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Collective Construction and Sharing of Information and Products from the Brazilian Cartographic Olympiad: Data Acquisition, Access and Availability

Angelica Carvalho Di Maio
Professor
Fluminense Federal University
Brazil

Kellen Milene Gomes e Santos
Teacher
Fluminense Federal University
Brazil

Luis Augusto Koenig Veiga
Professor
Parana Federal University - Earth Sciences Department
Brazil

Juliana Marques de Souza
Undergraduate Student
Fluminense Federal University
Brazil

Juliana Magalhães Menezes
Professor
Fluminense Federal University
Brazil

Hullysses Sabino
Master's Degree student
Federal University of Rio de Janeiro
Brazil

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Athens Institute for Education and Research
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Abstract

This work discusses the diffusion of spatial representations through maps and its technologies, associated to the role of education from school cartography, as a basis for changing reality. The cartographic learning brings the places and the people together, and thus provides conditions of accessing knowledge and skills for the exercise of citizenship, in this way it is considered fundamental to contribute to the democratization of knowledge from the availability of cartographic material in learning environment. Information and communication technologies favor access to a large amount of information, even those that are distant from the reality of the students and also stimulate the generation of scientific knowledge. In this perspective, the two editions of the Brazilian Cartographic Olympiad (OBRAC) were held. The OBRAC had national coverage and was focused on high school students. Each school participated with a team of 4 students and a teacher, the team leader. OBRAC is performed in stages and phases, with theoretical and practical tasks carried out at *Moodle* distance Learning platform. OBRAC covered a large number of participants throughout Brazil, a huge country with distinct characteristics, so the volume of educational material generated in the two editions of the competition was relevant. It counted with the participation of all the Brazilian states with a total of 1,500 participating schools. In the OBRAC editions (2015 and 2017) were produced hundreds of educational videos, maps, measuring equipments, models, issues with real situations of spatial knowledge application, and geotechnologies guides. The objective of this work was to organize and select relevant materials generated in OBRAC, and share the access through OBRAC's website and Youtube channel.

Keywords: Cartographic Olympiad, School Cartography, Geoinformation Access and Availability.

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Introduction

Information and communication technologies are facilitators in the process of information sharing, since they provide resources for interaction, organization and access to large-scale information (KAIMEN and CARELLI, 2007). Education is the foundation of a society that exercises citizen practices and it is in this sense that the present work sought the diffusion of the cartographic knowledge, as an important encouraging factor for citizenship consolidation. Thus, this work shows the diffusion of spatial representations through the production of mapping activities and its association with contemporary technologies in education during the two editions of a scientific Olympiad.

The cartographic learning provides approximation to Geography's object of study, the space, and provides conditions of accessing knowledge and skills for the exercise of citizenship, in this way it is considered fundamental to contribute to the democratization of knowledge, from the availability of cartographic material for school environment activities.

Information and communication technologies favor access to a very large amount of information, even those that are distant from the reality of the students and impel the generation of scientific knowledge. In this perspective, the two editions of the Brazilian Cartography Olympiad (OBRAC) were held in 2015 and 2017. OBRAC (http://olimpiadadecartografia.sites.uff.br) is nationally focused and targets high School students and the 9th grade of Elementary School. Each school participates with a team of four students and a teacher, the team leader. OBRAC (DI MAIO and VEIGA, 2015) is performed in stages and phases, with theoretical and practical assignments, carried out at Moodle distance learning platform, and in a face-to-face stage, where students participate in a orienteering competition. Orienteering activity helps the competitors develop a perceptive correlation between the real environment and its cartographic representation.

During OBRAC, considering the two editions of the competition, a large volume of educational material was generated. OBRAC had participation of schools from all the Brazilian states with 6000 students and 1500 teachers.

A significant contribution was made in the construction of activities geared towards the promotion and enrichment of geospatial knowledge in the school community. The collection and analysis of the data of the participating teams made it possible to verify the differences and potential of development of the activities in all unique regions of the country. In this way, this work organized, selected and disseminated the relevant materials developed in OBRAC, both by the organizing committee of the scientific Olympiad and by the teams participating in the schools. These materials cover the activities of creating cartographic instruments, maps, models, manuals and issues related to school cartographic knowledge.

