

USEFULNESS OF TUTORIAL ON REMOTE SENSING AND ENVIRONMENT FOR THE ACTIVE TEACHING OF GEOGRAPHY

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Since the 50s many atlas, tutorials and guides have been edited in different languages. Including aerial photography, photography taken from crewed spatial platforms (Gemini, Apollo, Space Shuttle, International Space Station, etc.) and images from helio-synchronous and geostationary satellites.

Most of these works have a didactic or educational intention. Its main objective is to train its readers and users (engineers, technical personnel, teachers, researchers and other professionals), providing a set of keys to be used in the photo-interpretation of satellite images and recognition of certain features and characteristics of the terrestrial surface. Depending on the geometry of the observation and of the height of flight of the used platform these images will be seen obliquely or vertically from the air or from the space.

One of the first and most popular tutorials, which incorporated a wide range of Landsat satellite images, has been the work of Short (1982). After an introduction of fundamental concepts related to remote sensing, the author tries to familiarize the reader with Landsat images and provides useful information for photo interpretation thereof, for comparison with aerial photographs and for the recognition of multiple geographical entities. In each chapter are proposed learning objectives. Several transparent sheets are included to be used in the proposed exercises. Other radar and multispectral images are included.

The Canadian Centre for Remote Sensing (CCRS, 2009) also offers an online tutorial that includes a wealth of imagery, examples and exercises that facilitate the learning of subjects related to Geography and other Earth Sciences.

At a national level, the National Geographic Institute coordinates the Remote Sensing National Plan and the Aerial Ortho-photography National Plan. Recently, it has developed a cartographic visor in which it is possible to visualize, in a dynamic and interactive form, a mosaic of images -of low, medium and high spatial resolution- and aerial ortophotos of the whole national territory.

<http://www2.ign.es/iberpix/visoriberpix/visorign.html>

The user can enable or disable other layers of information, such as a land use and land cover map (CORINE-Land Cover) and topographic mapping.

In short, it exists a wide range of didactic resources -tutorials, guides, images collections and atlas- that compile a wide collection of illustrative satellite images of different facts, phenomena and geographical processes that can be used at the classrooms in the active education of Geography and of other related disciplines, as Earth Sciences or Natural Sciences.

This work raises the hypothesis that, although the existence of this abundant and available material, most part of students and teachers of these subjects, in Secondary and High School, do not know its existence and/or do not use it due several circumstances. The lack of usage of these didactic resources and of other complementary ones causes, in some cases, a rejection attitude of the students to Geography and, in the extreme cases, to school failure.

The aim of this paper is to disseminate, to the Secondary and High School teachers, the Tutorial of Remote Sensing and Environment in order that, if they believe it's suitable, they could use it as didactic resource in their Geography, Natural Sciences and Earth Sciences classes. On the other hand, it is a question of thinking about its usefulness in the classrooms, doing a critical analysis about its possibilities and the difficulties of its usage.

Tutorial of Remote Sensing and Environment is a new online resource, located on the network, with free access, that looks forward to become a digest of spatial images with didactic usefulness for Geography and other related disciplines, as Earth Sciences and Environmental Sciences, education.

The tutorial objectives are:

1. Disclose the physical principles of remote sensing, the advantages over other systems and Earth observation, especially to provide a selected repertoire of environmental applications of remote sensing.
2. To provide quality visual aids to teachers of secondary education and upper secondary school to explain environmental processes that worry to the society.
3. Facilitate access to other educational resources, especially to other satellite images and aerial photographs, available in the image servers consulted.

4. To arise awareness to the pupils and tutorial readers on the need to preserve the Environment and to adopt a respectful guidelines with it.

Structurally, the guide is organized around seven chapters. The first one is a brief introduction. The second one summarizes the history of Remote sensing, in a very graphical way. The third includes a basic understanding of remote sensing for non-specialist readers understand the content of the tutorial. It includes a workflow that explains the different steps involved, from the collection of information to be processed, and obtaining products (maps, models, etc.). Also show different colour combinations and explains the differences between them. In the fourth chapter presents the advantages of Remote Sensing versus other traditional systems of Earth observation, direct observation through fieldwork or aerial photography. In the fifth chapter several natural risks observed from space are checked (hurricanes, volcanoes, earthquakes and tsunamis, floods and landslides), natural phenomena with a great radio coverage (big sandstorms, large landforms and glaciers) and the main rivers of the world, with its deltas and/or estuaries. In the sixth chapter, human activities are the main actor and the fingerprints that they leave on the territory and on the Environment. Deforestation effects, due the advance of the agricultural border or due forest fires, the impacts in the aquatic ecosystems due desiccation of the water bodies, its eutrophication or the hydrocarbons spills in the sea, the process of the world urbanization and the huge infrastructures are illustrated with a wide collection of satellite images. A serial of very important impacts are selected. It is analyzed the environmental consequences of these processes. These two last chapters are the most extensive and important. Intentionally the authors wanted to put more emphasis in them in order to improve the knowledge of the natural and human processes that influence the terrestrial and aquatic ecosystems and in order to aware all the societies to reinforce their commitment with the preservation of the natural resources and the achievement of a sustainable development. In the last paragraph, manuals and Remote Sensing tutorials are related. Where readers, students and teachers can deepen their knowledge and learning on this Earth observation technology.

