PROCEEDINGS OF

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"Cartography Connecting Schools"

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Proceedings of the Joint ICA Workshop “Cartography Connecting Schools”

December 2-3, 2021

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PROGRAMM E
Joint ICA Workshop

"Cartography Connecting Schools"

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Session 1

Mapping Geo-Spatial Examination of Pre-and Post Quarantine Nocturnal Illumination amidst the COVID 19 in the United Arab Emirates

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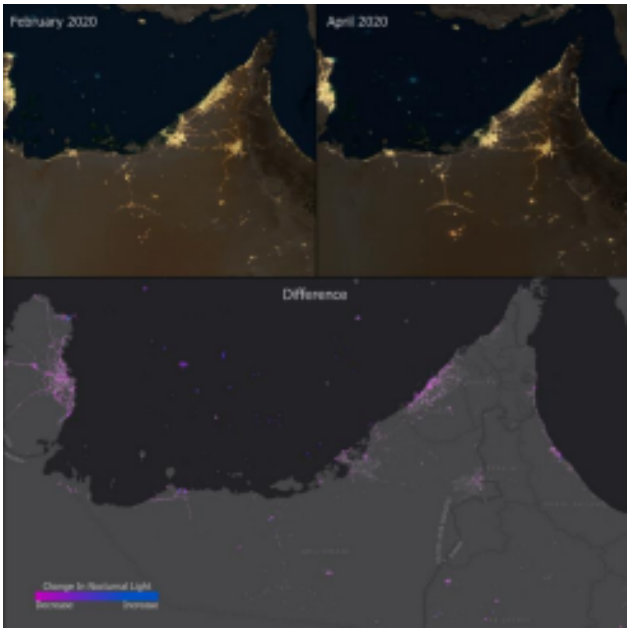
Keywords: COVID-19, quarantine, lighting, GIS, United Arab Emirates

Abstract: The COVID-19 pandemic has resulted in the adoption of quarantine measures aimed at restricting the movement of people to prevent the spread of the disease. The paper examines the pre- and post-quarantine social activities amidst the pandemic in the United Arab Emirates as indicated by nocturnal lighting or illumination. Lighting, for the purpose of this study, refers to artificial light in dwellings, office towers, roads, and so on, to achieve practical or aesthetic effects. The authors employed a methodology using geographical information systems (GIS) technology to capture and analyze spatial and geographic data. For this purpose, night-time satellite images and analogue maps were used to create the spatial database of the GIS for the study area. Using GIS advanced analytical functionality (Zonal Statistics for each emirate), visibility analysis was implemented. The output from this analysis are a series of maps reflecting the change in light emission in the emirates (Abu Dhabi, Ajman, Dubai, Fujairah, Ras Al Khaimah, Sharjah and Umm Al Quwain) during February 2020 (pre-quarantine) and April 2020 (post-quarantine). The findings demonstrate a decrease in lighting during the post-quarantine period in Dubai and Ajman and an increase in the remaining emirates. Furthermore, the increase in the overall light emission in Abu Dhabi is attributed to an increase in lighting on the offshore oil fields (see Map).

Map – Change in Nocturnal Light in the United Arab Emirates



The use of atlases in Czech geography teaching

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Keywords: atlas; map; survey; questionnaire; geography education; digital atlas

Abstract:

Geography education aims to provide an insight into geographical concepts, their principles, phenomena, causes, relationships, and implications. The best medium for understanding geographical space is a map. A map is a characteristic tool of the geographer and an essential instrument for geography teaching (Bailey, 1974). According to Gerber (2001), the school atlas is the second most frequently used tool in geography teaching after the textbook. The primary consumers of cartographic products for schools are the geography teachers who implement them in their lessons. Usability study allows cartographers to gain an understanding of how people interact and perceive their products.

This research investigates how Czech geographic teachers work with cartographic aids, especially printed atlases, maps, or other related digital aids. The research focused on how maps are implemented in geo education, the frequency of their use by teachers, and what tasks students complete with maps. The study also asks what they need and what would help them in working with cartographic aids. The most appropriate method to reach a large number of respondents to understand their needs is an online questionnaire survey. Over 600 geography teachers, which is approximately 15% of all geography teachers in the Czech Republic, answered 30 questions of various types[1]. One third of the questions were text-based. The analysis of textual responses is very challenging. To analyse these answers, cooperation with colleagues from the Department of General Linguistics was undertaken. Corpus linguistics methods were used to extract information from teachers' responses. The first type of analysis was to identify the most frequent words, their pairs, or triples. The second, a complementary way of analysing the responses, was based on the detection of key words that could potentially have low frequencies but still carry important information. The most frequently occurring verbs obtained were further assigned to categories using Bloom's taxonomy. Furthermore, an analysis of the relationships between the questions was conducted. This analysis was conducted using the standard chi-square test or its equivalent depending on the type of questions. Individual answers were also analysed separately using pivot tables.

A basic analysis of the individual questions revealed that school atlases are very frequently used aids, and teachers play an important role in their teaching. According to the teachers' answers, most students (57%) work with the atlas every lesson. Approximately one-third of them (29%) work with the school atlas every other lesson. The most frequently used school world atlas in the Czech Republic is the atlas from the publisher Kartografie PRAHA (67.5%). It is used in combination with other atlases by 93.9% of the respondents of the questionnaire survey. Only 12% of respondents use the electronic version of the atlas, while 35% of teachers do not know that publishers offer electronic versions of atlases. Geographic teachers most miss the thematic maps of different topics and scales. Most teachers (99%) use printed aids such as map sheets, wall maps and globes. A significant number of teachers use digital devices, mostly computers and interactive whiteboards, as well as mobile phones and tablets for map teaching. The most common source of maps is the Internet. One-third of teachers use GIS in their teaching, but only 1.2% of students use GIS for map-making. A linguistic analysis of the verbs in the responses revealed that maps are most often used to search geographic phenomena. The division of verbs into the categories of Bloom's taxonomy showed a high representation of the first level (retrieval) at the expense of the other categories. Analysis of the relationships between the questions revealed that female teachers use the atlas significantly more often than male teachers. However, the popularity of using digital devices among both male and female teachers is the same. The most important factor influencing the use of school atlases is the number of years of praxis. Teachers with fewer years of praxis use the atlas less often than their more experienced colleagues. More experienced teachers are more aware of the digital version of atlases, and they also work with the digital version more often. The type of school largely determines whether

teachers will use GIS in their teaching. GIS use is about three times higher at grammar schools than other types of schools (primary and secondary schools combined).

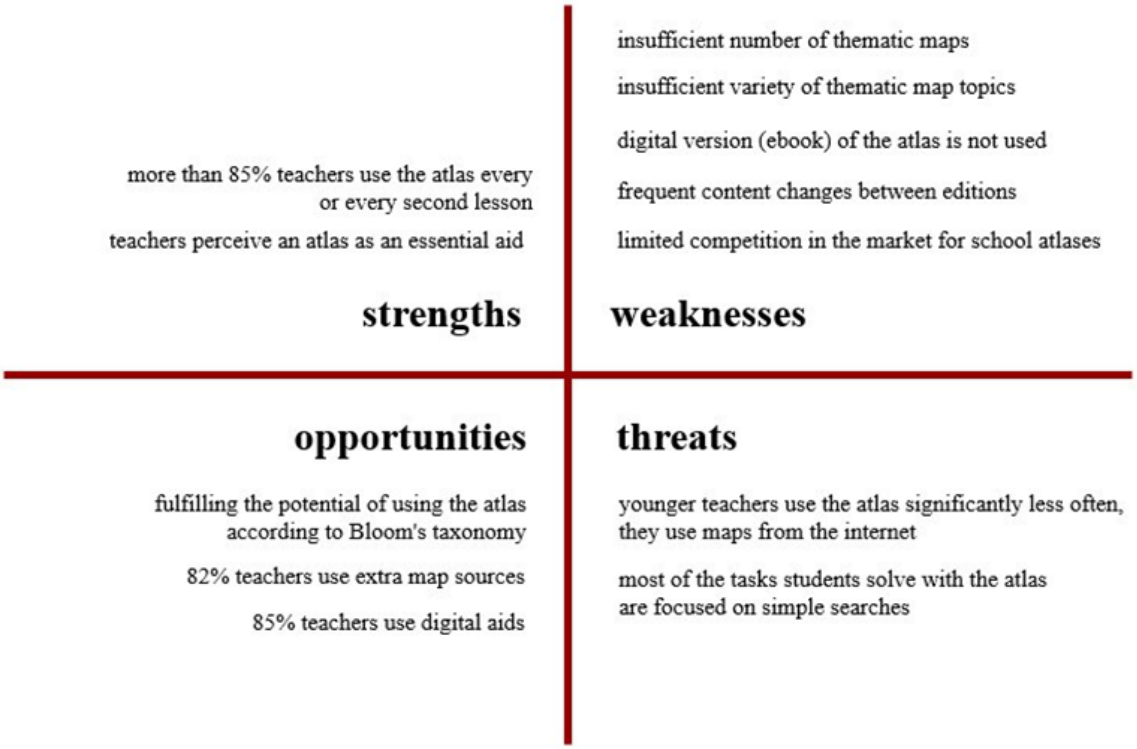

Figure 1. SWOT analysis of the most relevant findings.

Finally, the SWOT analysis (Figure 1) was employed to provide an overview of all the most important findings of the study. The results provided a detailed insight into the use of school atlases, maps, and other teaching aids. It demonstrated how teachers work with these aids and how they can use their benefits in teaching. The findings can be applied by university pedagogues while preparing future teachers or be useful for cartographic publishers. Finally, they will find application in further research.

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[1] The collected data are available at Mendeley data doi: 10.17632/h8vg9w9ht5.2.

Erwin Raisz and school cartography

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Keywords: Erwin Raisz, school cartography, school atlas, cartogram, textbook, physiographic method

Abstract:

Erwin Raisz was one of the most internationally recognized cartographers in the 20th century. He researched and worked on diverse cartographic areas: he developed the physiographic method for the representation of landforms, cartograms for data representation, a new map projection, etc. However, the international cartographic community does not associate his name to the field of school cartography, even though he made numerous works that were used in schools due to its high educational value. Current research gives a brief background on those works developed by Raisz and used by the teachers not only in schools of the United States, but in educational institutions of other countries too. His physical maps, cartograms and atlases were and are examples of how cartography is one of the most powerful didactic tools in the schools and how these tools can increase the children and young people's interest towards maps.

The themes studied and developed by Raisz, which are related to school cartography, can be resumed in five main areas:

- Development of the physiographic method: making of maps to be used in schools
- Studies on the possible use of cartograms in teaching activities
- Blackboard maps in schools as a tool for helping teaching
- Atlases that can be used in schools
- Maps, diagrams, cross sections, etc. in Geography textbooks published for secondary schools

Attending Columbia University in New York, Raisz had the opportunity to know the work developed by Prof. Armin K. Lobeck, who published his first physiographic map ("Physiographic Diagram of the United States", Nystrom Co.) two years earlier, in 1921. Raisz developed further the physiographic method introduces by Prof. Armin K. Lobeck at Columbia University in New York. The physiographic method was the theme of his doctoral research that he defended in 1929 and Raisz created his own system of physiographic symbols for the representation of landforms. In the next almost 40 years, he made numerous maps using this method. However, if only one of them should be highlighted, then we should select his best-known physiographic map, the "Landforms of the United States". The original map was drawn in 1939 and updated for almost 20 years to its last edition in 1957: it became "the wall map" par excellence in the schools in United States.

At same time, Erwin Raisz also was interested on the making cartograms for the public in general and he can be considered the first cartographer, who developed scientific research on this theme in the United States. Raisz published his ideas on this topic in the article entitled "The Rectangular Statistical Cartogram", published in the Geographical Review in 1934. He dedicated a chapter to cartograms in his textbooks on cartography and emphasized the positive role that cartograms can play in geographic thinking and in educational activities. By this reason, he also made three dimensional cartograms for his most popular atlas in the United States, the "Atlas of Global Geography" published in 1944.

Raisz also wrote about "diagrammatic maps" (name given by him in 1938) or "blackboard maps" (1962) in articles and mainly in his textbooks. Under these names Raisz explained the importance in teaching activities of those simplified outline maps that teachers often draw on the blackboards, because "students understand them better than wall maps with all their complexities".

An interesting detail of his rich cartographic life work is that in almost 40 years he created three own atlases only: the first one was the "Atlas of Global Geography" in 1944, the second one was the "Atlas of Cuba" in 1949 and the last one the "Atlas of Florida" published in 1964. All of them are masterpieces that were created for the public in general, but also used in schools. Specialists can also observe a continuous development of his conception on atlases: in the first atlas, he experimented with a new type of cartogram that later he did not use again. In the "Atlas of Cuba" we can see the strong influence of the Isotype System developed by Otto Neurath in Vienna and London. Finally, the "Atlas of Florida" was enriched with diverse types of thematic maps that gave a more accurate representation of the data related to this state.

An also almost unknown facet of Raisz's professional life is his interest to collaborate in publications (e.g., text- and workbooks) made for schools not only in the United States, but in other countries too (e.g., in Cuba). He made maps, cross sections, diagrams and other figures for different textbooks related to Geography teaching, and collaborated actively in the preparatory works related to those books, e.g. participated in study trips or even in aerial surveys. He also recognized the importance of the role that the "non-traditional" media can have for teaching activities and participated in the making of educational films in the United Sates in 1947 and 1951. Raisz was also interested on books made for the public in general, which he considered a very important way to popularize maps. Only an example: he made the maps for the the Pulitzer Prize-winning book entitled "Admiral of the Ocean Sea: A Life of Christopher Columbus", written by Samuel Eliot Morison published in the United States in 1942.

Resuming, the almost unknown relation between Erwin Raisz and school cartography was professionally strong, even though the international cartographic community does not remember him primarily in this specific field. His works are real examples of how cartography and maps are not only influential didactic tools in teaching, but they can also encourage the interest of the children and young people towards geographical and other learning activities.

Selection of works made by Raisz, from the upper left corner: physiographic map in the "Geografía de Cuba" textbook (1942), fragment of a map from the Atlas of Florida (1964), world map in the Atlas of Cuba (1949), fragment of "Landforms of the United States" (1952), cartogram made for the Atlas of Global Geography (1944) and cover page of the "Admiral of the Ocean Sea" book (1942)

The first geographic Atlas of Mars: a Martian equivalent of school atlases

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Keywords: School atlases, Atlas, Mars

Abstract: Mars, a Pocket Atlas was published in 2021 as a project aimed at creating an equivalent of school atlases, but with Mars, as the subject of the Atlas. We have followed the themes of school atlases, from overview maps, to thematic maps and the main section as a series of geographic maps. Geographic maps in this atlas are different from all previously published maps of Mars because they use a geographic approach: these maps are complex maps where all themes play an equal role and none of them dominates the map pages. In particular, the layers or themes on these pages are: relief (color coded topography), hillshading, artificial objects, natural landforms: paleohydrologic, volcanic, tectonic, glacial, and aeolian landforms; and nomenlcature (Fig. 1).

