

## REMOTE SENSING IN DIFFERENT EDUCATION LEVELS: A CASE STUDY

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Commission VI, Working Group VI/1

**KEY WORDS:** Remote sensing, Geography undergraduate course, transference of knowledge, elementary and high school education.

### ABSTRACT:

Several authors have been discussing the importance of remote sensing in different education levels, pointing out the need of adaptation of the acquired knowledge, or better, the conversion of graduation level knowledge, for instance, to elementary and high school levels. In this sense, the lecturers involved with Geography undergraduate course in the University of Vale do Paraíba (UNIVAP) have been having this concern. The students study Remote Sensing and Geoprocessing, along two years in three disciplines, they are involved with the content considered important for the understanding of this area of knowledge. This Geography course forms elementary and high school teachers and bachelors and the content of these disciplines seeks this professional's solid formation, considering that they will become technicians and educators. In this way, the purpose of this paper is to deal with this discussion and to describe the experience, quite productive, that the professionals involved with remote sensing education in the Geography course of UNIVAP have been having.

### 1. INTRODUCTION

The methods and the theories of the Traditional Geography became insufficient to apprehend the reality and its complexity and, mainly, to explain it, considering the changes happened in the World in the last 30 years. The surveying done through empiric studies became insufficient. It is necessary to accomplish studies interrelated to the analysis of the World interaction. On the other hand, the technical and scientific transformations get strong influence in the researches accomplished to the field of the Geography. The geographical spatial study, in the new global view, begun to appeal to technologies as the remote sensing and computer sciences, this one as articulator of the amount of data, that developed for the geographical information systems - GIS (MEC, 1999).

In this reasoning line, in the Document of Camburiú (Sausen et al., 1997), generated during I Remote Sensing Educational Seminar in Mercosul Ambit, in the period from 20 to 23 May, 1997, it was suggested the compulsory nature of remote sensing in Undergraduation Geography courses. This suggestion is due to the fact that the undergraduate of these courses will be the Geography teachers in the elementary and secondary levels, being them, therefore, the ones who should teach the basic spatial and environment notions, themes which the remote sensing can be extremely useful. In addition, the geographer's formation as technician belongs remarkably to a professional that works in multidisciplinary teams, where the knowledge of this science and technology is of vital importance (Sausen et al., 1998).

In this sense, the teachers involved with the Undergraduation Geography course in the University of Vale do Paraíba (UNIVAP) have been having this concern. Remote Sensing and Geoprocessing are taught along two years in three different disciplines, the first one is related to the fundamental contents

for the understanding of this field of knowledge. This Geography course forms teachers and bachelors and the contents of these disciplines seeks this professional's solid formation, considering that they will become technicians and educators. To transform the academical knowledge, without deforming it and without depreciating it, in teaching object, it supposes a didactic conversion that nor vulgarize and nor impoverish the academical knowledge, but that comes as a differentiated construction, accomplished with the intention of assisting the students (Simielli, 1999).

Starting from this premise, there is a concern with the transfer of knowledge, having in view that a elementary or high school is not a summary of the academical knowledge (Hugonie apud Simielli, 1999). In other words, the purposes, the objectives and the means of the practice of remote sensing in Geography are not the same ones in the University, in the elementary school and high school teaching.

In this sense, the objective of this paper is to focus on this discussion and to report the experiences, quite productive, that the professionals involved with remote sensing teaching in Geography have been having.

### 2. THE GEOGRAPHY UNDERGRADUATION COURSE OF UNIVAP

The Geography Undergraduation Course, offered in UNIVAP, was created in 1990 having a curriculum directed to graduating geography teachers in four years. This professional was very uncommon in the Paraíba Valley Region and this course came to supply the deficiency of this professional in this Region. However, it was not usual to use remote sensing as a didactic – pedagogical resource.

In the year of 1993, there was a curricular reformulation, when this course also begun to enable students for the bachelor

degree, when the disciplines of remote sensing and geoprocessing were introduced. The idea of introducing these disciplines came as a necessity to make available to the geography student an effective and important technique for monitoring the environment, theme of the geographers' interest.

It is important to point out that the proximity of the University in relation to the National Institute for Space Research (INPE) made possible the creation of a well equipped remote sensing laboratory. Since then, the course of Geography has worked actively with the students in this research line, in the level of Scientific Initiation and in the classroom activities as didactic resource in several disciplines. The students' experience, in relation to the use of this technique as didactic resource has been generating many researches, that are contributing in the teaching - learning process in Geography. Along this paper, some of these experiences will be described, as much in the sphere of education as in the environmental analysis.

