practice, and consequently, design maps more easily.

Maps drawn from the children's own experience help them understand *how people experience the places* and *why people live in those places*, rather than only identifying *how places are* or *where they are*. This approach distances itself from the conventional Geography readings and contributes to build a new spatial concept of *geographicity* (MORENO, 2014) that represents how people inhabit places.

Perceiving Cartography as a crucial content in Basic Education is a way to recreate a necessary knowledge for Geography Education, because the map offers the possibility of seeing the world in time and space. However, it is essential to clarify that there is no definite representation; each representation is unique, guided by a proposal, objective, assumption or theme, and the association of different maps is conclusive to ensure the comprehension of geographic content.

Resuming Cartography as *Geography language* means reconsidering the idea that "no geographer can do without a map". However, it not unusual to notice the little or no use of maps in the classroom due to the misunderstanding of some tendencies that have followed Geography since it was institutionalized as a school subject in the end of the 19th century.

Nowadays, the importance of teaching Cartography has been reinforced. The way it is taught has changed and research has disclosed information about the effectiveness of using maps when learning geographic contents.

Over two decades ago, School Cartography, as systematized content, returned in a more favourable position to the Geography National Curriculum Framework (PCNs) – primary, secondary and high school – and reappeared in several state and local government education programs due to the acknowledgment of the concept *Cartography as language* and the concern for spatial literacy, in different scales and configurations. Nevertheless, Cartography in the classrooms is still not recognized as scientific knowledge, thus, the challenge of reassociating Geography and Cartography continues to exist.

Despite all the technological development that Cartography has benefited from presently, the task of the map is not only to provide location tools for the students. This reduction of use may be cause, and at the same time consequence, of poor Cartography framework education. For this reason, awareness must be encouraged through continuous evaluation of cartographic use in social context.

Developing activities with mental map about a neighbourhood or a route requires certain abilities, such as the spatial transition (GERSMEHL, 2011). Spatial transition is related to the notions of time and space together, but the word *between*, as in a sequence of places – *to be between* –, is the real key to the way of thinking. This idea is also related to memorizing a route and the places around it, since spatial transition consists basically of moving from one place to another. The main question is “What (places, for example) is there between the elements in space?” Walking around the neighborhood and recognizing places, as John Snow did – identifying the houses where there were sick people, the sloping ground where the houses lay, people who lived on or near river banks, the location of sewage pits and water pumps –, allowed him to draw a mental map, by connecting places, establishing hierarchies and networks, making spatial associations and establishing patterns.

After recognizing the neighbourhood, John Snow introduced the maps as a means between experience and representation, a cultural dimension that stimulates the spatial thought and contributes for the reading of different representation forms. The cartographic language to intermediate the teaching-learning process is associated with **how to teach** the geographic objects and phenomena and, accordingly, is a methodological procedure that stimulates geographic reasoning by spatializing the contents (CASTELLAR; JULIASZ, 2018). The answer to “Where?” is not enough for a map. It is also necessary to answer “Why?”, “When?”, “By whom?” “What for?” and “To whom?” (TAYLOR, 2013). The answer to those questions must be part of the content organization in the classroom.

A site – identified in a map, in an aerial photograph or in a satellite image – is noticed and, depending on the chosen scale, it is possible to observe the city’s design and forms associated with the relief: the streets and avenues outlines interact with rivers and streams, which interfere in the organization conception of the road system and the way the city is planned. Maps display the outlines and are a relevant methodological resource to understand the geographic objects and phenomena – a language that stimulates the scientific accuracy.

Geography conceptual framework integrates the comprehension of the different territorialities, the spatial connections, the landscape production, the social mobility, the resource appropriation, the social group formation and their interaction with the changing processes of places and nature, and supports the experience interpretation by relating daily actions, way of life and local culture.

The use of the map: a methodological proposal for the study of cities

Choosing the city as School Geography content poses questions about how the students represent it. What do they know about the city? How important is it for them? What would they like to learn about it? What idea do they have of the city? How do they dream and think about the city? Why should they study the city?

Those are questions that allow identifying how singular the students' knowledge is and must be their starting point, a reference to the content study, since students will start with their own everyday life experience, what they learn outside school.