Diffusion of Spatial Representations through Maps, New Trends in Cartography and Their Technologies Associated With the Role of Education

The technological advances in the last decades, not only in the cartographic sciences, but also in the world-wide communication networks, have allowed the mass distribution of geospatial information, and this has contributed in large scale to the formation of geospatial information developers and readers.

In the twenty-first century, it was possible to see a great variety of materials freely available to users with Internet access, but it has to be borne in mind that enabling the citizen does not mean preparing information consumer. It means empowering people to take decisions based on reliable information about aspects of life in society (TAKAHASHI, 2000). This new reality was increased by the popularization of Internet access at the end of the 20th century and the availability of broadband providers at the beginning of the 21st century, as well as the improvement of the hardware and software technologies that transformed the way to acquire information and to communicate in the world (DUBA and DI MAIO, 2014).

Hasse (1999) wrote that the revolution which occurred in communication allows much more than the diffusion and socialization of information among people, since the knowledge that people possess is not only about what happens where they live, so it increases their possibilities of understanding and interfere in the world.

On the popularization of the use of geospatial information, Hamburg (2013) draws attention to the possibility of using computer science to access spatial data for two-dimensional and three-dimensional virtual exploitation of the world. However, for Field and Cartwright (2013), you need to be aware that in today's world there are many more maps, but that does not mean that the world is full of great quality maps. Cartography was the dominant trend, popularized by the large availability of maps on many websites. Care must be taken, as maps made by non-professional mappers with possible inaccuracies can be used by decision makers. For Escola (2005), it is not possible to accept the thesis that the techno-scientific evolution happens without dragging important and significant modifications in the communication and cultural space of the XXI century. The core of the Information Society is concerned with issues involving access, storage and processing of information. For the author, the new territories of communication have gained a nuclear role in society, culture and education.

However, the whole range of technological resources does not imply abandoning traditional cartography, but in a society permeated by technological resources, where students are skilled manipulators of technology and dominate it quickly and easily, teachers are called upon to the challenge of new approaches to handling geospatial data.

The world of maps is changing with the Internet that has expanded the distribution of maps for computers, mobile phones and tablets. According to Gartner et al. (2007), most Internet search engines, for example, have the ability to generate maps in response to spatial queries and routes between specific origins and destinations. These advances in computing technology, including mobile computing, provide access to mapping capabilities from virtually any location on Earth's surface.

In this way, technology is an ally in the impulsion of science. In addition to contributing to research methodologies improvement, the technological revolution promotes ideas dissemination throughout society. Thus, scientific dissemination is important in all fields of research, since it facilitates access to products that can contribute to science democratization, once the Internet shortens the distances, thereby speeding up the propagation of the ideas researched.

A scientific Olympiad stimulates knowledge, offering participants a constructive challenge. The OBRAC brought, to the scope of geospatial information sciences, a type of activity so stimulating for the students, the study of map science as an adventure. As a scientific Olympiad, OBRAC sought to innovate the teaching methods of cartography, with respect to the development of high school student learning and the applicability of the cartographic methods for Geography teaching in line with the students' contemporaneity.

As a challenge, scientific Olympiad are incentives to improve students achievements that can be awakened to the interest in science, in this case in the science of spatial representation and the use of maps.

The school environment is friendly to discussions, knowledge innovations and to challenges proposition. According to Cedro (2008), individuals develop their lives through activities and the learning activity makes the students take ownership of the knowledge, so there is a need for a mechanism or resource that stimulates students' curiosity and encourages them to solve problems.

Today in Brazil, the scientific Olympiads cover several areas of knowledge, e.g. astronomy, physics, math, history, biology, robotics, chemistry and they involve millions of students and thousands of teachers, and especially the map science Olympiad OBRAC produces a significant amount of cartographic products.