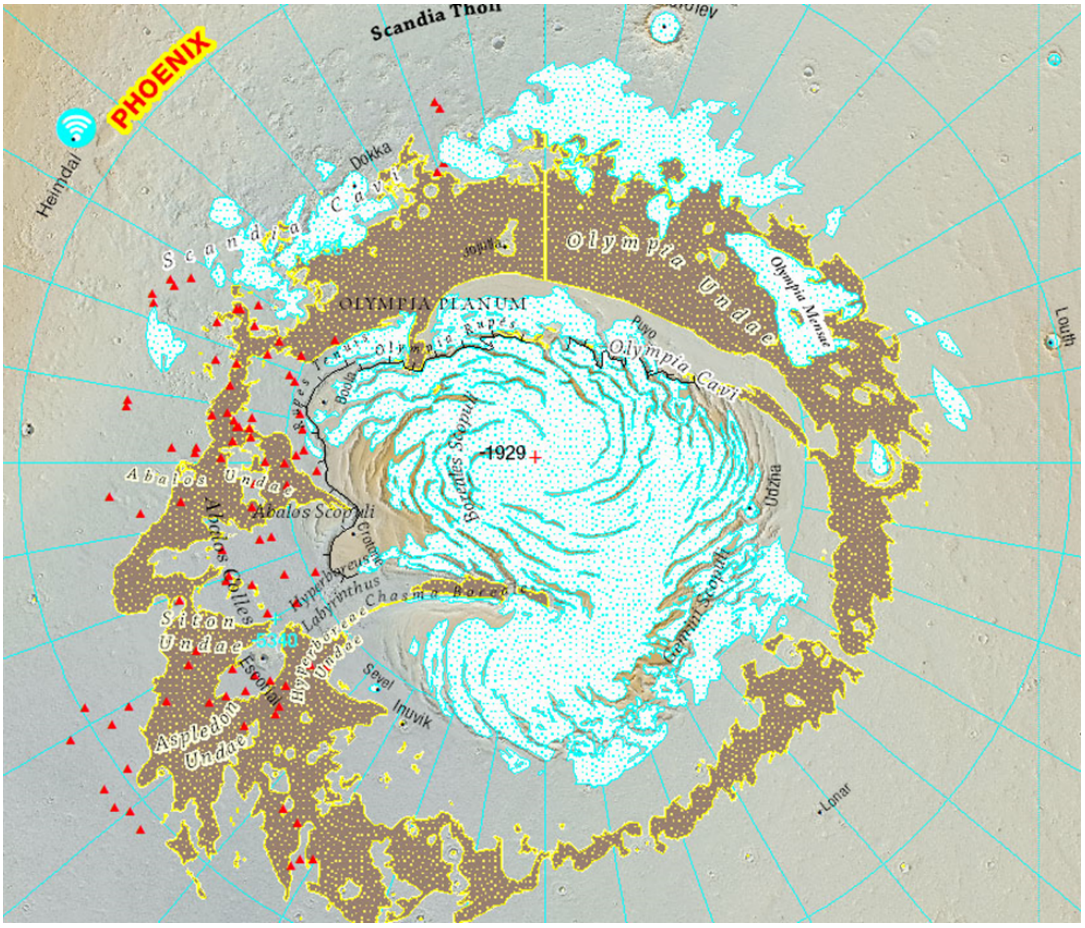

Figure 1. The north polar view in the Pocket Atlas

Figure 2. The front page of the Mars, Pocket Atlas – 3 editions, Hungary, UK, Turkey

The Atlas was published in 3 editions in 2021, with sponsorship from the Europlanet Central European Hub outreach program (Fig. 2). From the second, UK edition, the atlas contains exercises for schoolchildren on planetary stratigraphy, and they all contain climate maps and diagrams that enable teachers of geography to make comparative study between Earth and Mars, even as part of the curricula.

Our plan is to further develop the atlas, with more diverse themes and exercises.

Map as (auto)biography: children as authentic cartographers

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Keywords: Children;s mapping, sense of place, authentic cartography, biography

Abstract:

What might be meant by children as authentic cartographers? It is often argued that young children's mapping remains genuine to their view of the world, original and generally untainted by strict cartographic conventions. This is not to disparage conventional mapping as 'inauthentic' but to acknowledge that something may be lost as well as gained as children are taught 'correct' forms of cartographic practice. At the same time, we recognise that children are enculturated into conventional symbolisation from an early age (via picture books, television, etc.); for example sun symbols with rays of light proliferate in many maps.

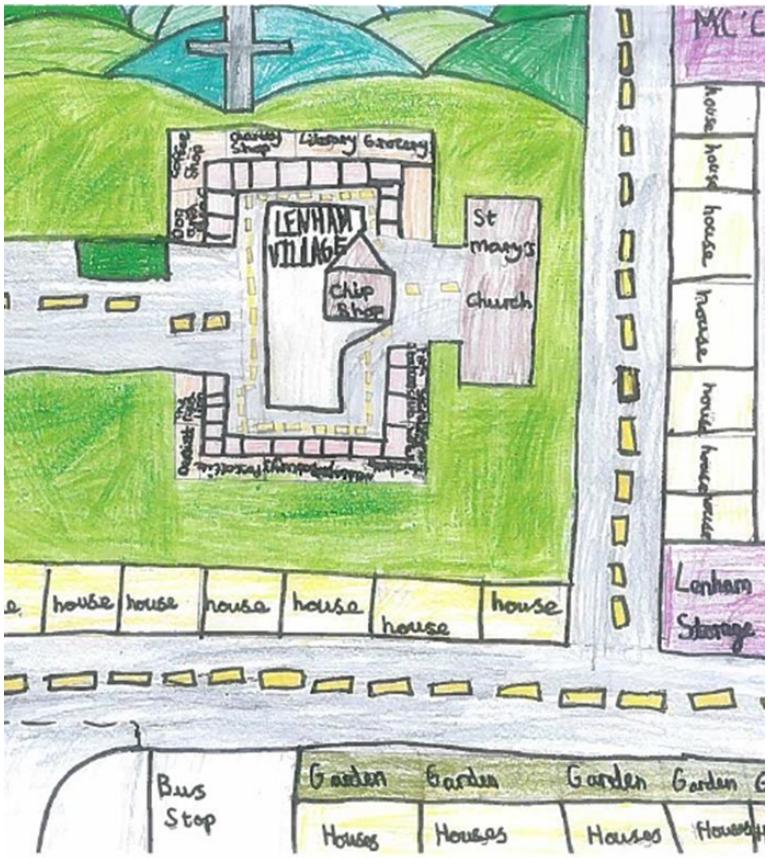

Figure 1. Extract from a child's map of the village of Lenham, Kent (UK)

In this paper we explicitly explore the individual child as authentic map maker, based on a large data set of over five hundred maps drawn by primary school children (aged 7-11 years) from across the UK (Meaningful Maps project, Vujakovic *et al*., 2018, Owens, *et al*, 2020). Our focus is on how each child sees and displays her/his immediate world through the map as biographic artefact. Some quantitative data will be introduced to demonstration that certain issues, for example overt inclusion of a named relative's or friend's homes, are common practice, but this should not overshadow our concern with map as

individual (auto)biography of place (Harley, 1987. Vujakovic,2021), a representation of the child's lived experience and sense of place.

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Cartographic activities to study the living place: a reading based on the continuing Geography teachers in service of geotechnologies

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Abstract: Geotechnologies can be able to think of didactic actions beyond cartographic representations traditionally like as printed maps, atlases, globe, models in the classroom as enhancers of their educational actions in conducting reading and geographical interpretation of places. This main goal is to show how geotechnologies have been getting news perspectives to Geography teachers on their cartographic activities about the students living place. Thus, a course to Geography teaching continuing in service was development with teachers that does class in São Gonçalo publics schools. To sum up, when teacher has knowledge in geotechnologies can be used as didactics in cartographic to students living place.

Keywords: Google Earth Pro, QGIS, Cartography Teaching

1. Introduction

Knowing how to orientate, locate and understand the logic of the organization of geographic space are spatial skills that can be expanded with cartographic activities using orbital images and maps prepared in Geographic Information System (GIS).

Reading and understanding the world with these geotechnologies contribute to overcome the cartographic category of location/analysis according to Simielli (1996), so that students can correlate and synthesize geographically social and environmental phenomena helping students to use critically and consciously these resources in daily tasks.

The use of geotechnologies as teaching tools demands knowledge, basic notions of Cartography and geoprocessing especially, Remote Sensing and GIS added to the classroom experiences "[...] organized from what he/she learned in the academic disciplines, as well as in his/her pedagogical practice (SACRAMENTO, 2015, p.13)". Thus, it is possible to think of didactic actions beyond cartographic representations traditionally worked in the classroom (printed maps, atlases, globe, models) as enhancers of their educational actions in conducting reading and geographical interpretation of places.

This paper addresses cartographic activities by using geotechnologies from 6th to 9th grade in Geography classes in the municipal public network of São Gonçalo/RJ. The course GEOPEES (Geotechnologies as instruments to think the spatial-geographic - GEOPEES) is used as a methodological path for the appropriation of satellite images and maps made in QGIS applied to students living place.

To this end, the research-action methodology was adopted as the structuring axis of a continuing teaching in service based on reflections about their classes, the construction of knowledge in geoinformation and, consequently, to constructed concepts and geographic contents with free mapping geotechnologies which the starting and end point is the place lived by students. The Research- Pedagogical Action (PAPe) recognizing teachers as researchers and authors of their classes (FRANCO, 2016a, 2016b). Thus, these professionals can be able to enrich Geography classes considering themselves as researchers aware of their tasks at the classroom.

This paper was divided into three parts. First, it portrays the importance of continued Geography teaching in serviice as a means of providing the appropriation of geotechnologies in the work on concepts and geographic contents using cartographic representations. The second moment addresses the Research-Action methodology used to development of GEOPEES in order for educators to recognize themselves as authors and protagonists of their actions in Cartography teaching. Finally, it will be discussed cartographic activities performed in Geography classes of Fundamental Education II by the

teachers of GEOPEES.

2. Continuing Geography teacher in service of geotechnologies: didactic perspectives for Cartography teaching

In conceiving teaching as a social and political commitment to the scientific and human formation of children, young people, adolescents and adults in school age, the exercise of teaching reveals itself as a constant investigative process, in view of the theoretical and epistemological foundations related to the science of performance in the school space.

The research is an essential premise for the development of didactic actions worked from the knowledge of what is cartographic science, the role of maps, globe, plants and, more recently, geotechnologies and the social relevance of this science. The preparation for the exercise of teaching does not end in the degree course, since continuing education enables critical-reflective thinking to be expanded with regard to didactic-pedagogical procedures, as well as the geographic science in dialogue with classroom experiences.

Within this scope, the continuing education of teachers Geographyshows itself as a way to promote cartographic activities using free geotechnologies to work, respectively, contents and geographic concepts such as, for example, Population, Urbanization, Socio-environmental problems whose starting and ending point is the place of living of the students. According to Imbernón (2010), these places allow to create news perspectives for classroom practices, by encouraging creativity, freedom and awareness about the pedagogical work of these education professionals.

This reading shows how important continuing education is for teachers' professional development. In this sense, Pimenta (2012) considers it an indispensable contribution to create conditions for the development of a technical and didactic teaching and learning process according to the sociocultural context of each class within the same school environment. It highlights that being and doing teacher is a permanent process of learning, actions and reflections on their teaching practices based always on the unity theory-practice.

One of the questions of many Geography teachers in public schools in Brazil is the absence of political-administrative maps, as well as thematic maps updated in schools on a large scale, i.e., different spatial clippings related to students living place.

Working with the geographic concept of place, through teaching strategies mediated by the teacher, favors the understanding of a dialectical and contradictory process of geographic space production resulting from the differentiated actions of men on their places of living (SANTOS, 2009). It means to mobilize the awareness of the spaces of "living" to understand dialectically the world around, whose participation of students in cartographic activities becomes the fundamental element.

Research around the teacher training in geospatial technologies conducted and Hong (2012) point out that educators were well receptive to these mapping resources and consider important to implement and use in their classes. These technologies, the current maps allow users to observe, to modify, and to analyze data and special information going beyond "where?", identify the geographical distribution of phenomena and their relations of occurrences (MILSON; KERSKI; DEMIRCI, 2012)

It is essential that teachers have knowledge on their initial training in Cartography and courses are offered throughout the exercise of teaching involving Geotechnologies and their applications in school, so that they can develop cartographic materials with contemporary resources to students. As far as the teacher has more opportunities to expand and build scientific knowledge, their practices in the classroom become more significant and productive.

This means building educational materials and new teaching strategies with orbital images and maps produced in GIS favoring students to build a geographical look from the integration of physical and socio-environmental data and updated places in correlation with other scales. It means favouring a redimensioning of the cartographic work in the classroom, opening up new possibilities for implementing mapping technologies in Primary II as teaching tools that mobilise a geographical look at the world.

In the 4th definitive and approved version of the Common National Curricular Base (BNCC) concerning Geography brings valuable contributions about the competencies to be achieved by the student at the end of the Elementary School II using the "[...] geotechnologies to solve problems that involve geographic information" (BRASIL, 2017, p.364). These directives officially support the insertion of mapping technologies in Geography classes as teaching resources.

In search of a dialogue between School Cartography, geotechnologies and a didactic in the teaching of

Geography about the conduction of a protagonist, mediator, autonomous and provider educational practice of the students' geographic thought.

3. Methodological path: pedagogical action research applied to Geography teachers in exercise

To develop didactic actions with the use of geotechnologies from the continuing education of Geography teachers, this study appropriated the methodology of Pedagogical Research-Action (PAPe), developed by Franco (2016b) seeking to value the educators, stimulate reflections of their classes and, consequently produce cartographic materials. With that there are other possibilities to perform educational practices in Cartography teaching, especially related to social and cultural reality and cognitive structures of students facilitating the study of local space.

We opted for a methodology focused on valuing teachers as authors and producers of their maps in the classroom. In this way, teachers can overcome the condition of reproducers of cartographic activities dictated by experts who, in most cases, do not know the school context and student's everyday reality. As an example we have the map of Brazil, map of Brazilian regions, map of population distribution in small scale present in textbooks, school atlases and, still, are worked through photocopies.

The adoption of the PAPe in this research, fruit of a doctoral thesis, consisted in the offer of a continuing education course for Geography teachers named GEOPEES (Geotechnologies as instruments to think the geographic space) that comprised the realization of workshops using Google Earth Pro, Google My Maps and QGIS. As a result of the involvement and participation of these educators, these subjects developed a classroom practice with one of these mapping resources at the end of 2016; in the following school year, they were monitored during a bimester, so that it could be understood whether they effectively appropriated these technologies in their educational actions.

3.1. Geopees (Geotechnologies as instruments to think the geographic space)

GEOPEES is an extension course offered by Proex/Unesp Rio Claro with support from the Municipal Education Secretary of São Gonçalo with an hour load of 120 hours: forty hours held at CREFCON (Reference Center for Education and Continuing Education (CREFCON) - Mayor Hairson Monteiro dos Santos, an agency linked to the city hall as shown in Figure 1.

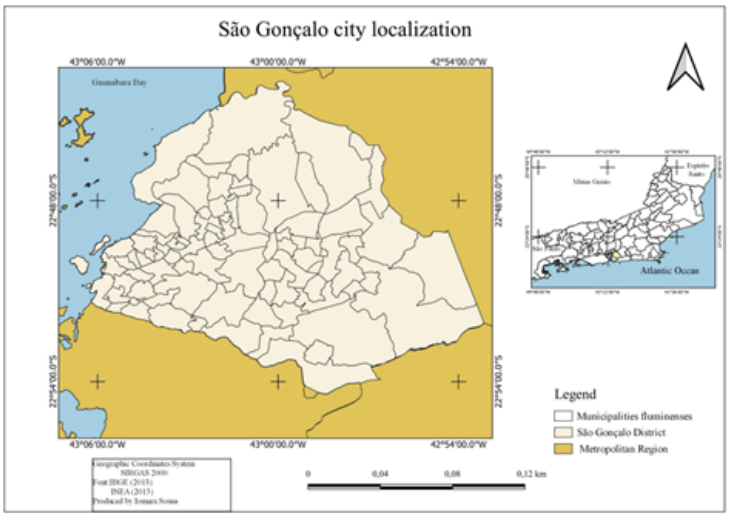

Figure 1. Margin settings for A4 size paper

The course was developed in two axes: face-to-face (10 meetings lasting four hours) and distance (80

hours), which included readings of articles and academic texts, workshops, preparation and application of a cartographic activity in the classroom involving Google Earth Pro, Google My Maps and QGIS, and also an experience report between 3 to 5 pages; in addition, the course was divided into six as shown in Table 1:

Module	Hourly load	Proposal
I. Use of Information and Communication Technologies (ICTs) in the Teaching of Geography	6 hours: 4 face-to-face and 2 distance	Familiarization with videos, smartphone, computer and internet
II. Basic Notonas of Cartography	12 hours: 8 face-to-face and 4 distance	Notions of Basic Cartography
III. Basics of Remote Sensing	20 hours: 12 face-to-Face and 8 distance	Concepts and basic principles of Remote Sensing
IV. Basics of Geographic Information System	22 hours: 14face-to-Face and 8 distance learning	Use of QGIS 2. 12 for mapping
V. Applications of Geotechnologies in Geography classes in Elementary School	9 hours: 1 face-to-face and 8 distance	Guidelines for developing a cartographic activity using QGIS 2.12
VI: Classroom practice	51 hours: 1 face-to-face and 50 distance	Preparation and application of one of the geotechnologies worked on in class. Preparation of a experience report

Table 1. Margin settings for A4 size paper

GEOPEES was developed and applied according to the questions, needs and interests of the 6th to 9th grade Geography teachers of the São Gonçalo/RJ municipal network regarding Cartography teaching. The objective was to enable the expansion of knowledge of these Geography educators and, consequently, the learning of basic notions of Remote Sensing and GIS, as presented in Figure 2.