Using those questions to organize the lessons is certainly a challenge for the teachers, but they give a broader sense to the previously acquired knowledge and bring to class the students' effective life experience in the city they live. In addition, this procedure greets the teachers with a special opportunity to promote investigative and contextualized learning together with the students' active participation.

This is the theoretical methodological sense of focusing on the study of the city – to recover the origin of the study of the city in Geography, to understand that the site can hinder the urban occupation and, at the same time, recognize the physical-natural elements related to the urban design. Studying the city enables the students to understand interactively where they live (nature and society), where changes are established and where the urban division of labour happens. The cities produce information, as declared by Peter Burk in *A social history of knowledge*. For him, the cities should disseminate knowledge in exchange for information and culture, because they hold the monks, churches, taverns and libraries.

Studying the city makes possible to understand its principles of organization and clarifies the perception of its distribution patterns and reference points of several networks and connections that exist in the territory, which reinforces the idea conveyed by Walter Christaller (1933) that every territory possesses a principle of organization associated with the goods and services available in the city. The social and economic relations also appear in the concept of urban network developed by Michel Rochefort (1957), Roberto Lobato Correia (2007), and Pierre Monbeig (1952) when they deal with pioneer front shifts in the State of São Paulo.

At this moment, I reiterate the idea of the city as a means to understand the everyday life, the trade and service, the city routes and the cultural changes produced by the roots of a place or by the society globalization. That is one of the several reasons to reinforce the study of the cities in

the classroom, since it fosters consolidating the geographic scientific knowledge and expanding the spontaneous concepts.

This theoretical methodological framework defines a way of seeing and observing the world, of perceiving and living the reality, a way of representing the world, the *geocartographic way*. As Michael Young (2010) states,

Schools are places where the world is treated as an 'object of thought' and not as a 'place of experience.' (...) Sometimes, these concepts have referents outside school, in the environment of the pupil's life, in a city like Auckland, for example. However, pupils' relationships with Auckland as a 'concept' should be different to their relationship with their 'experience' of Auckland as the place where they live. (YOUNG, 2011, p.25)

It is necessary to think the city beyond the descriptive and experienced perspective. Soja (1997) states that the *perceived space* refers to understanding the distribution of the phenomena in space by attentive observation, consequently, expanding the meaning of *lived space*.

Conceived space is seen as mental space, represented space, and is associated with Cartography and the graphic representations inasmuch as it expresses how people imagine the geographic space. Conceived space is mental, subjective, and refers to symbology and semiology. In conclusion, the lived space, the most complex of the three (perceived, conceived and lived spaces), incorporates the temporal dimension, the history, and is considered biographic because it integrates the everyday life practices.

In the geographic analysis, recovering the meaning of those three space dimensions allows to recognize things, phenomena and places, and understand the role of each one in spatial planning. Moreover, it implies using the maps as language to materialize the territory organization and realize the layouts and networks that exist in the cities.

We dare to say that the city, together with cartography and spatial thought, contributes for the development of the most complex thoughts (VYGOTSKY, 2009) insofar as the students start to understand the spatial concepts represented in the maps, which demonstrates a process of building the spatial thought that Jo & Bednarz (2009) explained. An example of that can be observed in appendix 2, *Spatial concepts represented by the map*.

The learning process, according to the culture-historical approach, considers the school to be a place where cultures, histories, knowledges, experiences and imagination meet and manifest themselves within social practices in school life. Thus, in that context, it makes sense to

understand the city not only as landscape, but also where the majority of the world population lives, where the relationship between production and consumption is established, where functional relationship network is managed in multiple superimposed scales, and where conflicts and inequality are visible.

For that reason, I believe that classroom practices are able to stimulate a more meaningful perception of the reality, and when I declared, in the beginning of this text, that school would be the place to make “young Snows”, that was not a rhetorical speech. I can really envision more constructive approaches to the learning process as a result of methodological innovations.

Gil Perez and Carvalho (2011, p. 23) declare that “learning about the problems that result in scientific knowledge building (...), learning, especially, the epistemological difficulties and obstacles – invaluable help to understand the students’ difficulties –” is the teacher’s responsibility in the teaching-learning process. I support that a proposal to teach Geography in a meaningful and investigative way demands that students recognize and appropriate places, as well as perceive and represent them.

