

# CARTOGRAPHIC INITIATION FOR YOUNG STUDENTS, USING AERIAL PHOTOGRAPHS AND SATELLITE IMAGES

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## **ABSTRACT:**

The process of mapping does not occur disconnected from all the other individual mental developments. The acquisition of the environment notion is a complex and progressive process of great importance for individuals development. It is unquestionable the importance of the cartographic formation, as part of the whole educational process of children and young people, taking into account the needs of human relations with the geographical space and the modern maps technologies. The alphabetising process has been always a problem that attracts the attention of educators, being faced as a teaching/apprenticeship process of reading and writing in a certain language. However, educators do not give to "map" the same treatment they give to reading and writing. In Brazil, maps are not used in the school as means of expression and communication, as they could and should be. Thus, because of the scarcity of didactic material for cartographic initiation, this work was developed with the objective to prepare a map initiation textbook, using remote sensing products (aerial photographs, satellites images). The textbook was divided into two parts, i.e., the first one related with the "cartographic initiation", presenting to the students basic orientation. The second part refers to the "cartographic products interpretation process", the map language reading, when the students read and interpret maps, aerial photographs and satellite images. The examples presented in this textbook were of the environs of São José dos Campos, the Paraíba River Valley and São Paulo North Coast Regions, familiar to the students. This cartographic initiation textbook intends to put young people in contact with maps and the new technologies used to prepare and use them, as well as it will contribute for young students citizenship, permitting them favourable actions to nature, as members of a particular city and region.

## **1. INTRODUCTION**

A map is a form of language older than the proper writing. It is known that the ancient people that were not able to register their happenings through writing expressions did it through graphic language. Map making to represent ideas about the geographical space is as antique as the proper human civilisation.

The cartographic practices vary in different societies along the time. So, maps could be seen as true "cultural texts". Some maps researchers say that maps are not impartial, because they transmit a certain vision of the geographic space, showing the acknowledges and carrying the way of life of the persons that prepared them. A map is considered an image socially constructed, thus, is desirable to comprehend the society that produced them. Thus, maps utility is proved since the first drawings done by the cavern men. Map-making is really a human necessity to know where things are located and where the events occur in earth surface. Maps preparation appeared as a manifestation of an immediately utility, influenced by the pressure of fundamental human needs, as for instance localisation, orientation, showing an efficient tool in terms of defence, security and movement (Oliveira, 1977).

There exist few maps prepared by the ancient people, due to the material they used to make them (destroyed by the time action).

Each society has some different way to produce images of the space they live that show cultural aspects of the people that produce them. The history of maps and map-making showed an intense technical refinement process and also several scientific improvements. The "cartographic techniques" passed through complex and differentiated processes, according to each culture interests, each one inserted in a special context and epoch, being some of these historical moments particularly relevant (Raisz, 1962). So, it is possible to conclude that through maps we infer that the geographic environment is historically produced by man, while he economically and socially organise society.

Oliveira (1977) comments about the complexity of map making, which originates, consequently, a product also complex to the map user. She refers to this communication process between the map maker and the map user. As the map is a symbolic system, the complete cycle of the map, as a model, constitutes a generalised communication system. The education for using and reading maps should be considered as the acquisition of some abilities by the young students, that will enable them to read the environment, to represent it and to construct some concepts about spatial relationships (Passini, 1997).

Thus, it is necessary a psychological relation between the map maker and the map user. It is possible to conclude that the most important map function is that one related with the "audience",

for whom the map is prepared. Both general and thematic maps are made for a variety of audiences. These range from young schoolchildren to college students, to the technical engineer (Robinson et al., 1984).

Rangel and Targino (1997) emphasise the cartographic acknowledgements value for young students, as well as the appropriation of the cartographic language, considered an important point in young people education, in order to prepare them to a new dialogue with the present moment and with the future. Le Sann (1997) also comments that maps have great potentialities for the introduction of cartographic information for young students, because as they “translate” the information, through a graphical language, they are increasing young student’s capacity of logic reasoning.