### 2.1 Remote Sensing and Geoprocessing in the Geography Course of UNIVAP

There are three courses that offer the remote sensing discipline in the curriculum: Geography, Architecture and Social Sciences. However, only the Geography course possesses 3 disciplines responsible for Geotechnologies: Introduction to Remote Sensing, Introduction to Geoprocessing and Applied Remote Sensing. These disciplines are offered in the university year 3 and year 4 of the course, corresponding to 200 hours in class. With the objective of offering to the future bachelor and teacher technical subsidies to facilitate the urban and regional environmental characterization and monitoring. In this way, the domain of the techniques of remote sensing products interpretation enlarges the possibilities of the professional's performance in the job market (Di Maio Mantovani and Costa, 1997). The structure of these disciplines can be visualized on table 1.

Introduction to Remote Sensing (80 hours)	Introduction to Geoprocessing (80 hours)	Applied Remote Sensing (40 hours)
Year 3	Year 3	Year 4
1. Introduction, Definitions and History; 2. Physics Principles; 3. Sensor systems; 4. Remote sensing of vegetation, water, urban landscape, soils and minerals; 5. Elements of Visual Photography and Image Interpretation; 6. Some Applications.	1. What is a GIS; 2. The GIS nature and conceptual model; 3. GIS Subsystems; 4. Data formats; 5. Spatial analysis 6. Cartographic Modelling; 7. Applications .	1. Remote sensing products potentialities; 2. Digital methods of information extraction; 3. Land use interpretation methodology; 4. Thematic maps generation

Table 1 – Contents Program

The access to this knowledge has been propitiating the students to use this technique in their final monographs, besides the students have been taken on by companies in the Region, for the apprenticeships accomplishment or even as professionals.

## 3. THE INTERFACE BETWEEN THE GEOTECHNOLOGICAL DISCIPLINES AND THE STUDENTS EDUCATION

### 3.1 The Influence in the Undergraduation Monographs

The existence of the remote sensing disciplines along the course of Geography has been waking the students interest in developing final monographs using the knowledge of this tool. In the year of 2001, the work developed by Oliveira (2000) was selected by the scientific commission of X Remote Sensing Symposium as one of the better five in the category scientific initiation, submitted to the event. Some of this researches developed along the last 3 years are shown as follow.

1) Santos and Silva (1999) obtained as a result of their research a land use map that allowed the identification of different classes of land use in the municipal district of Bananal, located in the State of São Paulo, using LANDSAT/TM image, colour composition 4R3GB5, scale 1/50000, acquired in October, 1998. This map made it possible to identify the farms that is still on production

2) Scheide (2000) used aerial photographs, obtained in 1962, 1973, 1985 and 1997, to map the urban land use changes in the São José dos Campos city, São Paulo, with the purpose of understanding the city functional changes.

3) Oliveira (2000) used MSS image, obtained in 1977, TM image, obtained in 1985 and SPOT-PAN image, obtained in 1997, to map the urban growth of the city of São José dos Campos, SP, comparing the potentiality of the sensors with the ground truth (aerial photographs). In this sense, it was possible to verify the consistency of the orbital data as substitutes of products of better spatial resolution to urban growth mapping.

4) Lopes (2001) mapped the green areas of the city of São José dos Campos, along 40 years, classifying them in two classes: native forest and reforestation. This mapping was accomplished using aerial photographs obtained in 1962, 1973, 1985 and 1997, which made it possible to visualize the process of green area loss in the urban perimeter along the studied period. The author also calculated the green index by inhabitant.

5) Bruno (2001) had as a result of her research urban occupation monitoring in risk areas in the municipal district of Caraguatatuba, state of São Paulo, using remote sensing and GIS data processing. In this research LANDSAT/TM image, obtained in 1989, and LANDSAT 7/ETM image, obtained in 2001, were used to monitor the urban growth.

6) Freitas (2001) accomplished a spatial urban dynamics study of the South Zone of São José dos Campos, São Paulo, using aerial photographs obtained in 1962 (scale 1:25.000), 1977 (1:8.000) 1988 (1:10.000) and 1997 (1:10.000). This study had as objective identifies the spatial changes concerning the residential occupation.

7) Bastos (2001) tested a methodology to teach the relief features in elementary education, using remote sensing orbital products, such as TM image. According to the author, there was a better students learning in the identification of the features, using those products.

### 3.2 Didactic Conversion of the Academical Knowledge

The remote sensing discipline program allows the apprehension of foundations and techniques of this science, and when associated to the discipline of Teaching Methodology and Practice of Geography it integrates the theoretical knowledge into the practice in the classroom, starting from proposed procedures and didactic activities.

The Geography undergraduate students, possessing remote sensing material and with the acquired theory, have as objective to adapt these knowledge for the elementary and high schools students.

The first step is the material elaboration during the Teaching Methodology and Practice classes, assisting to some criteria as:

- to adapt the written and visual language to elementary and high schools students;
- to relate remote sensing materials to the Brazil's Elementary and High Schools Education Curriculum objectives;
- to plan contextual practical activities;
- to produce the corresponding didactic material to the activity;
- to obtain the necessary images for the activity accomplishment (of the city, of the state, according to the appropriated scale etc.).