Mapping the city makes sense when one selects what to observe and analyses the facts and phenomena; an example is the students drawing how they imagine the city or the lived places to be. This drawing is a mental map that, when carefully worked in class, facilitates the study of cities and other several concepts by using the cartographic language in nontraditional ways. This approach relates to Vygotsky’s studies about mediation as well as to the concept of investigative lesson.

Bachelard (1996) affirms that to understand scientifically what is real, it is necessary to put oneself in a state of permanent mobilization, i.e., not to accept the notion of absolute truth. This idea helps us think of more challenging procedures in the teaching-learning process, in which the teacher has a fundamental role and whose implementation demands a consistent theoretical methodological framework. When the students have access to scientific knowledge, they can analyse what is real; however, as Bachelard presents, they also need to know that *what is real is never what it seems*.

The recognition may happen when studying the city and addressing physical-natural elements in a continuous transformation process. Thereby, we could explore different topics and connect at the same time, for instance, soil or hydrography to the changes defined by human labour in a capitalist society. Beginning such process may be the result of a simple question: *How? How* can

we study the rivers of a city? This investigation may help to overcome the dichotomies and geographic fragmentations as long as the study of the river flow, slope, channel and course are incorporated in the quest for the connections, articulations and interrelations that can be established to identify the environment altered by human labour.

Working on this theoretical framework makes it possible to state that, using everyday problems or scenarios as a starting point to contextualize the object of study enables to accomplish an integrated geographic analysis, taking, for example, the causes of flooding. This topic allows students to fully understand the natural components within the range of possible connections, temporal scales, representations and analysis, and demands that the students apply conceptual and complex knowledge. The implementation of tasks that promote reasoning encourages students to understand the environment in a relational way, as endorsed by Pierre Monbeig in the 1950s in his discussions about Geography teaching in Brazil.

That proposal of reading and understanding the city reinforces Bachelard's (1996) idea: the real is never what it seems, it is what should have been considered. That includes contemplating the complexity in articulating location, arrangements, temporality, changes and permanence, and observing that the landscape also reveals the cultural interactions, the production, the circulation and the policies.

Studying the city through the landscape allows understanding the reality and noticing the complexity of the Geography of the place expressed in the location, as declared by Max Sorre (1967). Such conception reinforces the idea of the complexity of landscape study presented by Santos (2012), when he states that it organizes itself according to levels of production and technology. Given the complexity of landscape reading, the draft of the analysis method is made taking it into consideration and emphasizing the events in the territory. That draft will assist us in the organization of the territory produced by human labour.

Monbeig justifies reading the landscape and understanding the complexity of the connections in his statement:

It is a common and persistent mistake to intend to take and teach isolated and atomized geographic facts. It is not the altitude of Agulhas Negras Peak that is a geographic fact, but the series of massifs made of singular categories of rocks, located in a distinct orographic setting, subject to certain weather conditions that determine a particular vegetation distribution and establish specific ways of human land use (MONBEIG, 1956, p. 9).

The approach I favour is referenced in integrated analysis and materialized in the above exert of Monbeig's thought. From that notion we can reassess the concept of Geosystems to explain the dynamics of nature and its relationship with the several ways of land use by connecting information and recognizing places beyond the students' living places.

Such associations allow us to understand the city. For example, overcoming the limits of human and physical dichotomy enables to associate the areas of risk or environmental vulnerability to how the land was used, understand the area outlines and the perceptions that led the areas become what they are. That means asking and reinforcing the questions *Where? How? When?* and *Why?* to explain landslide, erosion and deposition that modify the relief⁵, and allow to understand those processes by means of images, cartographic representations and landscape arrangements that contribute to spatialize the processes. Those questions are fundamental to analyse the urban environment in an integrated manner and express the spatial thought, the geospatial analysis and the thematic map design.

In Geography lessons, it is imperative to use information inventory in combination with geospatial analysis in research methodology in order to actually teach Geography. The study of cities enables to have an integrated approach of Simultaneous Geography in an interdisciplinary approach by using concepts derived from Chemistry, Physics, Mathematics, Biology etc. and applied to environmental analysis as well as the spatial thought concept present in any area of knowledge.