The present moment is richer, has a strong dynamic, in such a manner that strongly presses Schools for adapting their education curriculum to the new times. There can be no doubt that Cartography for educational purposes is one of the subjects most affected by the technological progress, considering that the map could be and should be the “image of the world” (Filizola, 1996). The changes in the process of making maps illustrate recent mapping advantages. Many times, in Brazil, teachers are not prepared or do not have specific competence in Cartography, having no conditions to treat maps as a communication and expression form.

The acquisition of the environment notion is a complex and progressive processes of great importance for individual’s development. This notion is not only restricted to geographic and cartographic subjects, but is inserted in all the fields of knowledge. So, it is important to promote cartographic initiation since the first years of children in school. Thus, Geography and Cartography should conduct the students to better understand “the reality”, facilitating their intervention in the environment. It is necessary to develop individual mapping experiences to cartographic processes.

Oliveira (1977) presents an important point of map didactic problem, that is, the process of mapping did not occurs disconnected from all the others individual mental developments. The maps are drawing prepared by human hands and controlled by human mind. It is also man who selected facts and the technique to complete mappings, revealing a certain subjectivity, when cartographing objective realities.

A map is only one of the most possible forms to represent reality. The writing and spoken languages are closed related to mind activity. According to Matias (1996), the researches about the “act of mapping” have the main objective to understand the functioning of mental processes involved in the perception, comprehension, memorising and problem solution tasks related to maps. The “map users” must be actives, with a real capacity to filter information, to act in a selective form, accumulating experiences and creating acknowledges, refuting the image of “passive information consumers”. Matias emphasises the great interaction that should exists between Cartographic subjects and Human and Social Sciences.

Nowadays, the map is a current use instrument as in scientific researches, as well as in territorial planning or in daily life. Maps are seen and used in school, are presented in television programs, used in newspapers, magazines, scientific papers etc. However, for most people, maps serve at most to situate a place or to prepare an itinerary that they not always know how to use.

Today, maps are prepared using aerial photographs and satellite images, with remote sensing technology.

The need to prepare children and young students to the new requirements of life, with updated information, is a requirement of all the schools. There can be no doubt that the cartographic language should be inserted in the first years of children in school, as soon as their mental development permits to understand the environment round about them. In Brazil, normally the schools do not give to the map the same treatment they give to reading and writing. Besides this, as mentioned before, the great part of teachers are not prepared to introduce the students in reading and making maps experience, in the comprehension of symbols, what would give to the students support to better understand the geographical space (Oliveira, 1977).

At this moment, the world is more and more connected to maps, codes, legends, related to cartographic products, in different scales, as photographs in soil level, aerial photographs, orbital images, as well as with the great Computer Science evolution. It is obvious the need to prepare children and young students to face technological challenges. They already live together with virtual realities, through electronic games, the Internet, television, as well as they use or observe several scales, for instance when they observe the city from their apartments or when they travel by plane. Many of them have some perception of the environment they live and are in condition to “interpret” this space. However, the great majority of them should be prepared for it. All maps are abstractions of reality. The real world is so intricate and complex that requires a special orientation.

Knowing about the scarcity of didactic material for Cartographic Initiation in Brazil, and also about the potentialities of the remote sensing techniques and products, this work is planned and prepared to a special audience, i.e., young students.

## 2. OBJECTIVES

This work has as Main Objective to propose and develop a “Cartographic Initiation Textbook for Young Students, using Aerial Photographs and Satellite Images” textbook.