Figure 2. Teachers at GEOPEES course

To conclued the course, they made a cartographic material about the student's spatiality by using geotechnologies to later, they were able to applied at the classroom in the last two months in 2016 school year. As part of the methodology PAPe appropriate of this study, teachers' classes were observed one year after at the end of the GEOPEES to effectively identify the contributions, difficulties and conceptions of them about the use of geotechnologies applied to Cartography teaching on yours teaching practices.

4. Cartographic activities applied in Geography classes in Elementary School by participantes of GEOPEES

The teaching profession is continuous, incomplete and always ongoing revealing the importance of awareness and development of activities, from the identification and resolution of problems involving the students' daily lives.
In search of a dialogue between Geographic Education, Cartography Teaching, geotechnologies and didactics with sense and meaning for the school subjects (teachers and students), this subchapter presents the didactic applications with the use of geotechnologies of four (4) graduates of the course dialoguing with the experience report produced by each of them.
Professor A addressed the "Socio-spatial transformations of the Santa Isabel neighborhood between 2003-2016". The teacher did one cartographic activity with two maps made from sheet of tracing paper by using a stereoscopic anaglyph based on a pair of orbital images from the program Google Earth Pro pair referring to 2003 and 2016. The proposal was to represent cartographically the socio-environmental changes have been occurring where the school is located as shown in Figure 3.

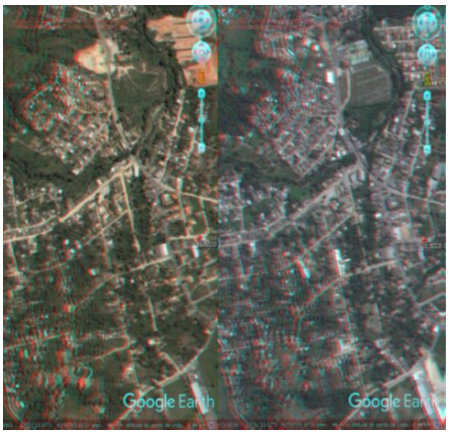

Figure 3. Material cartographic made by Profesor A

The student was be able to locate and to analyze the geographic objects like as vegetation, buildings and river guided by teacher, wrote in the blackboard and showed in the stereo pair as an anaglyph as shown in Figura 4. The map showed that the use of orbital images makes it possible to locate and analyze cartographically the objects in third dimension, despite some "[...] difficulties showed to student graphics representations, which require abstraction to understand the symbology used, as well as correspondence with the real space" (ALMEIDA; PASSINI, 2005, p.39).

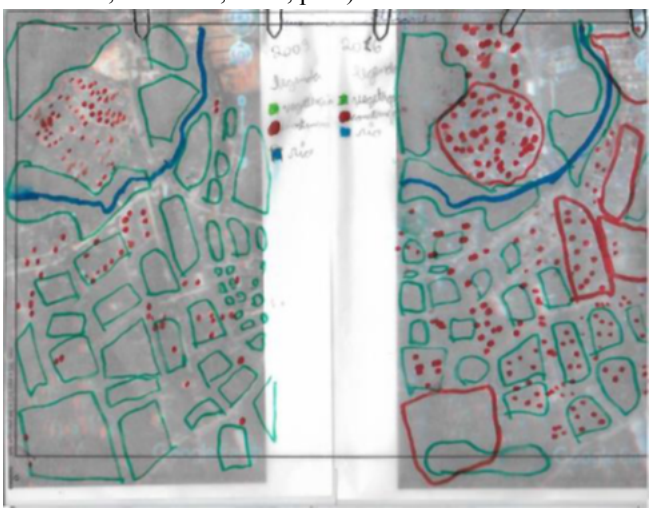

Figure 4. Map made by one student

Despite to difficulties by using symbology, the student interpreted the reduction of vegetation due to the increase in the urban area in 2016 showed with smaller polygons on the map in 2016 compared to map reffered to 2003; also represented the increase urban area, the reduction of river sinuosity, among other factors, like as siltation, as shown in Figure 4.

However, the PAPe methodology shows as this teacher has been reproductivist about your practices, because the task did not shows be creatived, considering the Module III. In this sense, Franco (2013, p. 00271) emphasises that consider the view of many teachers about continuing education is necessary: "[...] some researches, others apply, teachers have built positions of applicators of the knowledge constructed".

If a teacher want to be the author of your didactics materials it is necessary to reflect about their didactic actions. Observations made during the classes weren´t identify any activity with geotechnology in digital mode or analogic.

Professor C used GIS, more specifically, the QGIS 2.12.2, in module IV of GEOPEES to prepare didatic material, notably map print in which contemplated Alcântara neighborhood though the OpenStreetMap as shown in Figure 5.

Figure 5. Material cartographic made by Profesor C

The task was named "Economic activities: the tertiary sector in the Alcântara neighborhood", developed according to Geography Curriculum from São Gonçalo Municipal Network as shown in Figure 6. The concepts of geographic space and place were taken part of this cartographic and the choice was not

limited to the content "Globalization" of the 9th grade class, but a proposal about the students' living space joint to the content developed in the 6th grade class called "Economic Activities" (SÃO GONÇALO, 2008).

Figure 6. Map made by one student

The students were guided to make a legend, an essential element to communicate the message a thematic map. In this case, the tertiary sector was represented by using cartographic conventions.
The student made a legend according to the proposal wrote on the blackboard by the teacher. Pictorial symbols (church, bank and clothing shop), punctual symbols (school) and random symbols (pharmacy, natural products and multinational corporations) were used. The objects that takes parts of tertiary sector were inserted (church, multinational, school, bank, pharmacy, clothing store and natural products store). However the student putted the symbol design and the textual description on the map including others objects that are on their everyday lives.
It was observed that the symbols and cartographic conventions became confused, which hindered the cartographic communication of the objects belonging to
the tertiary sector, because the student reproduced in the map both the symbol and the identifying text related to it. Although the student was in the 9th grade, this situation reveals that the notion of the real function of a map legend was not properly worked in the Elementary School I, because the symbology used in the map should have presented the relationship between the signifier (map) and the meaning (legend) allowing its decoding (PASSINI, 2012). The Professor D degreed in History so its explain the reason his classes didn´t observed.
The didactic problem in this research about teaching with maps by geotecnologies shows the meaning of initial training in Geography compromised the cartographic reading and interpretation at the classroom. However, continuing teaching in service becomes aware of the relevance to construct new knowledges e to rethink theirs practices;
In general, the participants of GEOPEES encouraged the development of cartographic activities using mapping technologies and to become subjects of their teaching practices to develop their own teaching didactics materials. It is one of reasons to understand the familiar places to students, often become unnoticed in their daily activities.
In this scope, geotechnologies practices in the teaching of cartography, showed that teachers - despite the difficulties about basic notions of Cartography - appropriated geotechnologies in analogical environment from the infrastructure conditions of public schools in the São Gonçalo, ended up discouraging the use of geotechnologies.

5. Final considerations

The use of QGIS and printed orbital images obtained from Google Earth in Cartography teaching showed increase student by maps. As an example, there are specific thematics abording students lives, such as "Socio-spatial perception of the cartographic activity with geotechnologies, in order to promote new perspectives for Geographic Education in classes from 6th to 9th grade class.
The Research-Pedagogical Action (PAPe) was used to instigate these educators to think about changes in their classes. Thus, it is possible to become researchers awareness to develop a critical position and

promote problematizing activities whose starting and ending point is the reality of the students.
It was found that teachers used orbital images and map in QGIS in their classrooms, although these geotechnologies have been developed in modules III and IV of this course.
The fact that the teacher was not creative with the use of geotechnologies in his didactic practices showed that he was willing to work with Remote Sensing and/or GIS in the classroom during the GEOPEES evaluative activity. However, he did gsin ated the exercise with the stereoscopic pairs. Why didn't he do it? An admissible answer lies in the principle of the PAPe methodology, as changes in teacher practices are not immediate: it is important that, after the course, teachers become awaress of resources in their teaching actions and not just comply with a course evaluation.
An admissible answer lies in the very principle of the PAPe, because the changes in the teacher's practices are not immediate: it is important that, after the course, the teacher becomes aware of the use of these resources in their teaching practices and is not limited only to comply with a course evaluation.
This shows that participation in continuing teaching meant ways to think about the authorship and construction of the act of teaching with the use of geotechnologies to mediate the construction of geographic knowledge, thus contributing to the formation of citizenship of children, youth and adolescents in school age.

Acknowledgements

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The construction of geographical concepts by observing landscapes: when deaf students redefine the legend of map

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Keywords: deaf student, signal language, inclusive cartography, geographic reasoning, atlas

Abstract: The teaching of Geography in inclusive high schools in the Federal District (DF) uses cartographic language to develop the geographical concepts necessary to understand reality. However, in order to promote the proper learning, it requires appropriate adaptations for the needs of students with disabilities that are present in class. These adaptations are based on the principles of an inclusive cartography centred on the user, which gives him the possibility of creating and adjusting his own map.

During the discussion of connections between local and world spaces in a Geography class in 2019, an opportunity emerged to create an adaptation of the map, made by and for deaf students. Studies on the characterization of Administrative Regions (RAs), territorial areas of the DF that have different spatial configurations (local space), were carried out using the Historical and Cultural School Atlas of DF and were represented by coloured polygons without the captions in sign language. The students encountered difficulties to understand these symbols and, on their own initiative, prepared a proposal to adapt them.

The present article describes this proposal and adaptation carried out by two deaf students, an important initiative for the understanding of geographical concepts.

Deaf students use sign language as a communicative mediation. However, it often does not offer specific and standardized signs for different areas of knowledge. Thus, it is necessary to set new meanings in the discursive exchanges of existing signs or to create new ones with the purpose of establishing learning concepts. The signs are equivalent to the words and, in our case, the words represent the names of the RAs.

In this way, the students associated the name of RAs to a well-known characteristic of the location, whether through landscape research, photos on the internet and personal experiences at the city, or even associating it with objects of the same name, observing its morphological characteristics. (Example: the movement of the hand s that represent the fern plant represents the RA 12 Samambaia/fern). Some were created either in an arbitrary way or representing the initials of the name of the city.

As a result, the signs that represented the names of the RAs were culturally produced b y these students, with the help of classmates and the teacher interpreter, and attached to the map as a caption in sign language. In total, there were 31 cards that presented the image of the student making the movements, along with the description of the hand and movement configuration, which describe the signs. These cards were digitized and shared with other deaf students.

At the end of the work, the students pointed out the importance of this material adapted for deaf students. They realized that this exercise expanded the knowledge of the RAs in the application of geographic reasoning and allowed the understanding of the DF territory by developing the principles of analogy, connection, differentiation, distribution, extension, location, order of these spatial elements. They also learned about the temporal evolution of land occupations in the Federal District, punctuating the emergence of the RAs and their hierarchy according to the date of their creation.

Session 2

The Geography Teacher and Inclusive Cartography in Basic Education

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Keywords: continuing education, people with disabilities, inclusive classes

Abstract:

Has the Geography teacher facility or difficult to teach Cartography in Basic Education? How is Cartography taught? What teaching materials are used? These, among other questions, were brought to the classroom, during the Research on Geography Teacher Practice, in the public school system in the cities of Araguari, Campo Florido, Prata, Uberaba, and Uberlândia, in the state of Minas Gerais. Brazil.

To obtain these answers, it was necessary to go to the school and listen to the teacher, ask him how his initial and continuing education was going, what methodologies he was most interested in or available for use, his daily school life as a professional and, especially, how his practice as a geography teacher, and how he perceived the teaching and learning of Cartography. From these first questions, the research was carried out on the teaching of Geography in the context of the Triângulo Mineiro (SAMPAIO; SAMPAIO, 2018).

A questionnaire was carried out in order to know the reality of the Geography teacher in aspects such as their initial and continuing education, their professional career, and their practice in the classroom.

Some of the proposed questions were: if the teacher had a full degree, which materials were most used in their daily lives, which Geography contents were easier or more difficult to teach, for example, the themes of Human Geography and Physical Geography, or even from Geopolitics, Environmental Education or Cartography.

One of the hypotheses that stimulated the research was the possible difficulty of the teacher in teaching the contents of Cartography, which was confirmed by the data collected among 113 professors.

This research was not concerned with the issue of people with disabilities, however, from it, we can make interesting inferences: first, for the Geography teacher to feel more secure in teaching Cartography, in general, he needs to have more training in the area, and if Cartography is to be inclusive, then the training needs to be expanded and even more specific, in such a way that it can really meet the different needs, whether of vision, hearing, touch, taste or smell. All the senses can collaborate so that there is an opportunity for learning.

In Basic Education, Cartography demands time and dedication on the part of the teacher, as the understanding of this content favors all analyzes carried out in Geography. And knowing Cartography is not only good for passing Geography, since it is a daily tool in the life of every citizen who wishes to move around the city, outside it or even reflect on where they live, what surrounds them, among many other possibilities. Thus, the training of this teacher needs to be increasingly safe and guaranteeing that he/she is open to planning classes that are more and more inclusive.

THE IMPORTANCE OF TACTILE CARTOGRAPHY IN CONSTRUCTION AND SPATIAL REPRESENTATION OF STUDENTS WITH LOW VISION IN REGULAR GEOGRAPHY TEACHING

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Abstract: In recent decades there has been growing discussions and researches about the inclusion of people with disabilities in various social areas, including school education itself. In this sense, the works in education defend the need to think about pedagogical policies and strategies that allow students with any type of disability to be included in the regular teaching-learning process. Thus, the objective of this study was to analyze the practical experiences of the development and application of tactile teaching materials, for visually impaired students from Middle School and High School, in geography classes at the "Professor Odilon Correa State School" in Rio Claro/ SP. The research methodology adopted was qualitative, and focused on the construction and representation of basic concepts of cartography, such as orientation and spatial representation. The didactic materials used in the pedagogical practices were made or adapted following the parameters of tactile cartography and contained maps, models, globes and tactile games, which could be explored by both visually impaired and sighted students, thus making knowledge interesting, dynamic and accessible to everyone. As a result, the effectiveness of tactile materials for teaching geography at school was verified, as well as the methodological procedures and didactic sequences used throughout the classes. The students managed to achieve the proposed objectives and the classes contributed to the learning of cartographic content, not only for those with visual impairments, but also for the other sighted students.

Keywords: tactile cartography; low vision; inclusive education.

1. Introduction

This work was motivated by the interest and need to develop a practical study in the area of inclusive education, specifically in relation to the process of construction and spatial representation of students with visual impairment (VI) in regular geography education. Thus, from an initial research on the subject, it was identified that only after the Declaration of Human Rights (1948) and the International Conference of Salamanca, held in 1994 in Spain, some countries began to think about the inclusion of people with disabilities in all social spheres.

In Brazil, when dealing with an educational dimension, it appears that there is a series of public policies based on laws and guidelines that guide and guarantee access to quality education for all in an inclusive context, among them, the Law of Guidelines and Bases of National Education (Lei de Diretrizes e Bases da Educação Nacional) - 1996, the National Education Policy from the Perspective of Inclusive Education

(Política Nacional de Educação na Perspectiva da Educação Inclusiva) -2008 and the National Education Plan (Plano Nacional de Educação) - 2014.