During this competition, which lasts eight months, in theoretical tests, in addition to the fundamental content approach to the domain of cartographic language, interpretation questions involve students and teachers in subjects such as history, for example, Che Guevara's journey seen on maps, environmental issues, such as endangered animals seen from official maps and data, spatialization of yellow fever using official health Institute data, traditional indigenous and quilombola territories in Brazil from the access to a governmental WEBGIS database. The satellite images and their interpretation are used, for example, the Google Earth Virtual Globe took high school students to visit Universities in the country. The proposed questions and tasks are first introduced with a short text containing relevant data and information on the subject and then the query, calculation or interpretation, based on the map observation or elaboration, was requested.

Each activity is explained in detail, as it should be in the distance learning format. The teachers and students' doubts are answered by email or via the Moodle elearning platform.

The use of the Guides for the accomplishment of the OBRAC's activities generates new materials produced from the orientations and the use of new technologies, which also aims to introduce and encourage teachers to use technological tools in the way of handling and making maps and spatialize different types of data in the school. Teachers have reported that they have been using the Guides in other activities at the school, as well as promoting orienteering competitions based on the course and the competition taken place in the scope of OBRAC.

Cartography can help understanding spatial distribution of phenomena and this is very significant for students, since spatial thinking helps to find solutions for some everyday problems, especially the ones related to spatial organization. Today, we live a very rich moment in the dissemination of geospatial knowledge. In Internet, the students have access to a variety of geographic space representations, which have now become part of people quotidian tasks, as planning how to get to a place for the first time, for example. Finding where places are located is part of the human essence and the popularization and the benefits of geospatial data even through the use of simple tools can cause benefits on people's everyday lives.

The technological advances in Cartography, associated to the advances in web communication, allowed a wide distribution of geospatial information. This way, Cartography teaching should meet students' needs, that is, it should contribute to the understanding of the environment they live, revealing, as pointed out by Alves (2011), its physical, economic and social characteristics and also its socio-environmental relations and changes.

Maps are as old as human history and are present in all societies; they are powerful tools for understanding the complexity of modern society, since maps are *means of navigation, of*

fundamental importance in a turbulent sea of data and information from a wide range of topics (TAYLOR 1991).

Methodology

This work aimed in the organization and selection of relevant cartographic materials generated in OBRAC to share its access through the website http://olimpiadadecartografia.sites.uff.br and through the video library in the Olympiad channel on YouTube.

YouTube is a site for sharing videos uploaded by users over the Internet. The choice of this platform was due to the fact that it is a free, popular and collaborative channel, allowing the user easy access to all available material, being able to even carry all the content in the palm of the hands through a mobile network connection. It is also a way of disseminating the work of the teams that participated in the Brazilian Cartography Olympiad.

First, the OBRAC YouTube channel was created; the access to the site is https://www.youtube.com/channel/UCj73uRbNA2BK6G7a0_QylbQ, and then the materials produced by the teams participating in the 2015 and 2017 editions were made available.

The criteria used to select and share the activities were, firstly, the videos that the authors accepted the terms of publication, and then the cut off marks for the competition, that is, the works that were above cut marks and passed to the advanced phases.

The management of the files was done through upload and some visualization tools, where the user can choose which videos will be kept on the main page: the most recent, oldest or most viewed.

The OBRAC YouTube channel works as a kind of database, and to organize this database, a division was created in Playlists. The videos were separated by themes. The themes followed the names of the tasks promoted by OBRAC. So we have the Playlists according to both editions: cartographic instruments, maps of the palm trees, digital maps and relief models.

The OBRAC website bridges the video library of the channel through hyperlinks that direct the user to a desired video category. The selected materials were separated in other categories within the OBRAC website, for example, in the instruments category there are the following subdivisions: compass, theodolite, pantograph and others.

In this way, with the combination of YouTube and the OBRAC's website, it was possible to select and organize the numerous materials generated in both editions of the competition, in an environment that facilitates research for teachers, students and people interested in cartography. Serving not only as a reference for activities in school but also as a way of disseminating excellent works carried out, all over Brazil, by students of public and private schools.