To attain this General Objective, it was defined some Specific Educational Objectives, as follows:

- a) To evaluate the existing material about Cartographic Initiation, through specific bibliographies, as well as interacting with specialists on this area.
- b) To plan and develop a Cartographic Initiation Textbook for young students, presenting cartographic basic notions, using aerial photographs and satellite images of São José dos Campos Municipality, the Paraíba River Valley, and the North Coastal Region of São Paulo State, Brazil, considering their map understanding, the knowledge of how to “read”, to “represent” and “use” maps properly.
- c) To test and evaluate the Textbook, Chapter by Chapter, through an interaction with Specialists in Cartography, verifying their efficacy and need for modification.
- d) To test and evaluate the textbook with young students (14 years old), through an interaction with a group of students (4 students), verifying the comprehension they have of the text and of the cartographic products.
- e) In the text of the Master Thesis, to discuss the results, obtained in contact with Specialists (Cartography, Remote

Sensing, and Education) and the students, analysing the graphic language reading and interpretation process, considering the importance of the Cartographic Initiation for young students.

This work considers that, using remote sensing products, the students could have more interest to learn Cartography that will influence in a better apprenticeship of the cartographic process.

The great part of the cartographic examples is from the geographical space of São José dos Campos Municipality, the Paraíba River Valley and from the São Paulo North Coastal Region (Brazil), familiar to the students.

### 3. CARTOGRAPHIC COMMUNICATION

#### 3.1 The Textbooks in Brazil

During the bibliographic research process, two educational publications were identified, considered as "Mapping Textbook", i.e., that presents the cartographic subjects little by little, increasing in difficulties till the end of the publication, when the students will be able to understand cartographic bases and to produce and "read" cartographic information.

Through this bibliographic research, it was registered some groups of researchers that work with Cartographic Initiation, concentrated in the South and Southeast Regions of Brazil (States of São Paulo, Rio de Janeiro, Minas Gerais, Paraná), coinciding with the most progressed area of the country (scientific and technological areas). In fact, the cartographic basic notions were found distributed among Geography and Cartography books, in Thesis, Atlases and scientific reports, specially related to Educational Cartography and Environmental Studies as a whole. Two educational publications, specifically directed to Cartographic Initiation, through textbooks, characterised by the presentation of the subjects by degrees. These two studies were developed in the São Paulo University (USP), by Simielli (1995), and in the Júlio de Mesquita Filho State University (UNESP/Rio Claro), by Almeida, Sanchez and Picarelli (1996). These researchers presented works of Cartographic Initiation to children and young students, using aerial photographs, essential for cartographic initiation.

Besides the "textbooks", the didactic textbooks in the area of Geography and Atlases have been presented "Cartographic Initiation" subject through several methodologies, using conventional materials and products, as well as aerial photographs and satellite images (minor number). Le Sann (1996, 1997) has been working with pedagogical "Interactive Atlases" of cities of the Belo Horizonte Metropolitan Region in Minas Gerais State, introducing cartographic subjects to children and young students, using remote sensing products and conventional cartographic products. There are also Brazilian researchers that use others resources, besides Textbooks and Atlases.

However, the Cartographic Initiation works, using remote sensing products, as aerial photographs in several scales (black and white and coloured) and satellite images, are in smaller number, in comparison with these mentioned works. This constitutes one of the reason for the development of this "Textbook", besides the motivation of being preparing young students to take profit of the remote sensing products and technology that the Institute for Space Research (INPE) is using for more than 30 years. INPE receives and processes satellites images, transferring this technology to research institutes,

universities, governmental and non-governmental organisations, in Graduate and Postgraduate levels, with less significant works directed to children and young students, considering the remote sensing technology potentialities, as well as the number of students Brazil has in these two levels (Elementary Education and High School), that need to assimilate this technology.

### 4. METHODOLOGY

To prepare this work, a Master Thesis is developed, including a Cartographic Textbook for young students, using remote sensing products (aerial photographs and satellite images). It was necessary a series of methodological procedures, since a bibliographical research about Cartography, specially about Cartographic Initiation, remote sensing data and products, in order to form a data bank to support the textbook preparation.

It was started by the planning of the "**Textbook Structure**", dividing it into **Cartographic Basic Notions Chapters** (First Part). After this, it was established the Second Part, dedicated to **Map Reading Chapters**.