According to Carvalho et al. (2005), the purpose of inclusive education is to equal opportunities, guaranteeing everyone - including people with disabilities and high abilities / gifted people, the right to learn how to learn, learn how to do, learn how to be and learn how to live together.

Based on this theme, we selected to work on this research with visual impairment in the classroom, from an inclusive education perspective, addressing the potential of tactile cartography in teaching geography for blind and low vision students. Thus, among the questions that arose to guide the research, we sought to understand: In geography classes, how can a visually impaired child assimilate the contents related to school cartography? In what way and with the help of what teaching materials can the teacher work so that these students develop the ability to read, interpret and represent the space?

Inserted in the context of Cartography, Tactile Cartography presents itself as an important branch, with recognized potential for inclusive education. According to Castreghini (2016); Escanilla and Silva (2019); Perkins (2002); Loch (2008) and other authors in this area, this little-known branch of cartographic science has been seeking to develop and adapt maps, models, globes and other spatial representation materials that assist in mobility, orientation and learning for people with visual impairments.

According to Loch et al. (2008), tactile cartography is concerned with making maps and other cartographic products that can be read by people who are blind or have low vision. In this way, tactile maps, the main products of tactile cartography, are graphic representations in texture and relief, which serve to guide and locate places and objects for people with visual impairments. They are also used for disseminating spatial information, that is, for teaching geography and history, allowing the visually impaired to broaden their perception of the world; therefore, they are valuable instruments for social inclusion.

It is also important to emphasize that the resources of tactile cartography are built according to the needs of each individual, that is, in the preparation of teaching materials for readers with low vision, it is customary to use mainly contrasting colors and enlarged textual fonts that facilitate viewing, while for blind people to read, it is important that cartographic products present a variety of textures and reliefs that can be felt through touch. In the latter case, attention should also be paid to the use of subtitles printed in Braille, which makes it possible to understand the texts and spatial orientations of the cartographic material.

2. Development of teaching practices using tactile cartography

From this context, we will present in this work the main results of the practical experiences of making and applying tactile teaching materials, in the process of learning the forms of cartographic representation, for visually impaired students from Middle School and High School, in geography classes from the "Professor Odilon Correa State School", located in Rio Claro/SP.

Given the above, the materials used in the teaching practices of this research were developed or adapted using the infrastructure of the Tactile Cartography Laboratory, located at the Center for Environmental Analysis and Planning (CEAPLA), at UNESP in Rio Claro. This laboratory was created from a university extension project called Tactile Cartography, where studies were carried out on the preparation and application of tactile teaching materials, offering assistance to the visually impaired public, either in conventional schools or in existing special support centers in the municipality.

After the first contact with the coordination of E.E Prof. Odilon Correa, it was possible to identify the existence of two students with low vision, regularly enrolled in the school, one of them from the 6th year of Middle School, and the other from the 1st year of High School. In this initial conversation, we also met the geography teacher who teaches the subject to the respective classes, who told us a little about the difficulties in developing inclusive pedagogical practices for the visually impaired public. Based on this observation, the proposal for a work with tactile cartography was presented and the teacher allowed the application of teaching materials to be held with the students during classes, according to their needs.

For the development of geography classes in the 6th year of middle school and 1st year of high school, it was first necessary to identify the main difficulties in understanding the curricular contents related to spatial perception and representation. Thus, we found that the two students, although they were in different schooling cycles, had similar problems regarding the understanding of spatial representations.

Therefore, it was planned to work over six geography classes, with regular classes, on the basic foundations of school cartography, seeking to present the contents related to different forms of spatial representation, from the notions of orientation, scale and geographic coordinates . In the first classes,

there was an initial questioning about what the students understood by cartography. Some students in the class expressed their opinions, stating that it was about studying maps. Then, through the students' response, the concept of cartography was introduced as a science, technique and the art of graphical representation of the earth's surface.

From this explanation to all students in the class (low vision and sighted students), some thematic tactile maps were presented and they were intrigued by the way the elements were represented.

The first material was the "Tactile Map of the Municipality of Rio Claro - SP" (figure 1), in which students were able to analyze the size of the urban area of the city in relation to the rural area, in addition to the area of a conservation unit, the Edmundo Navarro de Andrade State Forest named (FEENA). Subsequently, elements such as railways (represented with yellow string), highways (dashed with 3D colored glue, in black) and neighboring municipalities (all labeled in Braille) were identified.

Figure 1: "Tactile Map of the Municipality of Rio Claro –SP"

Next, the students analyzed the "Mapa Mundi" (figure 2), in which they immediately realized that it had a much smaller scale when compared to the previous map of the city of Rio Claro. The World Map is also made up of elements labeled in Braille and with very different textures such as, Ethylene Vinyl Acetate (EVA), cork, corrugated paper and velvet, used to represent the continents of the globe, the tropics of Cancer and Capricorn, as well as the line of the equator that separates the Northern and Southern hemispheres.

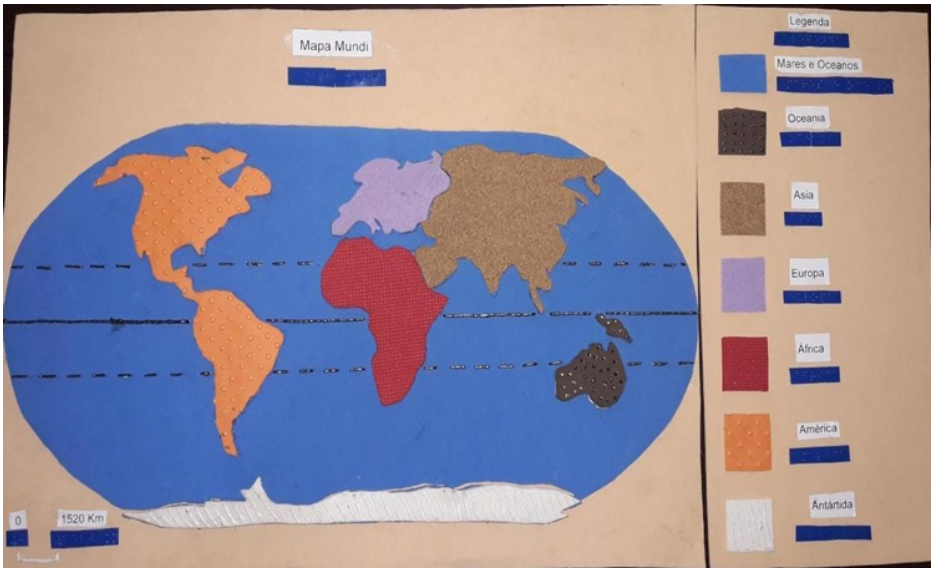

Figure 2: "Tactile World Map"

At a certain point in class, students were asked about the importance of spatial orientation; on this occasion, students with low vision mentioned everyday examples of the need to orient themselves in space. At the same time, some tools were discussed, which throughout history have helped man in spatial orientation, such as the compass at the time of the Great Navigations, and nowadays, the GNSS (Global Navigation Satellite System), highlighting the GPS (Positioning System Global), present in vehicles and also in mobile device applications.

Still within this theme, students learned/recalled about the wind rose, one of the main elements of spatial orientation, present in maps and other cartographic representations. Then, there was an exhibition of the teaching material "Compass Rose" (figure 3), which shows the position of the cardinal, collateral and sub collateral points.

With the presentation of the wind rose, the students asked how it would be possible to orient themselves in space without the aid of any technological resource (such as cell phones and GPS, for example). From this question, it was explained to the students in a playful way, that in the past people watched the stars and the positioning of the sun in relation to their bodies, to orient themselves in space. Regarding the Sun position, they had to identify the apparent movement from the "position in which the sun rises and sets". That way, the students could assimilate that pointing their right arm in the direction where the sun rises and their left arm in the direction where the sun goes down, they would find East and West; in front of them, they would locate the North and behind them, the South.

Finally, in the last classes, the students were divided into small groups of three or four members, to experience in practice the making of their own tactile cartographic product. Thus, using materials previously selected by the teacher, each group built and adapted their compass rose, according to the guidelines of the tactile cartography that had been worked on during all the classes.

Figure 3: Compass Rose made by one of the student groups

After completing the didactic practices with the use of tactile cartography, it was possible to conclude that the pedagogical work developed by the geography teacher, in contact with the visually impaired child/adolescent, should aim at their inclusion, preferably with the class to which they belong, so that they can participate in the learning process through socialization with other sighted students. This practice must occur with adapted teaching materials, which enable effective access to systematized knowledge.

3. Conclusions

At the end of the geography classes with the 6th year of Middle School and 1st year of High School, it was found that although few classes were given, both low vision and sighted students managed to complete the school cartography contents programmed, reaching the expected expectations.

According to the objective of the work proposal, we concluded that the development of inclusive teaching practices, mediated by the use of tactile cartographic materials, allowed students with visual impairments to broaden their knowledge about the basic principles of cartography. Through the analysis and comparison of the map of the city of Rio Claro/SP with the World Map, the students understood the relations of proportion and, therefore, the scale of the spatial representations. It is also important to mention that the activities developed from the compass rose great interest in students, which led to its wide use in classroom practices.

To conclude, we emphasize that in the geography classes taught for Middle School and High School, where the contents of orientation and spatial representation were worked on from tactile cartography methods, the groups managed to achieve the desired goals and the classes contributed to the learning process, not only for students with low vision, but also for the other sighted students.

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TACTILE CARTOGRAPHY WITH CHILDREN AT THE BENJAMIN CONSTANT INSTITUTE

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Keywords: Cartographic Literacy, Tactile Maps, Childhood Geography

Abstract: This work presents an excerpt from the doctoral research entitled: "I want the wind to take us there... to another country": (E) Winds and meetings with children at the Benjamin Constant Institute, where the Geography discipline dialogued with the process of building a cartographic literacy with blind and multipledisabled children in a first-year class of elementary school at the Benjamin Constant Institute (IBC), a school specialized in teaching visually impaired children and young people, with over 167 years of age existence and located in the city of Rio de Janeiro, Brazil, in 2019. The development of the work included a set of meetings with children and with the presence of adults, in which we redefined our geographical making based on collective and collaborative. The meetings were held throughout 2019, and the final result of the research was the construction of a tactile book entitled "The windy friends". In this book, two tactile world maps of the continents were inserted from the story, but, so that children could understand what maps are, the tactile globes existing at the IBC were presented so that they could learn about cartography, the maps. The first tactile globe the children knew when they were producing the pages of the book. At the beginning it was explained what a tactile map is and how it is used by people with visual impairments, it was also explained how the map was made and the size of planet Earth.


Figures 1 and 2: children and tactile maps.

I speak to the children: Let me explain to you, the Earth, it is round. Enzo: - The Earth is very small. I answer: - No, it had to be small to put it in the book, but, in reality, it is much bigger. After everyone finished the page with the world map, I introduced them to the tactile globe that exists at the IBC. This moment of the meeting was the first time that the children were getting to know a tactile globe and getting information about planet Earth, something very new for them. I explain: - I brought this tactile globe for you to understand that the planet where we live is round. The boys touch the globe, but Agatha doesn't accept this move.


Figures 3 and 4: Tactile globe

Then I took the children to the Geography room, I present to them the big tactile globe with the continents and oceans. I explain: - Do you know the maps we put in your tactile book? Aunt Lu Arruda had to reduce. I had to make the planet very small to fit in the pages of the book, but for you to understand what our planet is like, Aunt Lu had to take a tactile terrestrial globe to the classroom. The globe is how we show the way our planet is. This globe here (the kids are touching it) is bigger than what was brought into the classroom.


Figures 5 and 6: the Geography room

This research opens the way for new possibilities of geographic languages that escape the traditional ones, as children were co-authors of their constructions. The discovery of the Geography of children and their childhoods took place in their encounter with this new, which was geographic information, the discovery of new words, stories, new encounters in the construction of other stories and, of course, in the resignification of life, in the day-to-day at the institute, on the way to the Geography room, discovering new places, new spaces and new landscapes at the IBC. The beginning of a cartographic literacy that can offer information so that a cartography can be built WITH blind and multiple handicapped children and that tactile maps are present in their spatial experiences.

Cartography as an inclusive school activity.

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Keywords: Read maps, Inclusion, School Geography.

Abstract: In Brazil, in several situations, school geography is seen as a "science of maps", in others there is a kind of negligence of some teachers in enabling students to read maps. But reading maps today seems to be an essential skill and as such deserves special attention in schools, rather than as a "tool for understanding" geography, which is perceived as a tool for "understanding the world" around us, forming the perception of occupation and use of space that maps allow to see. Even more powerful than this, cartography taken seriously in Basic Education classrooms can be a didactic aid for the inclusion of students with disabilities in the common classroom.

Keywords: Read maps, Inclusion, School Geography.

The map speaks through the barrier of language.

(SAUER)

If we look carefully at the role of maps, in the most diverse situations they may be in, we easily accept their classification as a "language", rather than as a tool (as it is usually put). It is on this topic that I would like to raise the status of maps in schools and in every educational situation, whether with the intention of teaching looks, perceptions and creations, or the possibility of including/gathering people, whatever their way of being or communicating in the world, but being able to belong equally with other people. The concept of 'inclusive education' in Brazil has undergone transformations throughout history, with an important political milestone, contemporary with the writing of this text, considering the government's segregationist determination, the "regulatory framework for inclusive education" has been read by the families of people with disability (victims of a capacity rooted in human cultures for millennia) as a major setback to the hard-won rights of social belonging, in a constant struggle for acceptance in the daily lives of such a large and diverse country.

Taking a path in this text that begins by thinking of the school as the locus of learning like cartography, goes through understanding how the 'cartographic language' can be the educational element that can best express different aspects of spatial learning, but also a sense of location and self-location. We see an important observation in the thesis of Professor Antônio Carlos Freire Sampaio, when he says:

> Since the 1970s, Geography, as a science, has seen the growth of theoretical approaches in its production of knowledge. In parallel, the renewal of geographic education and the very needs of Geography, gave Cartography, worked in Geography, a status of great importance for the various geographic applications. New works will continue to appear in the certainty that the subject is not exhausted (...) [and that we are able to go] towards improving the points studied to, logically, improve the training of the future Geography teacher in terms of knowledge of Cartography. (SAMPAIO, 2006 p.237)

And also here, inspired by this interest in contributing, we hope that not only with the debate on themes that encompass school cartography, but mainly it is expected to be help in the daily lives of classrooms, in the teacher training of those who go, not only for through Geography, but going beyond its borders to assume educational responsibility for human beings in formation. Showing them the power of reading the world, of effective, powerful and sometimes even dangerous language, but at times shedding light on

neglected spaces of human society. Thus, returning to school, and bringing the map and its potential to it, the following words contribute to our reflections:

> Innovations in school environments bring positive consequences to the teaching and learning processes and this would be enough to justify the insertion of new resources in classes, after all "the advance of science and technology corresponds to the cognitive advances of the population and their research strategies" (Almeida and Fonseca Júnior, 2000). (...) the study of cartography helps not only in understanding maps, but also in developing the ability to represent and interpret geographic space. "Through this language it is possible to synthesize information, express knowledge, study situations, among other things – always involving the idea of space production: its organization and distribution" (Brasil, 1999). Today, cartography seeks to meet the various branches of human activity, aiming to generate products in the shortest possible time and with increasing precision. For this, it relies on the help of modern technologies such as remote sensing, GPS (Global Positioning System) and GIS (Geographic Information Systems), which make it possible to insert dynamism in the manipulation and representation of cartographic data. (DI MAIO et al., 2009. p.2398)

So it seems that if we are in tune with technological innovations, which (through commercial relationships, require the development of 'mapping/locating technology') will always be in line with the greatest human innovations of the moment, and returning to our privileged locus which is the school , we found another medium where the more the teacher is in tune with such innovations, the more he will be able to connect effectively with the students and the more potential educator he will have in his hands. In this sense, the view of the author mentioned below on maps is especially interesting because it takes us here to the tactile map, an inclusive modality par excellence in cartography, because it was born not to "sell a mountainous terrain", but to allow people with disabilities visual reading some certain represented hypsometric territoriality:

> The concept of geographic space as the set of objects and actions that reveals social practices of different groups that live in a given place, interacting, fighting, dreaming, producing and (re)constructing their living space continuously, as Milton Santos indicated throughout his extensive and important work. (...) Thus, the cartographic document is the realization of the reality that now presents itself, synthesizing the intertwined network of factors that compose and help explain the geographic dynamics (...) Thus, cartography is simultaneously considered a science, an art and a technique, with the objective of representing the organization of space through maps, "(...) which result from a series of operations that are part of a defined field of human activity: Cartography" (DUARTE, 2002, p. 15). Tactile Cartography is the specific area of Cartography dedicated to methodological development, the production of teaching material for the transmission of geographical concepts, the environment and life in society, as well as its application in class for blind and low vision students, for which the "tactile maps" (ALMEIDA and LOCH, 2006, p. 03), that is, graphic representations in texture and relief that serve for orientation and location of places and geographic phenomena. (CAMPOS, 2012. p.166 and 167)

It is still important to add to this the idea of the Universal Design for Learning (UDL) which, more than teaching some students with some communication limitation, seeks to create pedagogical preparation so that any learning situation is able to receive any special condition of absorption in the student universe. And in this regard, Professor Sampaio, Professor Adriany de Melo Ávila Sampaio and other authors make an important observation in the excerpt:

> Problems related to teaching in Basic Education can be reported, not only in terms of the themes taught in Geography, as in the case of Cartography, but also in teaching-learning cases, where in a classroom we can find a diversity of students with characteristics learning cognitives differentiated from each other. In this case, the idea of inclusive education comes in, where students with some type of disability cannot be excluded from education but included, that is, that any barrier that may prevent the participation of anyone with any kind of limitation is eliminated. . How to teach a subject in the classroom where there are students who need special education? Would it be correct to separate them into different rooms according to each student's disability? And Geography teachers! Are you following the State of the Art in the development of the Geography discipline, especially those themes that rely on information technology, for the proper performance of their teaching activities? (SAMPAIO et al, 2011., p.3)

The questions that end the excerpt brought here to elucidate our reasoning: of "looking at the map as an inclusive element in the reality of the classroom" are extremely important to draw attention to the importance of teacher education and highlight the already active teachers who consider the The diversity you will find in each classroom, paying attention to the unique learning of each one, is a potentiating element of the educating function, and finally, the following considerations are appropriate:

> There are currently dozens of programs on the market on a wide variety of topics that allow the student to participate in the construction of concepts, or even in the search for more information on the topic discussed in class. Future research should take tactile cartography into a broader field of inclusive cartography with maps reaching more people and being made available to all users, whether from a traditional tactile map made in collage or a virtual mobile map that uses services based on location or cloud computing that can also be accessed by voice command. All maps are relevant and they are a fundamental means of achieving perception and knowledge of space, communicating spatial information, navigating and learning geography. (DE SENA, 2018. p.121)

However, there is still a lot to develop in this regard, we know that maps are inclusive educational power and a powerful element of exercise and cognitive expansion, we also know that, despite accepting government impositions on the educational concept built as ideal in our social context, it can to be inclusive and give the right to social life to every human being born in this society, a certainty of belonging, recognition, valuing and enhancing the abilities of each one, recognizing and respecting human differences, in the collective, for better construction. it. It is in this logic that we will continue to follow, in the certainty that it can indeed build the foundations of a stronger society, directed towards some harmonious development possible for the human being.

*This epigraph was found in another epigraph, in the doctoral thesis of one dear professor. Sauer... would it be Carl Sauer, the American cultural geographer belonging to the Berkeley School in California? Well, even if it isn't, trying to find out who this guy is opened up another category of fascinating ideas about cartography... But the professor's quote came from (apud): MENEZES, A.. The cartography-geoecology interface in diagnostic and prognostic studies of landscape: a model for evaluating integrative analytical procedures. 2000. 271 p. Thesis (Doctorate in 2000) – Department of Geography. Institute of Geosciences, Federal University of Rio de Janeiro, Rio de Janeiro, RJ, 2000.

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Session 3

The use of scale models in augmented reality (AR) for the teaching of cartography

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Keywords: Augmented Reality, Geography, Education

Abstract: The discussion about technologies' applicability in the classroom has always been a very present agenda within teaching. Advances in communication, computing and science changed our way of thinking and interacting with the world, showing the need to consider the current technological context and keep up with these evolutions. For this reason, nowadays, it is possible to observe more and more the great emphasis of technologies in the educational scope as a whole. This paper aims to address the use of technologies as a support tool in the teaching of cartography, in particular the use of augmented reality (AR), which is one of the technologies that are transforming teaching practices. According to Billinghurst & Dunser (2012), AR facilitates understanding complex phenomena, by providing unique visual and interactive experiences that are able to combine real and virtual information, in addition to helping to communicate abstract problems to students. In this sense, AR is understood as the addition of virtual objects in real scenes through the screens of devices such as smartphones and tablets, in which students are able to visualize in practice the concepts seen in the classroom, eliminating the application of costly resources for this purpose, considering that such technology only requires the use of a mobile device and a marker.

Thus, it is possible to observe that AR can be a great artifice to teach content in a playful way, since according to Cardoso et al. (2014) the acquisition of knowledge becomes more efficient and enjoyable from the moment that its visualization becomes possible, i. e.: the theoretical is applied in a practical way, as in the learning process it is much simpler to understand the representation in a visual way than just trying to imagine the process. The immersion of students in this technology may reflect in motivation to learn the content, given the way it is presented to them.

Thinking about the teaching of cartography, an area that works a lot with the visualization and representation of space, AR can help to observe these processes in practice, as Garcia et al. (2017) point out that this technology can provide the recreation of the environment in virtual mode, especially locations that are far or difficult to access because often it is not possible to be physically present at the location and the use of AR would be very useful for this matter. Therefore, with the advantages of using this technology in the educational context, the creation of an application that allows the visualization of Gericinó-Mendanha massif's AR scale model through a QR code was thought, in which the user points the camera of his mobile device at the marker, that captures the image and transmits it to the RA software causing the virtual object to appear (Figure 1).

Figure 1. QR code for the scale model's visualization in augmented reality.

The Gericinó-Mendanha massif is part of one of the three groups of coastal massifs located in the Metropolitan Area of Rio de Janeiro State (MARJ), between the cities of Nova Iguaçu, Mesquita and Rio de Janeiro, with an area of approximately 7,972.40 hectares. According to Santos Junior and Costa (2017), the massif area is covered by an overlap of four environmentally protected areas: Gericinó-Mendanha Enviromental Protection Area (GMEPA), Serra do Mendanha Natural Municipal Park (SMNMP), Municipal Natural Park of Nova Iguaçu (MNPNI), and Mendanha State Park (MSP), units that ensure the protection of the local fauna and flora, the appreciation of the great scenic beauty of its natural landscape and the conservation of the geo-hydrological systems. Showing the importance of this enormous green area concentrated among the main municipalities in the state.

The development of the application had two phases: the first refers to the creation of a three-dimensional model of the study area using QGIS software and the second phase refers to the construction of the augmented reality scale model using this model within developers such as Unity together with Vuforia.

In the elaboration of the three-dimensional model of the Gericinó-Mendanha massif, the SRTM Plus (Shuttle Radar Topography Mission Plus - NASA) digital elevation model was used as a cartographic basis. This processing was carried out within QGIS 3.4, with the help of the Qgis2threejs plugin, which was responsible for applying the vertical exaggeration to the model with the value of 2.0. This complement generated a glTF file, which was converted to OBJ format, aiming at making cuts of the study area with the Meshmixer software and also transforming the three-dimensional model into a scale model in AR. In this case, to obtain the scale model in augmented reality, Vuforia was used, which is one of the most famous AR development platforms, and Unity, which served as editor and was the final step to transform the scale model into an application.

It was necessary to create a marker to serve as a target when viewing the scale model, so the QR code that was downloaded inside the Vuforia platform was adopted. Furthermore, this code was printed in order to facilitate the application's testing. With all these processes completed, the last step was to create a project in Unity, using a 3D configuration, requiring Vuforia to be activated on the platform. In a single scene, the QR code, the three-dimensional model of the Gericinó-Mendanha massif, the municipal boundaries surrounding this formation, and the buttons with information referring to each municipality were compiled. From that, the scene can be finalized and turned into an application within the Unity developer.

The augmented reality scale model has been converted to an application and is available on the Google Play digital distribution service via the link: https://play.google.com/store/apps/details?id=com.ThallytaFaperj.MendanhaRA. The application was named Mendanha RA and is available on the Android operating system free of charge, so that everyone has access to the material, serving as a tool to help in the teaching-learning process in a visual form. Another feature is the implementation of information about neighboring cities on the IBGE Cidades@ website, for this it is only necessary to click on the name of each city to obtain socioeconomic indicators that will be opened in an independent tab (Figure 2).

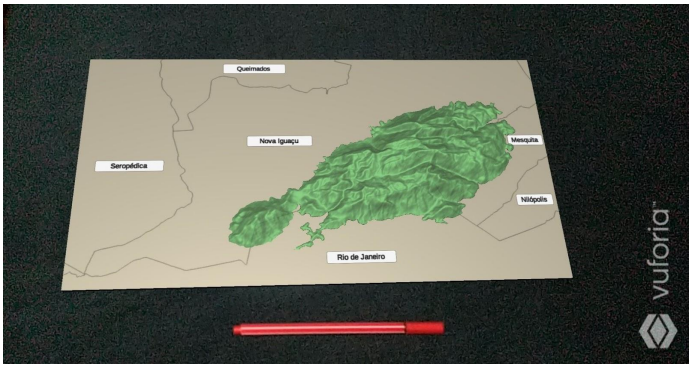

Figure 2. Scale model in augmented reality of the Gericinó-Mendanha massif

The construction of the Gericinó-Mendanha massif's scale model in augmented reality enabled greater familiarity with the location, facilitating the comprehension and visualization of the space, besides the possibility of working with interdisciplinarity, which makes teaching more interesting and effective. In addition, this application can be geared towards different ages, not being restricted to a specific age group or class. Creating a remarkable and attractive content that can reach different audiences, from kindergarten to university education.

Children's cartographic culture in the context of the pandemic

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Abstract: The objective of this work is to register the child protagonism in its cartographic cultural productions during the pandemic. In this way, this article, took as a basis of reflection a house located in a large Brazilian city, of a middle-class family, as a way to observe the experience of two children who live there during the process of social isolation. This house in question, became object of study, after all if we study the children inserted in the school space the light of the historical-cultural theory vigotskian. If we already study children inserted in a school environment based on the vigotskian theory, why don´t we try it with our children in our homes? To see what kind of new meaning this old environment, currently our children's classroom, can have. And so we did during this pandemic. The data collected for this research occurred are from the pandemic experiences in family, in the new school spaces that our homes have become, from the observation of the cultural production of maps between children and their grandparents at home and also in the inside the car. From the results of these children that were inserted in a cartographic culture, we can highlight four aspects observed: 1) the map speaks; 2) the map walks; 3) the map grows and shrinks; 4) the map is analog and digital.

Keywords: Child Protagonism. Cartographic culture. Children's authorship. Pandemic.

1. Introduction

For context, the pandemic started in March 2020 in Brazil, especially with researchers in the educational area, with the pandemic it meant that their contact with the school, teachers and children would be different, because if before we had the possibility of being face-to-face with all these, now everything is done by a screen.

The lack of contact with this group in school, potentiated something that before was already done by some teacher-researchers, being the closer look at children, being them in school, or not, we had, so the possibility to follow closely their growth, so much that this experience allowed the construction of a line of research to look the sense of the map in children's cartoons in several works (LOBATO and COLEHO, 2018; LOBATO, 2020; LOBATO *et al*, 2021).

That said, it is then realized that dimensions where mixed, the home, the school, the street and thus, these boundaries are broken by technology and imposed by the isolation. Considering also that not all families could go through the pandemic in the same way, since any historical process manifests itself very differently in space (SANTOS, 2003), and the Pandemic was no different.

Social isolation evidenced the brutal inequality of the world and especially of Brazil: structural unemployment, deficient housing, unequal access to technology, populations living on the streets and many other situations were made public with sanitary measures. For those who have the minimum structure to live in, the living room became school, a work and studies environment and many other enviroments too.

Thus, this article, took as a basis for reflection a house located in a large Brazilian city, of a middle-class family, as a way to observe the experience of two children who live there during the process of social isolation. This house in question became the object of study. After all, if we already study children inserted in a school environment based on the vigotskian theory, why don´t we try it with our children in our homes? To see what kind of new meaning this old environment, currently our children's classroom, can have and so we did in this pandemic.

This way, it can be observed throughout these months locked in this school that is in our homes, the children's cultural production from the perspective of a visual culture that we are inserted. Thus, the objective of this work is to register the child protagonism in their cartographic cultural productions during the pandemic.

2. Methodological paths

This study is inserted within the post-doctoral research that investigates the genesis of the cartographic way of thinking of children, their authorship and protagonism in their sociogenesis, which we consider to be inserted in a visual and cartographic culture.

The data collected for this research occurred during the pandemic experiences in family, in the new school spaces that our homes became, from the observation of the cultural production of maps between children and their grandparents at home and also in the itineraries inside the car. The new routines imposed by sanitary measures, decreed by the World Health Organization, changed the daily life of the world population, including the Brazilian. It was, in our living space, that we dedicated ourselves to look and to have a open mind for the children's experience and about their productions involving the cartographic knowledge.

The cartographic production took place with different types of resources, namely: A4 paper, colored pens, pencils and a smartphone with internet access for the cultural production of the mappings. Finally, we must point out that the maps used in this study have a time lapse of one year within the pandemic, being the analog map in the year 2020 and the digital map in 2021.

3. Experiences and mappings in the pandemic

"Dad, you can turn off your cell phone GPS.
I'll plug mine in and tell you the way home.
The map will tell me the arrows and I'll tell you, okay?
When it gets to "x" it's because we're home"
Catarina, 4 years old (2020)

"Dad, come see the houses I built.
I made several houses and can then see them all by that map.
Ah... looking at that mountain on the map made me want to make a house there"
Catarina, 5 years old (2021)

The first highlighted quote brings the speech of the same child[1] in two different moments during the pandemic. In the first, she talks to her father inside the car, for him to turn off the GPS that was used to view the traffic and the route home, justifying that she had a map that told the way, through arrows and also showed the final destination, represented by an "x", figure 01.

Figure 01: Catarina's GPS. **Source**: Author

The second quote, one year later, has this child also talking about her house constructions, figure 02, and how she can visualize this result by a digital map in a smartphone app and also brings clues of her using a map both in two-dimensional perspective and in a digital elevation model (DEM), figure 03.

[1] The children's names are real and we have authorization from both their parents.

Figure 02: Construction of houses by Catarina in the APP *Block Craft* 3D. **Source**: Author

Figure 03: Maps in 2D and 3D perspective. **Source**: Author

The enunciation of human life is made by the relationship that we establish with the elements present in the social world; this is the essence of the concept of experience forged by Vigotski (2010) and which has been one of the references of our investigations. Thus, the piece of paper became a living map for her (LOPES *et al*, 2016), since it was used both to find the candies in the home backyard, as well as to be used as a map in the city to find her house.

In this perspective, it goes beyond the experiential map that is stated by Lopes *et al* (2016), in which children create their own maps, but it is considered as a creative attitude towards this visual record. For Girardi (2007), map is information, it is born as information about the territory. Lopes and Mello (2017a) remind us that maps also create territories, apague as an element of language they forge the what exists. Wouldn't this child be using her map to take the information of the territory and create her own territory?

To address this topic, Lopes and Marisol (2017a; 2017b) extrapolated the matter of autonomy to think about the educational practices of students at school, working with the concept of children's authorship, presenting how children are able to bring their apprehensions of the lived space, but from a creative, imaginative and experiential perspective. In this regard, it´s assumed not only the children's authorial condition, but also in pointing out the impossibility of thinking the life of these students outside the geographic spaces and times of today (LOPES and MELLO, 2017a).