Results

The activities proposed by OBRAC, such as the construction of cartographic instruments using recyclable material, the Fernando de Noronha Archipelago relief model (Figure 1), the elaboration of maps with the theme "The Palms of Brazil" (Figure 2) and the activities in the world of digital maps, were selected and organized by themes for public access, since it could contribute to enrich students knowledge, in aspects related to the country and its regions, and further arouse students' interest in Cartography.

Figure 1. *Relief Model of Fernando de Noronha Archipelago in Atlantic Ocean*

Source: OBRAC 2017. Team from Mackenzie Tamboré School.

Figure 2. *Palm trees in extinction risk in Brazil*

Source: OBRAC 2017.Team from UTFPR Pato Branco Campus.

The tests and activities proposed in OBRAC along with the Guides for the accomplishment of the tasks are available at:

OBRAC 2015 - http://olimpiadadecartografia.sites.uff.br/provas-obrac-2015/
OBRAC 2017 - http://olimpiadadecartografia.sites.uff.br/provas-obrac-2017/

The following Guides (Figure 3) were prepared and made available to the teams: The construction of models, The construction of anaglyphs, Digital map elaboration in Google My Maps application software and use of mobile GPS. These Guides were used in the tasks and considered by the teachers as a teaching material of great utility, being available on the OBRAC website for download.

Figure 3. *Guides for Digital Map and Anaglyph construction*

Source: OBRAC 2017.

OBRAC has become an important source of content for analysis, since it presents attractive pedagogical alternatives aimed at the creation of differentiated activities, linked to cartography in a school environment, considering the different characteristics of Brazilian regions.

Figure 4 shows the OBRAC channel, where people can sign up to receive information and news on their emails.

Figure 4. *The Brazilian Cartographic Olympiad Channel on YouTube*

Source: OBRAC 2018.

The Figure 5 shows examples of activities that were published on the channel.

Figure 5. *Publications on the Youtube Channel. Activity 1: mapping the school environment and land use, Activity 2:constructing a measuring instrument, the quadrant*

Source: OBRAC 2015.

Some other works can be seen in Figures 6 and 7.

Figure 6. *The Carnaúba Palm tree Production in Ceara State, in the northest of Brazil*

Source: OBRAC 2017. Team from Luiz Gonzaga da F. Mota School

Figure 7. *A tactile map. Babassu of Brazil: Earth's wealth, livelihood of many people*

Source: OBRAC 2017. Team from Guines Affonso Morales School.

In Figure 8 it is possible to observe the Playlists created which represent the different activities proposed in OBRAC's editions.

Figure 8. *Playlists on YouTube Channel: Palm Trees Maps, Models, Cartographic Instrument and Digital Maps*

Source: OBRAC 2018.

Figure 9 presents the OBRAC website and shows search options for themes developed during the competition in the country's different regions.

Figure 9. *OBRAC website: access to materials*

Source: OBRAC 2018.

Discussion

The social engagement, focused on public policy issues, was stimulated in the OBRAC editions, for example, one of the practical issues proposed was the elaboration of maps that could represent situations related to the school and the community. In this regard, there were maps developed by the teams that showed areas subject to floods, environmental problems and even traffic flows, among other relevant topics. Another approach proposed in digital maps was the awakening about the beauties and problems faced in the city or region where the school was inserted, using technological resources such as GPS (free mobile app) and online mapping

application (Google My Maps). The teams reported their findings on important historical and environmental facts that they had not previously known about their own municipalities (Figure 10).

Figure 10. *Touristic aspects around the team's school in Fortaleza city*

Source: OBRAC 2017. Team from Maria Alves Carioca School.

There were many discoveries about the importance of Palm trees for example, the teams produced maps that showed The Palms in danger of extinction in Brazil, the importance of the Imperial Palms in the reproduction of Canide macaws, and they also represented the babassu coconut breakers, associating this theme with social and gender importance in the "cocais" forest. They produced many works of great importance for the knowledge, not only of cartography but of the country and the human, economic and physical relations that connect stories, show realities and are present in the "between-lines" of the maps. In other activity, measuring instruments such as compasses, theodolites and pantographs (Figure 11) were produced by the teams with recyclable materials. They were stimulated in using the instrument created on their maps elaboration.