The planned structure of this textbook was discussed with specialists in Education and Cartography, in order to obtain the final "textbook structure", according to Brazilian Educational Ministry requirements, to the Cartographic Initiation subjects. These interactions were really important from the beginning to the end of the work.

These efforts were important to support next work, i.e., to prepare each chapter, the necessary revisions to correct the information distributed along the chapters, as well as the need for illustration. These data were acquired from many sources, using illustrations already prepared, adapting or preparing other ones, especially for the textbook. To complete this phase, each Chapter requires sometimes four drafts till its final version.

Among the material used, it was really important to select specific remote sensing products, which supplied the "textbook" with the best aerial photographs (black and white or coloured – from 1947 to 1998) or satellite images of São José dos Campos Municipality, the Paraíba River Valley Region and the São Paulo State North Coastal Area. So, remote sensing products are considered as important methodological basis for this textbook, constituting the central point of this cartographic initiation. Remote sensing products constitutes an important part of mapping, increasingly so with modern developments in electronic data processing and satellites. Young students must be aware of and understand these developments in remote sensing to make the most use of them.

### 5. RESULTS

#### 5.1 - The Textbook Structure

The textbook "Cartographic Initiation for Young Students, using Aerial Photographs and Satellite Images" constitutes the final product of the Master Thesis (Soares; Kurkdjian; Di Maio, 1999). The resource to divide the textbook into Chapters showed to be efficient by the obtained results in the Test Phase with the students. It is known the need to improve it through testing the textbook in real situation of a classroom, when it will be evaluated by another form and others improvements will be incorporated in this didactical material.

To obtain this Structure and Sequence of Chapters, it was necessary to make specific researches. After the researches, it

was established the final Structure and Sequence of the Textbook Chapters, dividing the cartographic subjects in "Cartographic Basic Notions" (First Part) and "Reading and Maps Interpretation" (Second Part). The textbook division in Chapters, with the two mentioned great parts, is presented as follows.

## **CARTOGRAPHIC INITIATION FOR YOUNG STUDENTS, USING AERIAL PHOTOGRAPHS AND SATELLITE IMAGES**

### **First Part - Cartographic Basic Notions**

#### **Chapter 1 – Maps History**

Definitions, Ancient and Modern Maps, the History of Map making.

Selected References.

#### **Chapter 2- Forms, Contours and Forms Combinations**

The real world seen from different positions.

Vertical and Oblique aerial photographs: forms, shapes and forms combination.

Selected References.

#### **Chapter 3 – Map Scales: Differentiation, Importance and Measurements**

Measurements and Proportions in Mappings. Graphic or Bar Scale and Area Scale.

Selected References.

#### **Chapter 4 – Localization: Orientation and Geographical Coordinate Systems**

Means of Orientation, Orientation through Instruments. Geographical Coordinates (Localization of Points in Earth Surface). Latitude (Length of a Degree of Latitude) – Longitude (Length of a Degree of Longitude).

Selected References.

#### **Chapter 5 – Introduction to Map Projections - The Classification of Projections**

Terrestrial Globe, World Maps, Maps. Classification of Projections (Cylindrical, Conic and Azimuthal Projections). Mercator Projection.

Selected References.

### **Second Part – Reading and Maps Interpretation**

#### **Chapter 6 – Planimetric Maps**

Cartography: Steps to read Maps: Titles, Legends (various symbols used, arrangements of the components), Scales, Geographical Coordinates, and Directions on the Earth, Localization, Data, Source of Data, Authorship, and Data Interpretation.

Selected References.

#### **Chapter 7 – Topographic Maps**

Cartography: Hill-shaded Topographic Map. Terrain Features. Styles of Contour Lines.

Spaced Outlines on the Map. How to read Topographic Maps. Topographic Map Example: São Francisco Xavier District hill-shaded topographic map (contour interval lines - depression contours – from 2.082 meters till 800 meters of altitude).

Selected References.