It is appropriate to remember Gomes (2017), when he points out that Geography is an autonomous and original way of thinking, it is seen that this child developed a whole geographic thinking around her map, without losing also the cartographic thinking, in which her visual language was guiding and translating this thinking. In view of this, it is inferred that the map is the materialization of the geographic thought itself, because as Vigotski (2007) pointed out, there is in the relation thought and speech, thought and language an affective-volitional action, which puts in unity the personal plane and the social plane, and one is in constant process of transformation of the other.

If Cartography has a visual language in the vehicle of communication, that is the map, and informs us the spatial references of someone including a historical time as well as geographic clippings that space. Then yes, we have the geographical thought transcribed by maps and at the same time the map is creating thoughts, just like Vygotsky reminded us. The relationship between the two is a potentially living process, a map does not die socially after its creation, as a cultural element, it becomes a social language and as language, it starts to have the same creative force that originated it.

This is the strength of Cartography and any other element present in the experiences: it is created in life, as a "microcosm" (Vigotski) of the human that poured it in the form of a drip, but at the same time, drips socially in the form of return. When a child creates a map, she is also creating the cartographic culture and creating itself in cartographic culture, becomes a maker of spatial records, just return to the maps already presenting, this was the great beauty of the legacy of the Cultural-Historical Theory: the certainty that we are not dead as subjects, but we are all potencies of living.
Therefore, we chose to speak of mapping/mappers instead of maps (final product), because we understand it as a continuous process, and according to Cosgrove (1999), it cannot be reduced to topographic and geodetic surveys, to precision measurements and material forms.
In this regard, Girardi says (2012):

> The concept "map" is used to refer to references (not necessarily fixed) with which people deal with the world, that is, how they territorialize themselves; but this world and these people change all the time, requiring that this map be remade all the time. Therefore, **the map is never ready, but is constantly being remade**, sometimes more slowly, sometimes more abruptly.

In view of the arguments presented, "if maps are only defined in terms of the precision measurement of longitude and latitude, this will reduce the act of mapping to a mathematical activity [...] and ignore the possibility that mapping could be a cultural activity" (SEEMANN, 2012, p. 70).
Unlike this perspective of a School Cartography focused on an agenda of technical education and memorization, we have at least four interesting facts that can be highlighted in the initial excerpts of the article: 1) the map speaks; 2) the map walks; 3) the map grows and shrinks; 4) the map is analog and digital. Theme that will be treated in the following topic.

4. The map talks, walks, grows and shrinks, is analog and digital.

Brown (2018), states that the production of maps is part of the human experience. We affirm that this map production is inserted in a cartographic sociogenesis and is much more widespread and practiced in current times. By observing Catarina's experience, we can see this experience since early childhood, through the production of maps in an analog environment, as well as in a digital environment.
In the experience of this child, the piece of paper that was in her hand, figure 01, was used by her grandfather to create a treasure map for Catarina and Helena to find the hidden candies, but it was also used to communicate the way to get home. That fragment of paper was a powerful instrument, a social artifact, which enunciated itself in small hands, a work of cartographic culture and set-in motion many lives in relation.
Having the smartphone in hand, Catarina first makes the following request: "*Dad, can you help me play this game?*" However, her father, having to make his home an academic environment, was busy and did not help at that moment. Moreover, it should also be noted that Catarina's father did not know how to play that particular game, a game similar to Minecraft, called Block Craft 3D, and said that when he had time, he would watch a tutorial on how to play the game.
The result was Catarina learning to play alone, building houses, visualizing maps and then teaching her father how to do it, because when he saw all this production asked her to do it again, but in front of him. It is not only a question of questioning if these authorships were from this child, but to want to see this child protagonism and the creative capacity of children, when inheriting a story from other generations, are able to act intensely in them.
To address the images drawn by children, we need to understand that the image is part of our life. They are elements that circulate in the social world and are part of everyday life, even in its inequality, of many children, because it is structured and systematized in social disputes throughout the civilizing process.
Thus, the image is an important element of cultural expression (QUEIROZ *et al*, 2021). As a cultural object of a communicational society, highlighting children, it should be emphasized that this production is performed by a social subject (KRAMER (1986). Who has a geo-historical dimension (LOPES, 2018); "has a history, who lives a geography, who belongs to a particular social class, who establishes defined relations according to its context of origin, who presents a language arising from these established social and cultural relations" (KRAMER, 1986, p.79).
In complement, this expression and authorial cultural production is dated, located and signed by these children, either with or without records for posterity. Children are not concerned with a "to come to be", this mark of modernity created by a social and capital project, which points to a redemption in a diffuse future, but in creating life in life that is happening, this for many can be read as a "child egocentrism", for us is part of an ethical choice of children to live in the world, arising from their singularities.

The map speaks, it is a drawing and is a cultural expression for Catarina. Being a drawing, she considers it as an image and in this regard, Queiroz *et al* (2021, p.13), points out "that the image is a sign that can refer to various meanings of the same object. If it brings signification is because it is communicating and speaking".

Before the grandfather's map was to find the hidden treasures, and after that, it became a car's GPS that was literally in motion and showing movements to get home, as Catarina enunciated: "when it reaches ***X*** it is because we got home".

Considering Girardi (2014, p. 90-91) "the maps being part of the set of human works to talk about the space and to present a place". In the light of the cultural-historical theory is necessary to complete: every cultural element is created and creator, this other unit inferred from the vigotskyan postulates, narrates the said, but also creates, the said and as subjects of languages we all are, because we are inherently present in this process.

And, every language, being so diverse with meanings, has an axiological and ideological value (VOLÓCHINOV, 2017), is always a mark of the narratives that have become hegemonic forces. We could ask ourselves: why many children's maps are often not considered maps, even tho they´re recognized by children as maps. Even when they are, they appear in a hierarchical timeline, as if the cartographic sociogenesis group was replicated by the humam phylogenesis of a certain group.

Having said that, based on the idea of Girardi (2014), it is understood that children's maps present, locate and orient the world, rather than. Simply representing a geometric space and with official rules. Since the child's communication is not based on these technical values of a mathematical modeling. Catarina found a new meaning to both the use of the map and the places he was presenting and not representing cartographically[2] her orientation, in the world within the backyard or in the world within the city, and so it can also be considered the idea that the map grows and shrinks. If before this geographical scale happened in the child's imagination, from another experience with the maps, but this time in a digital environment, mediated by a *smartphone* with internet access, the zoom will be mediating this geographical perception by cartographic visualization, both in two-dimensional perspective, as three-dimensional, figure 3.

Bringing up Girardi (2014) once again, he discerned that the teaching of Cartography in school does not accompany the cartographies that arise daily, but are denied by not considering the formal cartographic rules, and thus there is a lack of connection between school theory and the daily lives of children since early childhood education. By the way, drawing is not a map and has a hierarchical position inferring the map, according to this formal and School Cartography.

5. Final reflections as a hook for new questions

Considering that in this pandemic, our homes have become school spaces, and the children of these spaces also become students, they are part of an observation and became an object of study. In this sense, our homes went from an informal learning space to another formal space that is the school, that was used to observe the child protagonism and cartographic production, which is inserted in a visual culture.

Even without articulating with a formal teaching of Cartography or saying what a map is, the insertion in this cartographic sociogenesis provided such protagonisms, authorial and experiential maps, so much so that Catarina can use maps produced with different spatialities and temporalities from their historical and cultural construction.

Hence, some points to talk about this child protagonism is necessary to consider these cultural productions in the context from enunciations about spatial lovingness and existential justice. According to Lopes (2021), this thought stresses on an EXISTENTENTIAL JUSTICE, a justice that recognizes babies and children as people in authorial creative activities, involved with the CREATION OF THE NEW and not something that should be denied in the name of an adult-centrism and/or an adult egocentrism and in our case an adult point of view.

This correlates with a Geography of caring, in which this child will not only have the support of infrastructural conditions in his home to go through the pandemic, but it is also necessary to have love and emotional affection for this childhood. Finally, despite the results brought, we cannot romanticize the teaching profession, and it should be noted that this pandemic period passed like a steamroller (to a greater or lesser extent), because the teaching activities at home made the teacher work from the time he wakes up until bedtime. Since the activities at home are mixed with the professional practices and this brought emotional, psychological, health problems and various syndromes.

[2] A deeper reading in this regard, but which is not focused on Cartography itself, but can use as a foundation from the chapter by Jörn Seemann, entitled: O Fim das Representações na Geografia Cultural, do "V COLÓQUIO NACIONAL DO NEER (Núcleo de Estudos em Espaço e Representações)" in 2015.

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Potential of Geotechnologies Online Platforms as a Didactic Resource in Geography Teaching

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Abstract: Currently, the use of geotechnologies is rapidly gaining ground as a tool to support teaching-learning, this was due to the evolution of technologies and the popularization of software that address geographic information. The use of Information and Communication Technologies (ICT) are extremely valuable for both the teacher and the student in the quest to analyze and understand the geographic space, in a dynamic way. The objective of this work was to carry out a survey of some forms of application of geotechnologies in the teaching of Geography in the context of Basic Education, both in Elementary School and High School, which can be used in the classroom. For this, the adopted methodology was based on the analysis of the National Curriculum Plans (PCN) of Geography and on the use of software that have spatial representation functions, as well as on the indication of educational projects based on the use of geotechnologies. From this survey, it was possible to observe that from these tools, a large portion of information circulates in real time and informational technological objects have participated in the daily lives of the population and, specifically, the younger ones, it is worth emphasizing the presentation and discussion of the new free geotechnologies that are being or may be used for the teaching of geography, as well as that remote sensing data has been disseminated considerably in the educational environment and that contemporary WebSigs have shown great value to be used as a teaching resource.

Keywords: WEBGIS, GIS, technological, informational

1. Introduction

Teaching learning practices become more effective when they move from concrete to visual, so when using orbital (satellite) images of a known region, the student can better visualize and understand his/her lived space and the teacher acts as mediator of this knowledge. In this context, Cartography as a science and art comprises the techniques and operations that will allow, based on observed results or documentary exploration, to develop maps, plans and thematic maps.

Following the National Curriculum Parameters (PCN) and the Common National Curriculum Base (BNCC), in relation to the guidelines for elementary education, they emphasize that, in the teaching of Geography, the study of graphic language is an important component from the beginning of schooling, as "it contributes not only for students to come to understand and use a basic tool of geography, maps, but also to
develop skills related to the representation of space. (BRASIL, 1998). Cartographic activities gain space as it is the form of graphic expression of the terrestrial surface and that, with it, it is possible to carry out a dialogue about geographic space through a more accessible and democratic language (BRAZIL, 2018).

With the advancement of geotechnologies linked to geosciences, the information to understand the geographic space as

it is built, organized, and modified has become more accessible, overriding the simple use of maps (FITZ, 2010). The use of different teaching resources in the classroom has always been a reference in the discussion of innovative proposals in teaching. These proposals have been based on a discourse of educational reform, which became synonymous with pedagogical renewal, progress and change (FISCARELLI, 2007).

According to Ricarte and Carvalho (2011), geography teachers, seen as social scientists and educators who interact in a dialectical way in the events that take place in the globalized world, are thus called to

research, interact, question, criticize and also create perspectives about it. of the structure and context of digital inclusion now focused on the studies of Information and Communication Technologies in the teaching of the discipline, making geography classes much more dynamic, interesting and interactive for students through the support of didactic-technological tools.

This relationship between remote sensing and cartography within the academic community go hand in hand. However, in the school context, it takes on other properties that require particular notions of interpretation of geographic space and which, as well as in the academic education process, are fundamental in the process of formation of geographic thought (MARTINS and BECKER, 2014).

1.1. The importance of Geotechnologies in teaching geography

According to Callai et al. (2016) the graphic language awakens logical reasoning, enabling quick and detailed analysis of the contents, in addition to facilitating the memorization of spatial distributions, as well as the reflection and analysis of environmental issues that affect the lived space. One of these processes is known as cartographic literacy and aims to develop, in students, the construction of structures that offer the necessary conditions for the daily use of maps and images.

These geotechnological changes are increasingly present in our daily lives, however, it is noteworthy that they are not accessible in all Brazilian territories. We know that knowledge of geographic knowledge requires the mediation of digital educational resources to be understood in all its possibilities and dimensions (STÜRMER, 2011).

Geotechnologies allow a wide application in the fields of science, being a very useful tool in the teaching of Geography, at its various levels, including elementary and high school. Thus, the different methodological theoretical conceptions and innovations that use it are a stimulus to the production of new didactic models (AGUIAR, 2013).

Geotechnologies are recognized for being part of geoprocessing techniques possible to better understand the issues dealt with by physical geography such as cartography, relief, hydrography, location, in addition to topics such as : territories, the location of countries and continents or local scales, among other matters.

According to Callai (2001) the world has changed rapidly and with it the school and the teaching that is done in it must also change". Thus, this technological complexity also becomes a challenge for education, as in addition to adapting to new advances in technologies, it must be concerned with guiding everyone's path towards mastering and critically appropriating these new means.

The objective of this work was to carry out a survey of some digital platforms for the application of geotechnologies in the teaching of Geography in the context of Basic Education, both in Elementary and High School, which can be used in the classroom.

2. Methodology

The analysis was based on the qualitative approach, and the procedures for survey, assessment, knowledge and the use of online platforms that can help in teaching Geography and developing a class using one of the researched applications as a support tool.

First, the bibliographical research was carried out, in this way it was possible to delimit sources in relation to the theme. The bibliographic consultation, according to Gressler, (2007) is considered as one of the first steps of a scientific research, as it involves the survey of information from various sources such as: books, magazines, publications, maps, internet, regardless of the method and technique used. The second stage was the documentary research that follows the same paths as the bibliographic research, but what distinguishes them, according to Fonseca (2002), is the use of diversified sources, without analytical treatment, such as: statistical tables, newspapers, magazines, reports, official documents, letters, films, photographs, paintings, tapestries, company reports, videos, manuals, etc. The evaluated platforms are shown in Table 1, below:

SOFTWARE	MODALIDADE	FINALIDADE
Google Hearth Pro	Software free	Presentation of the terrestrial globe in 3D
Stat Planet	Software: Digital Atlas - free	Presents indexes along with maps, can be built by the user.
SNIRH	Digital Atlas - Webmapping	Geographic Atlas of Water Resources, allows the insertion of maps by the user.
IBGE	Atlas Estatcart	Statistical Grids expands the possibilities for viewing and analyzing statistical data and allows you to obtain information about regions and places regardless of their administrative boundaries.
EDUCA SeRe	Digital Atlas	Statistical Grids expands the possibilities for viewing and analyzing statistical data and allows you to obtain information about regions and places regardless of their administrative boundaries.
i3Geo	Map Generation	Integrated Geoprocessing Tools Internet Interface

Table 1. Online platforms, which use geotechnologies and can support the teaching of geography:

An exploratory survey was carried out through a survey of free platforms with an exploratory research character, in which the resources of these sites were evaluated, tested and experimented on, as well as the consistent relationship of the resources with the content provided in the Curriculum Framework. For Gil (2010), the Exploratory Research provides the researcher with familiarization with a subject and aims to make it more explicit and at the end of it will be better able to build hypotheses, which mainly uses bibliographic research necessary to verify some existing methodologies for the study of educational software, focused on geographic themes.

3. Discussion

The survey of platforms, evaluation, description of resources and the relationship with the geography content, resulted in the characterization of this in relation to the content that can be approached. In the literature analyzed, the Google Earth platform stands out as the most used in Geography classes, a program that shows maps produced from satellite images and 3D maps. Seeking to show the importance of using Google Earth in teaching Geography, Silva et al. (2014), used images provided in the software as an aid in teaching environmental issues.

Bonini (2009) used Google Earth as a support to observe the Earth in three dimensions; observe cities from different countries; going from one country to another, from one continent to another, crossing oceans, deserts and jungles, knowing the names of countries, their main cities, population, seas, lakes, rivers, volcanoes; observe cultural heritage walking the streets; using polygons to find mountains; area calculation; measure distances calculate topographic profile of 3D objects, Figure 1. We can consider that with the popularization of Google Earth, it has been gaining prominence with a large number of users who use it, such as access to satellite images, route creation, availability of the application for smartphones.