The guide graphical resources are extensive: 260 figures illustrate its 197 pages. Beside to maps, field and spatial oblique photography, taken by the astronauts from several platforms, a total of 215 satellite images are the graphical principal resources. All the images have an auxiliary figure beside them. A terrestrial globe on which, indicate by a red point, the image is placed in its geographical context. Likewise, at the feet of the photograph it is indicated the sources of each image, so the reader could locate the image in the images server, in Internet.

The wide source of information has been used. Images have been downloaded, mainly, from the most relevant spatial agencies - as the American NASA, European ESA, German DLR, French CNES, Italian Agenzia Spaziale, the Taiwanese NSPO-, from the private companies consortiums of satellite images (Spot Image, Digital

Globe, GeoEye, Deimos) and from other cooperation or investigation environmental agencies (UNEP, USGS, NOAA, NCGIA, ITOPF, Red Cross, Institut de Geomàtica),

The tutorial can be downloaded, for free, from the Spanish Association of Remote Sensing website and from the Digital CSIC, institutional repository in the following links:

<http://www.aet.org.es/?q=guia-didactica>

<http://digital.csic.es/handle/10261/28306>

In the future, it is planned to add new updated images, as the those illustrating the volcanic submarine eruption in the surrounding areas of the Canary island of El Hierro, the recent Etna lava and ash emission, those related to the typhoon Washi, which is devastating The Philippines and is causing abundant landslides, floods and more than 400 dead men and those that show the effects caused by the tsunami generated by Tohoku-Oki's earthquake, in Japan. It is also planned to add some multitemporal images, in order to facilitate the comprehension of some described phenomena, dynamic in the time and in the space.

As it has been indicated, potentially, the guide can be of great help for the teachers responsible for subjects as Earth Sciences and Environmental, taught in second grade of High School. The examples that included in the guide can be used as didactic resources, at least in topics related to the major environmental problems. The frequent usage of the images in the classrooms can help to aware the students on the need to manage the land in a sustainable way. On the other hand, it frequently happens in the exams of university entrance, that questions include satellite images. Satellite images and geological photography are used in Secondary School in order to show specific geographical and geological features (impact craters, volcanic craters), geomorphologic phenomena (fluvial, coastal), meteorological phenomena and some images that helps to analyze, comparatively, the temporal evolution of ecosystems (glaciers) and of certain processes (desertification, forest fires).

It is suggested that the images should be projected on a digital whiteboard, on a screen using a video projector or visualized at the computer monitors of a practices classroom, as an example. Teachers can comment on precise details of an image selection, calling the attention on specific topics. Students can also be asked what they observe in the images, about the reasons of certain phenomena observed and bring the reflection around today relevant topics. As a result, the new European Higher Education Area (EHEA) planned objectives regarding more active educational methodologies, based in the employment of IT resources in the classroom, might be fulfilled. The basics of the active education can be set up to become the needed driver to fight against the traditional and deep-rooted memory based education of Geography. Marrón (2011), demonstrates the poor geographical training that the Spanish students have when arriving to the University and the perception they have of Geography. Based on the results of a survey, 76 % of the students that arrive to the University have

a weak knowledge level in geographical contents. 68 % thinks that the Geography is a slightly useful subject and 77 % confirms that the method used in the process of learning Geography, in Primary and Secondary School, is basically, memory based. Only 14 % of the students indicate that their teachers have used an explanatory method for the education of this subject. This situation must bring up the usage of active methodologies of education-learning and the use of new didactic resources. The tutorial presented in this paper can help to achieve that students and future teachers reach the basic objectives for the learning-education of the Geography in the 21st century; among others, the capacities of perception, orientation, systematization and understanding of space, environmental and social commitment values and the ICT management capacities.

Despite the potential usefulness of the tutorial, the actual use made of the same in the classroom may be limited. In order to know the reasons that reduce the usage of this type of audio-visual resources in the classrooms, several teachers of public and private Secondary and High School centres of the region of Madrid have been personally interviewed. Among the reasons arisen, we can highlight the lack of teacher's interest in didactic innovation, their un-complete education and the lack of information regarding new resources and availability of new education.

On the other hand, one can still speak of an incomplete supply of digital equipment to support the teaching function of educators and deficiencies in Internet connections to use these online resources, in an agile way.

In the perception aspect, some teachers still consider a loss of time the movement of students to a different place beside its traditional classroom in order to teach Geography using different methods and resources. The usage of paper based technologies is still too much extended. And what is most important, 2nd grade High School teachers are pretty much under pressure due the short time they have to teach a huge amount of contents as well as the proximity of the University Access Test.

A last consideration is a legal rate and/or administrative. The official curriculum for High School (Spanish Ministry of Education and Department of Education in the region of Madrid) only makes reference to the Remote Sensing or to satellite imagery in the following subjects: Biology and Geology (1º) and Earth Sciences (2nd) in the Sciences specialization and it does not indicate anything in Geography (2nd).