After this stage the undergraduate students apply/test the material with the elementary and high school students of the public and private sectors.

The procedures of a second stage follow some criterias as the activity adaptation to Teacher's planning for the group, to the elementary teaching level or to the geography discipline, for high school teaching level. It is essential not to lose the view that the objective is to teach geography with remote sensing aid, and not to teach only remote sensing. Remote sensing works as an important tool for the Geography principles interpretation.

**3.2.1 Experiences in the Classroom:** Considering the pedagogical practices of geography students, initially, they explain the historical evolution of remote sensing techniques, going by the period of the "cold war", subject meditated in year eight e program of elementary school, until current days, showing the evolution of the images and its different applications.

Along the classes, the students participate questioning and reporting the previous knowledge on the approached subject, such as some documentary that they had watched on television, and others.

In some activities, the students, divided in groups, manipulate aerial photographs, and they visualized the terrain in three dimensions using a pocked stereoscopy, through which the students can recognize features and describe the observed area.

At the end of the activity, they elaborate posters with the terrain information that they observed and set up an exhibition, where each group relate about their study area and their experience with the didactic material.

In other activities, orbital images and maps are used in different scales, of the Municipal district of São José dos Campos, to explore some aspects that are explained as follow.

#### ➤ **Localization**

- objective: to identify in the image some spatial elements

- steps: detection of reference planimetric features in a map (scale 1:100.000), for example: airport, rivers, shopping etc; to associate the place identified in the map with the image used in class; starting from this association, a number of hypotheses is picked up by the students taking into account the features that they observed in the image, mainly in respect to the forms and colors/tones that indicate the interpretation, that happens naturally.

#### ➤ **Where is My School?**

- Objective: to build up concepts of localization and neighborhood;
- Steps: using remote sensing data with different spatial resolutions (aerial photographs, SPOT/TM/IKONOS images), the student is motivated to locate the school, in detailed scale product, such as aerial photographs, evaluating the neighborhood. It is provided, to the student, the possibility to recognize some known spatial aspects;
- Starting from this recognition, the geography undergraduate student uses other products, in smaller scales, to show to the students how the school is placed in the neighborhood, the neighborhood in the city, and the city in the municipal district;
- This activity is lectured to year five students of elementary education.

#### ➤ **Working on the Concept of Scale**

- Objective: to develop the concept of scale;
- Steps: Just as the previous activity, orbital images are used, in different scales, such as SPOP, LANDSAT and NOAA, to show to the student of year five that, depending on the scale, there is the possibility to visualize different geographical spatial details;
- The undergraduate student takes advantage of this opportunity to discuss with the students some local, regional, and national spatial elements.

#### ➤ **Physical Aspects of the São José dos Campos Landscape**

- Objective: to introduce the students to some landscape physical concepts working on their own reality;
- Steps: a) Flood Area: using TM images, the undergraduate student shows to year six students of elementary school how the flood area is occupied in the municipal district and in the Region of the Paraíba Valley (agriculture, urbanization, industry etc), trying to explore the aspects related to the occupation process;
- b) Mar and Mantiqueira Mountains: The undergraduate student, through the TM images, explores the textural aspect of the image to present the student the two mountains that cross through the Region of Paraíba Valley, its dimension and altitude.

#### ➤ **Spatial Dynamics: Deforestation and Urbanization**

- Objective: to comprehend the spatial transformation, its velocity, causes and consequences;
- a) Deforestation: using two images (MSS and TM), obtained in different dates (1977 and 1993), the undergraute student explores with the students of grade six the process of deforestation in the Amazônia Forest , discussing the size of the agricultural farms, the diversity of occupation and the intensity of the process;
- b) Urbanization: using MSS and TM images of the city of São Paulo, of different dates and scales, the undergraduate student, during his/her training, explores, in classroom, the urban dynamics and life quality.

All the products used by the students are elaborated in the discipline Introduction to Remote Sensing associated to Teaching Methodology and Practice discipline.

#### 4. FINAL CONSIDERATIONS

There has not been yet an evaluation, considering the formal point of view, of the consequences of using these products in the classroom for the Geography undergraduate students in their supervised apprenticeships. Even though, the return that they have from the students, in classes, is of a great acceptance and an immediate interest for the approached theme.

Preliminary results show that remote sensing is an effective teaching aid, although it is necessary to do some formal classroom assessments. It provides pedagogical benefits for students and these benefits focus on making the learning process more interesting.

It is providing teachers at different educational levels with a tool to teach Geography. Using a new technology in the classroom is not easy due to inadequate didactic material, technically inexperienced and reluctant teachers but it is hoped that teachers be encouraged to use and take advantages of remote sensing technology and methods to improve the quality of education and to help keeping the students interested in Geography.

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