Figure 1 – Google Earth Pro Software Screen Playback

According to Voges and Nascimento (2010), the platform provides interactive satellite images where areas of various parts of the planet can be viewed, some visualization tools allow the user to observe various elements of the Earth's surface from different angles. In addition to Google Earth, other software has been used in research and projects as a tool to support education in elementary school in Brazil. Another highlighted platform is the Digital Geographic Atlas of Water Resources in Brazil, available at http:// http://portal1.snirh.gov.br/atlasrh2013/, under the responsibility of the National Water Agency, which provides 25 related interactive maps to Brazil's water resources, a system for collecting, treating, storing and retrieving information on water resources, as well as intervening factors for its management (Figure 2), presents the following information: Hydrosphere: continental waters (rivers, lakes).

Figure 2. Portal of the Digital Geographic Atlas of Water Resources in Brazil.

In this the teacher can tell more interactive, maps in pdf videos and other audio visual resources that can help in understanding the Brazilian territorial space. In addition to these, several works stand out with the use of other software that have been used in research and projects as a support tool in elementary education education in Brazil. With the "Risk Areas" project, developed by the Institutional Teaching Initiation Scholarship Program (PIBID), Trindade et al. (2014) carried out a study on the feasibility of using GIS TerraView by Geography teachers at the Ministro Edmundo Lins Municipal School (Viçosa-MG). Oak; Dornelas and Di Maio, (2009), carried out the application of digital Geotechnologies in high school: practical assessment of its potential, and had as a result of their research the Research Project Digital Geotechnologies in Education (GEODEN), an educational site that has been developed since 2004, available at: http://geoden.uff.br/>. StatPlanet (Figure 3) is an online platform that contains various health, demographic, educational, environmental and socio-economic indicators from sources such as the World Health Organization, the user can produce maps and graphs by adding or importing their own interactive data between graphics and mappings, using cartography techniques Available on the website: http< http://www.sacmeq.org/interactive-maps/statplanet/>

Figure 3 – StarPlanet website splash screen presentation

It is important to highlight that according to Silva (2012) that the use of digital atlases in geography will depend on the knowledge acquired by the teacher, the age of the students and the cognitive level, otherwise the inadequate selection of the tool can make teaching tiring. Atlas Estatcart, is the Georeferenced Information Retrieval System, developed to facilitate the consultation of the extensive collection of data available throughout Brazil, for the federation units, municipalities and census sectors, currently dispersed in different sources and formats. The School Geographic Atlas was created with the purpose of teaching the user the importance of geography and cartography. Therefore, in the software itself there are basic explanations about cartographic science and planet Earth. As stated on the IBGE website, the information is as follows: explanations on the formation of continents, the shape of the Earth, geographic coordinates, altitude, GPS, projections, scale, remote sensing, aerophotogrammetry, cartographic conventions and thematic mapping.

Figure 4 – Atlas Estatcart - IBGE initial interface

In this tool it is also possible to analyze by census sector, where the user can check the situation of their city, specifically with the visualization of the remote sensor image as the background of the map, in addition to the generation of graphics that help the user in reading the map and understanding of geographic space.

The WebGis surveyed have great potential for pedagogical didactic use in basic education geography classes, taking into account the complexity of the planned content and its adequacy to the students' school age. In addition, the use of computer resources in the classroom alone has helped students to develop a series of skills. Based on data from the 2010 Census, the IBGE, Brazilian Institute of Geography and Statistics, through the 2010 Census Panel, available at the link <http://www.censo2010.ibge.gov.br/painel/>, makes it possible for its users prepare thematic maps of Brazilian states and municipalities, with the possibility of generating and manipulating subtitles on the topic being researched.

The National Institute for Space Research (INPE) developed the EDUCA SeRe project, whose main objective is the development of teaching material, using remote sensing data and geoprocessing techniques to teach geography and natural sciences in elementary and high school. More information about INPE's courses and projects can be accessed

on its website, on the way to disseminate knowledge, didactic booklets, or through the link <http://www.inpe.br/ensino_documentacao/difusao_kno wledge/cartilhas_didaticas. php.

Figure 5 – Educa SeRe's initial interface -INPE

The WebGis i3Geo (Integrated Interface for the Internet of Geoprocessing Tools), based on MapServer, is a sophisticated free online map generation software that can be accessed through the link http://mapas.mma.gov.br/i3geo/mma/openlayers.htm?fokt4jhmkhtep16l67888bqr55. With it, the user has access to a gigantic database of geographic information about the country, with the certainty of viewing reliable data, since the source is the government itself. Several Ministries, such as the Environment, which even created i3Geo, and Education, use the tool for different purposes. i3Geo provides a great set of tools for navigation, analysis generation and map sharing through a very friendly interface, as illustrated in Figure 6, being possible to print to work in the classroom, developing thematic maps, with scale, legend and projection.

Figure 6 – WebGis or i3Geo, home page

Girotto and Pelegrina (2010, p. 44) in the teaching of geography mention that: By allowing students to cross-reference information of different natures, projecting them spatiotemporally, i3Geo brings up the discussion about the correlation of phenomena, one of the elements of geographical reasoning. It is no longer a question of memorizing which Brazilian biomes or existing relief units are, but of understanding the relationship between the type of climate and the vegetation of a given place. This correlation can allow the student to understand that the natural and social elements do not exist separately in the territory, but that they can only be understood in an interrelated way.

4. Conclusion

It followed the premise of analyzing and disposing of the usability of some free websites that, since elementary and high school, could be used as the use of geotechnologies in the classroom in the teaching of geography. The use of technologies in the teaching learning process implies the much-discussed "digital inclusion" of both teachers and students, but we cannot forget that without a certain mastery in the way these technologies are used, it is impossible to make them strategic means, to achieve the ultimate goal. Technologies allow the teacher to use them as tools that can motivate their students in the search for new information, but in addition to mastering and having prior knowledge about the possibilities that these resources offer, the important thing is to identify the best way to use them and how carry out the approach of a theme with the purpose of uniting technology and improvement in the quality of teaching. Thus, it is clear that there are alternatives for the teacher to use numerous free sites as support tools. In this work, we limited ourselves to a few that covered practically all grades of elementary school. The National Curriculum Parameters predict that the reality of the world is much broader than the theoretical possibility of any area of knowledge to account for its explanation and understanding in isolation, and that this cannot be done in a fragmented way, the didactic and pedagogical practice of interdisciplinarity becomes a resource to prevent fragmented teaching in the world.

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Playing and Learning with Maps

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Keywords: Games and Education, School Cartography, Playing with Maps

Abstract: Digital games have grown significantly in recent years, and their use in the teaching-learning process has been gaining more space in the school environment. Inserting technology in teaching helps and encourages restructuring the learning way, and this may contribute to student to be more autonomous in their learning process. A digital game can be an important tool when worked in conjunction with the conventional means of teaching, as games are characterized as fun and are able to stimulate student's memory, curiosity and creativity, motivating participation with more enthusiasm in the pedagogical process (Fernandes 2021). Bringing together the universe of games, already present in the student's life, with information from the official curriculum is to reformulate the idea that school content can only be worked in a traditional way in the classroom.

The developed game aimed to bring to the student a playful learning proposal. The chosen platform was digital, an online game hosted on a website with free and unrestricted access. The game Playing and learning with maps is composed of a set of activities aimed at students in the sixth and seventh grades of elementary school, and addresses issues related to cartography and geography. The activities emphasize mainly the different cutouts and maps of Brazil. All pedagogical contents used were built based on thematic units and skills proposed by the National Common Curriculum Base (BNCC), recommended for the final years of elementary school.

The game's structure is developed by two units, a Board Game composed of six phases and a Paint Color with cutouts from the Brazilian states. In the Board Game, the player clicks on a virtual (random) dice that will trigger the phases, where the game's mascot, Ema, will advance the squares according to the number drawn on the dice (Figure 1).

Figure 1- Game's initial page showing the mascot Ema1 and the phases in the game.

There are in the phases: a) a puzzle game with the political map of Brazil. The map appears in its entirety for a few seconds, then it is divided into small parts that are shuffled in the right corner of the screen. To assemble it the user needs to drag and return the parts to its respective position in the frame's shadow; b) a Quiz (question and answer game) based on the content of the geography curriculum. The user needs to select, among the four options presented, which is the correct answer for the presented question, the program will go to the next question at random; c) an introductory activity with the essential elements of the map; d) a collection of maps with the main physiographic information of Brazil's regions; e) a game to associate types of geographic landscapes. In this activity, students should link different types of geographic landscapes by dragging the word to its corresponding image; and f) an orientation activity.

1 The mascot of the Brazilian Cartography Olympiad.

In Paint Color it is possible for the player to draw freely, as well as triggering cutouts from Brazilian states, working with imagination and playfulness with the physical shapes of each state. The game consists of a white screen, hollow outlines of the states and a color palette where the player can select the desired color to color and/or draw; the mouse works as a brush, shaping the player's imagination (Figure 2)

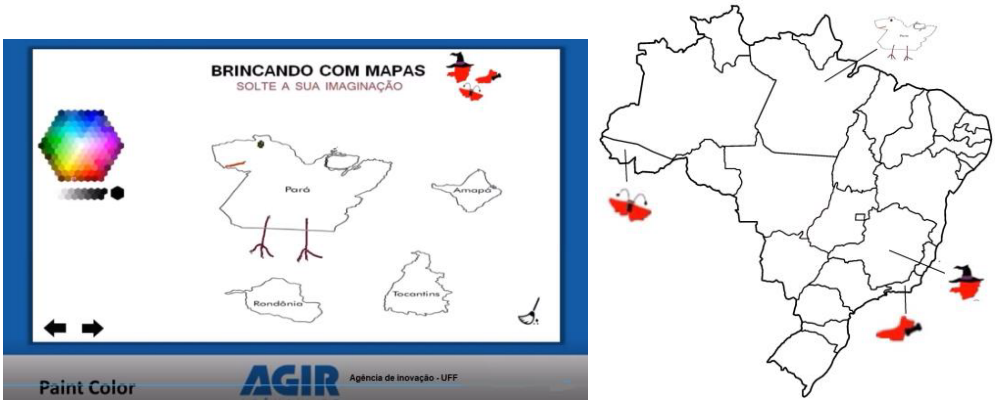

Figure 2 – Paint color activity. Playing with the shapes of the states.

The game was developed in the Construct 2 program (SCIRRA 2021), it works as a game engine, allows the creation of 2D digital games in multiplatform, its code is structured in HTML 5, it does not require in-depth knowledge in programming language. It is a lightweight software of low usage of system resources, which makes it easy to use, for creating digital games. This program was chosen also due to the fact that it has a free version with numerous tools, functions and sophisticated layouts.

The game Playing and learning with maps was hosted on a server at Universidade Federal Fluminense, and is available for free on the page within the GEODEN Project website (Di Maio et al. 2017), with access at: http://www.geoden.uff.br.

The project resulted in a set of games built based on BNCC pedagogical content (Brasil 2021), which can be used by the teachers as an auxiliary tool in the teaching-learning process and on the student's own initiative, arousing their curiosity about topics related to cartography and geography.

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Session 4

Testing Inclusive Cartography at Eötvös Loránd University, Hungary

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Keywords: Inclusive cartography, special education, tactile map, a visual disability.

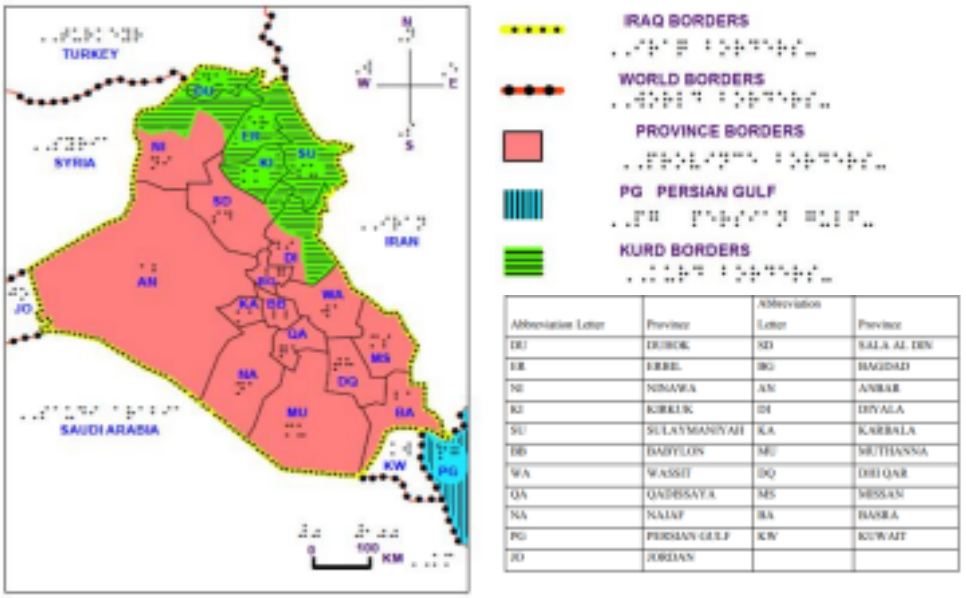
Abstract:

This article discussed how tactile map and inclusive cartography design work together to empower people with disabilities to improve the special education in the Iraqi Kurdistan Region. The case studies offered were primarily about how students with visual impairment and blindness are studying maps at school. Similarly, this article explores another common visual disability and impairment in both Hungary and the Iraqi Kurdistan Region. Both have the same goals: inclusiveness and awareness to serve the community with special needs. Back in the old days, maps were often used for state secrets or better to say in political or military situations. However, in the last two decades, maps are a beneficial rich source of rich information for understanding a place in a particular time, within a particular cultural context about the world so nowadays maps have become global that people take them for granted. Nevertheless, only sight people can use them effectively. So that, this article offers solutions that can be used to provide maps for those who cannot read the map and it can be entered into the most modern techniques in the Kurdish special education as well as studying the educational systems of other countries such as the renewal of cartographic principles to make maps and atlases of inclusive cartography in Hungary. The obtained results show that the design process for tactile map and its challenges will be very similar in these educational systems while there are differences in the structure, and curriculum subjects. For example, Figure 1 shows one example map from Special Geographical Atlas in Hungary for people with visual disabilities. This Atlas collected all geographical locations for healthy, partially sighted, and blind people so both people can develop their benefits and be familiar with all geographical information (Rohonczi, 2007). Recently, the atlas is being used by Hungarian visually impaired students.

Figure 1: Cover of the Special Geographical Atlas with a fragment of a political map of Europe (Zada, Rohonczi and Reyes Nuñez, 2019).

On the other hand, Figure 2 is designed to familiarize the visually disabled by clarifying basic map elements and by providing the skills necessary for successful map reading and information taken from the curriculum and textbooks that are used in the autonomous region of Kurdistan to determine the thematic content of the maps. The text, diagrams, map symbols, and sample maps have evolved only after extensive testing amongst blind and visually impaired people, ranging from young high school and primary students to mature adults (Zada, 2019). The preparation of tactile maps in close collaboration with a total of 100 visually impaired people aged between four and eighteen years old. The principles and methods set out here are relevant to the design of a range of standard tactile map designs used in the

Hungarian Atlas mostly, from simple Information to complex maps of geography topics. Additionally, the map is prepared in two languages, one for Braille readers and the other for readers needing bold print and for parents and teachers assisting Braille readers. Low vision maps are made for readers with varying degrees of seeing difficulty. Capital letters, large font, bold type, which occupies about the same space on maps as Braille is used. In addition, the degree of generalization and simplification of map detail necessary for efficient map reading by users with severe visual impairment is about the same as for tactual map reading. These maps allow having hope that the new tactile maps for Iraq generally and Kurdistan particularly will be appearing soon as well as the research becomes the part of the school curriculum for developing map skills for blind and low vision students.