Figure 11. *The theodolite, the pantograph and the odometer*

Source: OBRAC 2015. Teams from Odilon Behrens, IEE and Carlos Drumond de A. Médici Schools.

It was observed that maps production of the places near the students' living space aroused interest in the problems surrounding their schools, neighborhoods and municipalities and also aroused students' interest in science and technology, and this was stimulated by the challenges proposed by the Olympiad and the discoveries about Cartography and its interdisciplinary character.

Much of the experience and challenges faced seriously by students and teachers are available and can be replicated by other students and teachers. Some teams have produced materials for blind people and this material is in school being used by visually impaired students.

Cartography is a Science that deals with many sciences for the composition of its final product, which is the spatial representation of diverse themes that cover physical and human aspects. The elaboration of a cartographic document implies in a multidisciplinary team with interdisciplinary work, i.e. it is necessary the cooperation between several areas so that a whole is constructed.

For example, for palm trees mapping, the teams consulted biologists, visited regions to meet communities that live from the use of "açaí" fruit. There was a team (CEFET-MG / Divinópolis) that inspired the work in the buriti palm; the team represented in the map of Minas Gerais state the distribution of the buriti palm areas in 17 municipalities and also conducted a research, seeking to raise in these same municipalities, the number of cases of eye, cardiovascular and bone diseases, which can be prevented with the correct use of vitamin A, present in the fruit of buriti. At the same time, a map of Minas Gerais was printed on a 3D printer in association to a software with audio resource, positioning the same information so that blind people could use.

The MIBM (Interactive Buritis Map of Minas) was created for the cartography competition (Figure 12), but the team members intend to continue the studies on the importance of buriti palm for human health, as well as contribute with the expansion of technological resources for inclusion. In this interdisciplinary team, there were students from the technical courses of computer science, mechatronics and fashion and the teacher was a Geographer.

Figure 12. *The MIBM (Interactive Buritis Map of Minas) from IFMG Divinópolis Campus Team*

Source: OBRAC 2017. Team from CEFET-MG Divinopolis Campus.

Cartography goes beyond its traditional role (TAYLOR, 2013) when used in the construction of a variety of material in favor of education and citizenship, it fulfills a role of vehicle of integration in the school because it promotes the multidisciplinary participation in teams and in an interdisciplinary way. The material collection generated was a collective construction that involved many schools, many areas of knowledge, students and teachers.

About the construction of palm trees maps, students and teachers said that the theme awaked them for the importance of this tree species and they also said what was remarkable for them:

> *"The possibility of working society and nature considering the national, regional and local biodiversity."*
> *"The importance of fieldwork for Geography and also the importance of preserving the palms in our region".*
> *"We loved the experience, we did field work to collect data, we knew the history of the Juçara palm, a specific palm tree in our region and now we are even doing a project to replant it in our municipality."*

This is especially interesting, as we can observe that they wanted to continue the work, they were practicing citizen actions in their city, and the accomplished task was the trigger for it. That is, education is a trigger for critical thinking and good actions.
More comments:

"It sure was the field research, this learning will never be removed, it was very good."
"The field research and the knowledge of our rich nature."

Another result of the activities carried out was the learning with the use of geoprocessing programs as the GIS (Geographical Information System):

"The greatest legacy was the domain of using geoprocessing software."
"Learning about manipulation of QGIS software and field and documentary research techniques".
"The use of the tool we chose, since this was also used in other tasks proposed by the teacher for the high school classes. The data collected in the survey were also shared as an example in elementary classes. "

This comment is interesting because it is clear that the teacher used the material and the software with other students that did not participate on the Olympiad. This teacher could multiply the new learning.

More Comments:

"Using the Google map program and how to deal not only with cartographic equipment but also how to deal with the technologies and the socio-economic and historical context of our own country".