Young's (2010) thesis is here reinforced. He proposes that the environments, the city for example, be studied in a *conceptualized* manner, and that the students have a "geographer's view" of the city and understand the geographic method, including field work. In this way, students do not experience only what is lived. The students need to understand *conceptually* what is required to undertake a study based on activities that are associated with human interaction in space, which vary according to spatiality, sociability and temporality, as stated by Soja (1997).

Everyday life will contribute to the perception of the several territorialities that exist in a city (ghettos, slums, communities, neighbourhoods etc.) and broaden the limited dimension the students usually have of the city.

I incorporate here the conceptions of city and urban, as space of conflict and social struggles. David Harvey's (*Social justice and the city*) and Milton Santos's (*Unequal urbanization*) teachings

⁵ Information taken from the investigation about mass movement – as the one that happened in Nova Friburgo, Brazil, in 2011 – and other landslide events present in Professor Ana Luiza Coelho Neto's research, Federal University of Rio de Janeiro (UFRJ), Brazil.

add to Christaller's classical Geography through the concepts of network, centrality, flow and static, and help to understand the "city of the capital". A very interesting application of this method is the discussion about the "two cities" – *the city of capital* and *the city of citizenship*.

The *city of capital*, namely, the city where capital is reproduced, is the one whose focus is the goods and the accumulation process that are characteristics of capitalism (HARVEY, 2007; LEFEBVRE, 1991). Such city is structured from the need to approximate and ensure the nexus between production and consumption. It is a means to manage the production, distribution, exchange and consume processes and, therefore, is functional and favourable; the concentration, circulation and communication networks are characteristics that typify the city.

The city of capital can be understood as a territorial organization that involves production and consumption, characteristics of Fordist and post-Fordist cities. The former promotes the integration of its inhabitants and aims to make them consumers, besides being characterized by social segregation. The latter, restructured after the 1980s, abandons the Keynesian system of hegemony and reinforces the dual model – who is in and who is out of the consumption system.

The *city of citizenship* focuses on urban management and social struggles, mobilization and confrontation for the right of being part of the city's building, appraisal, realization, appropriation and collective use (LEFEBVRE, 1991; SANTOS, 1996, 2012), which means to discuss the city and call attention to its unequal, uneasy and exclusive nature. This discussion centers on understanding that the place people occupy in the city enables them to enjoy it or not, and identifying the relationship between proximity to and distance from basic services due to the location, i.e., the distance between where people live and work, which comprise the flow and static systems.

As promised before, I resume the introductory metaphor about the richness of apprehending Geography through problem solving and investigation. I conclude offering a methodological journey similar to the one taken by John Snow and posing the challenge of mobilizing students at school, I mean, *give the reason reasons to develop*.

I propose rethinking teacher education and Geography teaching practices using the study of the cities as a productive means to accomplish objectives and progress from the mistaken and settled view of Geography merely as a science to number and describe physical phenomena on the surface of the Earth. Geography must focus on studying the geographic space considering all its dimensions, complexities, conflicts and dynamics.

From the inventory of spatial data, observations, records, classifications and grouping, it is possible to design synthesis maps about several approaches, an example being people's access to public health. The selection of a method to treat spatial information – a double-entry chart, a triangular graph, a semi-logarithmic graph, or as adopted by John Snow, a Voronoi diagram – enables to discuss about the city's healthcare quality and the regional concentration of health facilities, as well as to develop a critical perspective on the concept of socio-spatial segregation. This can be achieved when the teacher lets “the maps tell the students” and the students creating their maps about the geographic spaces in the city in a thorough and clear manner, as the cartographic language connections allow, and, thus, fosters the development of the students' spatial thought.

I am driven by the conviction that Cartography cannot be separated from School Geography and that, by restoring this concept and the importance of Cartography as a method to teach School Geography in primary and secondary schools, together with the Study of the Cities as structural basis of the curriculum, it is possible to reshape education positively to bind citizens to the world and the contemporaneous cities. Moreover, it makes the geographic teaching a creative, accurate, meaningful, useful, inclusive and emancipating activity.

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