Abbreviation Letter	Province	Abbreviation Letter	Province
DU	DUHOK	SD	SALA AL DIN
ER	ERBIL	BG	BAGDAD
NI	NINAWA	AN	ANBAR
KI	KIRKUK	DI	DIYALA
SU	SULAYMANIYAH	KA	KARBALA
BB	BABYLON	MU	MUTHANNA
WA	WASSIT	DQ	DHI QAR
QA	QADISSAYA	MS	MISSAN
NA	NAJAF	BA	BASRA
PG	PERSIAN GULF	KW	KUWAIT
JO	JORDAN		

Figure 2: Example of Tactile Map for Kurdistan Region Map (Zada and Trojan, 2021)

Besides, Hungarian Atlas used the Corel Draw program while they created maps for their students, but maps of Iraq and Kurdistan were produced using ArcGIS, which means that maps are spatially referenced. It is the best way to update thematic maps and add new information into the old maps any time without losing data and time consuming as well. As mentioned earlier, both attached maps are simply a guideline to enhance students' "with low vision and blindness" information map about Geography. Maps will serve them to be independent and familiar with names and regions as well as understand maps better and develop the skills necessary to make map reading an enjoyable and valuable experience. Finally, both atlas are the most hopeful method for map studying across the whole countries. The Atlases for visually impaired people assist students to be able to read maps through the touch using their fingers.

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Tactile street intersection maps for orientation and mobility training

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Keywords: tactile map, visual impairment, accessibility, orientation and mobility

Abstract:

Street intersections are challenging and dangerous in the journeys of blind and visually impaired people, and they are an essential part of the orientation and mobility (O&M) training, where the learner is taught to analyse the geometry and the traffic control of the intersection, as well as the practical technique of preparing and timing the crossing action (Fazzi & Barlow, 2017). Tactile maps are an important part in O&M training as they communicate spatial layouts and facilitate mental map developments (Espinosa et al., 1998). To teach street crossings, the maps can be along side the on site listening and exploration of the intersection (Fazzi & Barlow, 2017). Most of the maps used for O&M training are still being handmade in a rather time-consuming manner and Long & Giudice (2010) argue that map use in O&M training could be more widespread if the maps were more available. The learners also need more maps to be exposed to a variety of types and geometries of intersections of various complexity to prepare for their independent journeys to unfamiliar intersections in the future (Fazzi & Barlow, 2017). Although there are now available mobility-oriented tactile mapping services (e.g. Götzelmann & Eichler, 2016), they are often on the neighborhood scale emphasizing building footprints and street networks, and rarely include the details of streets intersections that PVIs need for learning and orientation.

In the framework of the ANR ACTIVmap project, one of the aims is to assist O&M instructors with (semi-)automatic generated (audio-)tactile maps of street intersections. A first experiment was earlier made to automatically map street intersections with OpenStreetMap data (Jiang et al. in press) where the resulting maps could also be used in O&M training, potentially augmented with (audio) interactions and/or 3D printing. In that experiment, streets intersections are represented by the basic geometry elements of streets (areas), pedestrian crossing (lines), and traffic islands (areas). A map produced by the pipeline is shown in Figure 1-b. The map aims to provide an overview of the geometry of the intersection in more detail than available services while trying not to crowd the map with information that is not directly relevant to learning the intersection geometry. Yet because O&M training is often very individual, the instructor could also draw additional information, such as bus stops, on the automatically generated base map depending on the learning need.

To facilitate the learning, the map could be further augmented with audio interactions. Brock et al. (2015) proposed an interactive tactile map where a paper-based tactile cover can be put on a regular tablet, and points/areas of interest can be linked with audio descriptions triggered by pressing. With this setup, a proof-of-concept example was made as in Figure 1-c, where (semi-)automatically generated verbal descriptions for streets and pedestrian crossings (Kalsron et al., 2021) could be linked with the tactile map cover and be triggered by double-press. In actual O&M teaching, however, the instructor might wish to use own deceptions and comments on the map elements catering to the specific situation. Such interactive setup has already been used for educational purposes including teaching school subjects (history, maths, etc.) and explaining COVID-19 related topics (Cherchons pour Voir, 2020), and with automatically generated tactile map covers, it could also be used in the teaching of spatial content and O&M skills, to introduce learners to a variety of intersection layouts with fewer efforts demanded in manually creating the maps.

By adjusting the parameters and styling choices in the previous mapping pipeline, it's also possible to produce (vector) maps that can be 3D printed, potentially adding in more elevation levels and even further augmented with (additional) realistic icons, which can then be used on (specialized) interactive devices that support 3D printed covers. With more possibilities in elevation and realistic icons, the map can potentially be used more intuitively without a legend or braille labels, which not only gives more space to the present the geometries without cluttering but also reduce the difficulty introduced by reading braille and tactile graphics in general (Holloway et al., 2018; Toyoda et al., 2020).

Ongoing work aims towards integrating the (3D-printed) maps from the pipeline with automatically generated verbal descriptions on an interactive device, and it also aims to further evaluate the conceptual product with O&M instructors and learners.

a) b) c)

Figure 1. Mapping an intersection and possible interactions. a) a street intersection (Source: Google Maps); b) map produced by the pipeline; c) a first experiment of an interactive map using a swell paper tactile cover on top of a tablet, with audio descriptions for streets and pedestrian crossings.

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Tactile Cartography and Spatial Thinking: brief considerations

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Keywords: tactile maps, spatial thinking, geographic reasoning

Abstract:

The methodology that supports this work is based on the analysis of national surveys from 1993 to 2020 on tactile cartography and international surveys from 2007 to 2020 on spatial thinking, with the possibility of connecting two fields.

Tactile Cartography is a specific field of Cartography dedicated to the research and analysis of methodological procedures concerning the production and use of tactile cartographic resources. These resources aim to contribute to the teaching of cartographic, geographical, historical, and environmental concepts. They help to broaden world knowledge and develop spatial representation skills of students with visual impairment. Thus, Tactile Cartography seeks mechanisms to enable people with visual impairment, multiple deficiencies, or blindness to benefit from map use and geographical education in the classroom.

Although mostly restricted to academic circles in Brazil, Tactile Cartography has gained visibility due to the need for inclusion and participation of all individuals in society. Such gains are resultant from years of demands and pressure made to the government by the people with disabilities. Because of educational policies regarding this group, the community started adapting school materials designed to support Geography classes. Initially, volunteers, parents, guardians, and teachers from elementary and special schools took the initiative to customize resources needed for Geography classes. Over the years, research centers started to develop materials and methodologies for their application.

Between the 1990s and 2000s, Tactile Cartography started to consolidate as a field of research, and theories on graphic semiology, cartographic communication, and special education constitute its theoretical framework. More recently, as of 2015, these theories have been gaining attention inside the Brazilian field of Geography Teaching, for they promote valuable discussions and help substantiate the classroom use of tactile maps.

Theories on spatial thinking were first established in the mid-twentieth century, especially in English-speaking countries, through field researches on cognitive psychology, neuropsychology, and education. In 1970, R.N. Shepard was the first author to use the term 'spatial thinking'. Shepard conceived it as an essentially non-verbal way of thinking, which involves internal, individual representations concerning the space dimension. Other studies (i.e. LIBEN, 1991; NEWCOMBE & HUTTENLOCHER, 2000) also demonstrated concerns about the development process of skills, such as distance, direction, and orientation, in the classroom environment. These studies aimed to conduct tests with the students, and with the results, improve teaching strategies.

Therefore, spatial thinking is a set of concepts, skills, and representation, intrinsically connected to the fields of Geography and Cartography. Considering this analytical perspective, we highlight Reginald Golledge (2002), whose work establishes a connection between geographical education, Cartography, and spatial thinking development: "In short, geographical thinking and reasoning provide the basis for understanding – or rationalization – of why there are spatial effects and not just finding out what they are" (p.6).

According to Golledge (2002), maps contribute substantially to spatial thinking, and school geography plays a relevant role in this process. The guiding document entitled Learning to Think Spatially: GIS as a Support System in the K-12 Curriculum, published in 2006 by the National Research Council, reinforced this analysis perspective. The document highlights the importance of spatial dimension and natural phenomenon in human relations, considering them a specific way of thinking, which helps people to identify problems and propose solutions. It is also relevant because it determines which elements constitute spatial thinking and explains the connections between them.

Knowing the theoretical framework on spatial thinking and applying it to activities designed for students with visual impairment contribute to the development of new teaching techniques and resources, which allow them to experience and benefit from spatial thinking as a cognitive process.
Thus, understanding spatial concepts and knowing how to use geographical representations have tremendous importance to these students because it favors the development of their spatial autonomy. That is, it endorses their knowledge about the space they experience daily. Students acquire different levels of complexity of spatial relations, as quotidian situations require the teacher to resort to new concepts, skills, and forms of representation.

Goodchild (2006) argues that spatial thinking is one of the fundamental types of intelligence required for human beings to function successfully in modern society, as it is an essential skill, and its development should be part of global education. Spatial thinking is a crucial cognitive skill for students with low sight or blindness to develop geographical knowledge. Spatial thinking empowers individuals with visual impairment to recognize themselves as agents of their surroundings and identify possible connections between their lifestyle and location. In addition, spatial thinking allows students to make complex spatial connections in different scales through maps and understand where they are in this dynamic. Spatial thinking combined with Tactile Cartography help to develop the individual's identity and promote a consistent spatial practice through the gains derived from the cognitive process.

Thus, teaching how to read the world from a geographical perspective is a complex task that requires a broad set of elements. Relating spatial thinking to Geography and Cartography at school revalidates the importance of these fields of study and allows teachers to reflect on their practice, to turn students into conscious readers and mappers.

Universities need to expand knowledge production in this field to support a teaching degree in Geography based on a current theoretical basis, providing interdisciplinary and inclusive practices.

Development of a Tactile Map for Citizens with Visual Impairments: the UFPR Study Case

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Keywords: Tactile maps, visually impaired, social inclusion.

Abstract:

Social inclusion of people with disabilities enables justice and equality in a society, reducing differences. It generates environments aimed at serving all citizens, stablishing safe spaces, and promoting movement autonomy. Besides, it increases the self-esteem and confidence of people who are still on the margins of society. To better use urban spaces and reach its facilities, the citizen needs to be free to move along the space and for this purpose he needs information about the location of buildings and facilities, as well as the geometry of roads and transportation. Such information is available in printed maps, that are provided to the citizen or located at strategic locations along a city, or virtual maps that can be displayed on the screen of a computer or smartphone. Such media is not accessible to all citizens. For example, unalphabetized citizens cannot read them and, even worse, are useless for blind persons.

According to the 2010 Demographic Census (IBGE, 2010), there are about 35.75 million Brazilians with some type of visual impairment. For them, reading printed maps is impossible. The present work aims at proposing and developing a tactile map for the polytechnic center of the Federal University of Parana to help the mobility of blind citizens within the campus and thus facilitate its integration within the university environment.

A blind person uses the remaining senses or the help of other people to move and gets knowledge about the geometry of objects largely by touch and cenesthesia. Hearing provides clues as to the direction and distance of objects that produce sounds but does not provide a detailed description of the objects. Reading and inspecting objects are performed using the tact and tactile experiences require direct contact with objects or movement around them. Therefore, the proposed map uses shapes and textures to communicate cartographic information as a solution.

Vygotsky (1997) states that blindness reduce the abilities needed for spatial orientation and freedom of movement. Thus, Orientation and Mobility (OM) techniques need to be learned to explore the space safely and independently. According to Mazzaro (2003), a visually impaired person must learn that there are three basic principles in the orientation process: "*where am I? Where do I want to go? How will I get to the desired location?"* and that the person must be able to perform the following steps:

- Perception: capture the information of the environment through sensory channels.
- Analysis: organization of perceived data to varying degrees of trust, familiarity, sensations, and others.
- Selection, choice of the most important elements that meet the immediate needs of guidance.
- Planning, action plan: how can I reach my goal, based on the previous phases.
- Implementation: mobility itself, carry out the action plan through practice.

In Brazil, there are still no norms and guidelines for standardization of elaboration of tactile maps. Nevertheless, some research was done on the field. The studies consider that there are some special requirements to get information using the hands than the eyes. So, some recommendations are: The use of legend in Braille and, if possible, sound devices. A frame should be used around the map to inform its limits. Information about the Direction (North) and scale should be included using standardized representations. These recommendations, and others proposed by the American Printing House for the Blind (APH) in the Guide to Designing Tactile Illustrations for Children's Books were considered to produce the tactile map.

Care was taken to use textures, shapes, lines, and symbols that look different from each other; Reduce the number of elements to allow Simplicity (Generalization); Avoid clutter, separating elements with at least 6mm distance. When displaying 3D buildings, special care was taken to simplify the height to allow access to the space (streets) between

buildings; Avoid using shapes that are too small (approximately 1cm). Large shapes, representing larger objects and spaces, like gardens, were filled in a standard way with or without texture to enable distinguishing them and their limits.

The official map of the Federal University of Parana was used as basic cartographic source. Spatial features were edited in ArcGis, eliminating some features to reduce map pollution and grant cartographic communication. A frame, and symbols to represent scale and orientations were included. Later, with the help of sketchup and autocad software, shape and volume were included, especially for buildings, and textures were provided to the cartographic entities. Figure 1 shows the tactile map of the UFPR Polytechnic Center. Due to the dimensions of the map, it was plotted in parts that were joined, taking care not to leave discontinuities that could interfere with the tactile reading (fig. 2). The map was positioned in a way that allows reading with the person standing, and with good ergonomics.

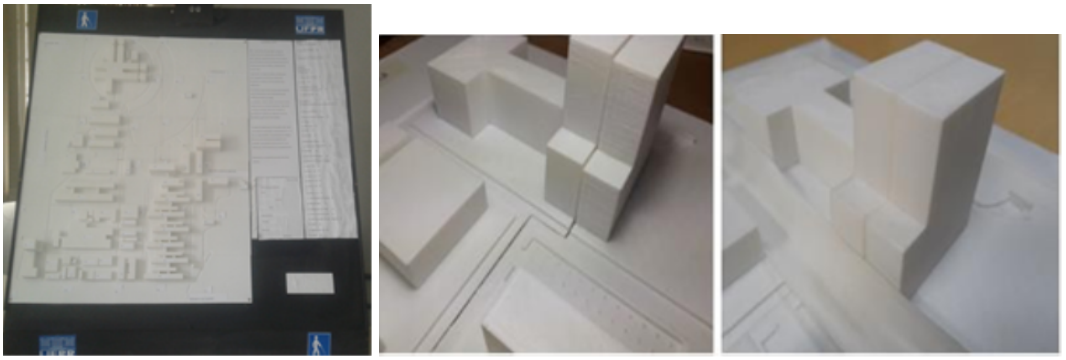
To evaluate the functionality of the tactile map proposed in this work, it was performed an in-depth research and interviews with invited evaluators. Two classes of evaluators were chosen, the first is composed by students at the Federal University of Parana, who have a certain knowledge about the campus because they have already moved within it. The second group includes persons who were unaware of the geography of the campus, to allow non-biased analysis due to a prior knowledge of the environment. This situation was chosen to ensure that the tactile map meets the needs of all people, without interference from prior knowledge about the site.

The evaluation performed in this study showed that the use of textures facilitates communication. This was tested in the case of vegetation and lawn. However, it was also found that the number of textures should be keep small to avoid confusion. The use of the same material to represent different features, as in the case of parking lots and streets lead to confusion and it is recommended to research alternatives varying material.

An iterative system with presence sensor based on the Arduino platform was also incorporated into the map. Upon detecting a person positioned in front of the map, a recording guides the layout of the map, the starting place to start reading (place where the map was installed - library), which can be identified through markings on the sides of the map and by a highlighted symbol placed in the position of the library. It is possible to simply reset the messages by moving closer or further away from the sensor.

One fact that was visible is the need to include information that is not traditionally included in the printed maps because there are differences in the way to obtain information by a visually impaired person For example, users pointed out the need to include barriers that indicate, for example, dead end streets.

The phenomenon of visual pollution of a printed map can also be found on a touch map. For this reason, agglomeration should be avoided, as this makes the map unreadable and difficult to communicate.



(a) **(b)**

Figure 1. 3D tactile map (a) and detailed view of building blocks (b)

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