About the participation on Cartographic Olympiad's tasks and about what have changed in the way they deal with spatial representation, they said:

The practical tests have made us add many knowledge and skills. We developed not only cartographic knowledge, but geography, geodesics, topography, mathematics, art, history, sociology, economics, technology, among other areas. What has developed our intellectually, preparing us for the future."

This phrase mentioned above makes us refer to Kerski (2015) when he said that,

"For centuries, maps have been valued because they provide a large amount of details in a small amount of space, and because of their capacity for telling a story".

Other comments about the activities:

"I think they were very interesting proposals, quite different and unexpected by everyone from any team, I imagine. This makes us leave our comfort zone and pick up and research things that would hardly attract our attention outside the Olympiad."
Participation has stimulated me to seek new knowledge and changed my way of visualizing the geographical space, because a project like this Olympiad captures the student in a sphere of knowledge that alters previous conceptions about that area. "

This speech is full of meaning; it expresses thoughts and feelings about the role of education.

Other comments:

"Yes, because before there was the notion that cartography was just the analysis of maps and scales. With the Olympiad we can bring to our everyday routine and build more concrete points."
"It has changed a lot, so much that I intend to go to college on this subject and teach at a technical college here in my city."
"I loved the experience, OBRAC changed the way I see the world and showed me how I can participate in it."
"Because we ourselves have built the instrument and the maps, we have learned a lot ..."

This is also interesting to point out because this phrase above shows how important is to really do the work, as they did their spatial representation, starting from the data survey, the field work.

For Damiani (2002), the notion of citizenship involves the sense people have of their place and space, since they are the materialization of relations of all orders, both near and far. One who knows about the geographic space can understand the network of relationships to which he or she is subjected and from which he or she is subjected. The author also says that alienation of geographic space and citizenship constitutes an antagonism to be considered.

For Hasse (1999) all the revolution in communication allows much more than the diffusion and socialization of information among people, since the knowledge we have, from the place we live and from other places throughout the world, increases our chances of understanding and interfering in the world. However, some schools resist about innovations or at least they are not in line with students. That is, there is a disengagement of the relationship between young people and school culture in contemporary times, as Bauman (2001) points out; they are the young people of liquid modernity in the school of solid modernity.

Many times the problem becomes worst because of laboratories infrastructure conditions and excessive working hours for teachers. This situation turns the technological innovation in education in a challenge for educational systems, especially in cartography classes when it is considered all spatial information available on the Internet. Otherwise it is important to have in mind that,*"information wants to be free"* as Stewart Brand said[1], that is, people should have freely access to information or as Gans (2012) argues *"Information wants to be shared".*

Conclusions

Information is a social right for all; it should be shared indistinctly, since there is no exercise of citizenship without access to information. It is hoped that the collection of available materials focusing on secondary education may contribute to a new approach to cartography content explored in schools, promoting cartographic knowledge from challenging, integrative and citizenship-oriented activities.

It is expected that the proposal of activities and challenges related to the spatialization of important environmental, historical and cultural aspects of the diverse and heterogeneous regions of the country, addressed in the scientific Olympiad, can promote and encourage the appropriation of science, technology within geospatial knowledge and also stimulate school interest in the mapping science, promoting socialization of teachers and students through group

[1] This iconic phrase is attributed to Stewart Brand at the first Hackers Conference in 1984.

activities that foster the interest in the field of Cartography. And that this may also contribute to an emancipatory education, enableing students to gain autonomy**.**

However, the use of softwares as the GIS, and the geotechnologies like GNSS (Global Navigation Satellite System) and remote sensing images in school activities, as the teams did in the OBRAC's proposed tasks, is not in itself the solution to the issues related to educational and social problems, but the information they mobilize can encourage knowledge and citizenship actions. So, the inclusion of challenge tasks in teaching practices would have positive impacts for students, in view of the large amount of data available with free access on the web that should be understanded. For Di Maio and Veiga (2015), geoinformation can provide tools to think spatially and to help consolidating the social use of spatial information.

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