#### **Chapter 8 – Cartography and Remote Sensing in Landscape Representation**

Landscape Transformation by Society. Aerial Photographs and Satellite Images in surveying Geographical Space Transformations. Examples: Aerial Photographs and Satellite Images of São José

dos Campos (different scales and dates) to emphasize urban transformation.

Selected References.

#### **Chapter 9 – Remote Sensing**

The Aerial Photographs and Satellite Images Uses in Cartography. The Remote Sensing Technology. Examples of the São José dos Campos and Paraíba River Valley.

Selected References.

#### **Glossary of Technical Terms**

### **5.2 - Test Phase**

This textbook constitutes the chosen resources to attain young students of the last period of the Elementary Education (14 years old) with "Cartographic Basic Notions" (First Part) and "Reading and Maps Interpretation" (Second Part), preparing them to be "map-makers" and "map-users".

The test phase with the students is considered a methodological step of great importance to "evaluate" this didactic material. The test program was done with four students (14 years old), during a nine meetings periods (October/November, 1999). This contact with young students showed that the use of aerial photographs and of satellite images contributed to motivate them to study cartography, as well as to certify them of the importance of this technology actually and in the future. According Auricchio (1977, p.228), this kind of test with small groups of students has the advantage to make a close contact with them, contributing to detect difficulties or possible errors in the didactic material, making possible corrections, improvements etc.

### **5.3 - Interactions with the Students**

During the test period, the students showed interest to use aerial photos and satellite images, putting into practice identification tasks, selecting elements, mapping different areas, using overlays, pencils for map reproduction etc. Several contours in aerial photos and satellite images were done by the students, originating simple maps of the geographical space of São José dos Campos (State of São Paulo, Brazil).

This motivation was based on the fact that they are using a "different kind of textbook" they normally used, provoking a positive reaction on the students. Another point of interest was the fact they are using remote sensing techniques, something new that could be useful for them in the future.

During this period, the interaction with the students proved that the use of aerial photos and satellite images in this textbook was considered useful for them. Thus, it is supposed that, in the future, when this textbook may be taking part of normal class periods, teachers will have better conditions to present cartographic notions to the students, showing them the São José dos Campos environment with success.

After evaluation, it is possible to say that the young students have all the conditions to understand and use remote sensing for cartographic purposes without great difficulties. This kind of material constitutes a motivation to study Cartography. Another important point registered is that as the students work with aerial photos and satellite images of a known geographical space, they have more interest to study cartography of a known place. To prepare young students for reading and using maps should include their action as map makers. This cartographic

material prepares them to better know their space, as well as to love this space and take care of it with responsibility.

## 6. FINAL CONSIDERATIONS

During the test period, the students showed interest to use aerial photos and satellite images, putting into practice identification tasks, selecting elements, mapping different areas, using overlays, pencils for map reproduction etc. Several drawings using aerial photos and satellite images were done by the students, originating simple maps of the geographical space of São José dos Campos, presented by aerial photographs or orbital images of this test site. This motivation was based on the fact that they are using a "different kind of textbook", different from the books they normally used, provoking a positive reaction on the students. Another point of interest was the fact they are using remote sensing techniques, something new that could be useful for them in the future.

To complete the project of this Master Thesis, it is planned to prepare "Teacher Manual", as well as a material for "Teachers Cartographical Training". It is hoped to obtain a financial support for preparing orientation material, related to chapter by chapter of the "Text Book", in order to offer the teachers other cartographic examples and details, not appropriate for the textbook used by the students. This new phase will be important, facilitating teachers work, furnishing them information about cartography, remote sense techniques and products with more details.

After evaluating this test period, it is possible to say that the young students have all the conditions to understand and use remote sensing for cartographic purposes without great difficulties. This kind of material constitutes a motivation to study Cartography. Another important point registered is that as the students work with aerial photos and satellite images of a known geographical space, they have more interest to study cartography of a known place. To prepare young students for reading and using maps should include their action as mapmakers. This cartographic material prepares them to better know their space, as well as to love this space and take care of it with responsibility.

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