A multidisciplinary educational prototype: geography and CATGIS

Massimo Gherardi[a], Gilmo Vianello[a], Livia Vittori Antisari[a], Nicoletta Zamboni[a]

[a] CSSAS, Dipartimento di Scienze e Tecnologie Agroambientali
Facoltà di Agraria, Università di Bologna
Via Fanin 409 – 40127 Bologna Tel: +39 051.2096232 Fax: +39 051.2096203
E-mail: massimo.gherardi@.unibo.it; gilmovianell@unibo.it; nzamb@tin.it

Abstract
CATGIS is an approach to the knowledge of the physical and human characteristics of Italy as a result of the pluriannual research project "Dissemination and experimentation of the cartography, remote sensing and Geographic Information Systems (GIS) as a educational technology applied to the territorial and environmental study" financed by MIUR (Education, University and Research Italian Ministry) [1]. The aim was to develop a prototype for a new didactic methodology, far from the mnemonic teaching of the geography opened to a different educational graduation (school, university) and also to the technician refreshing.
CATGIS is easily opened to anyone by web site, with a simple surf, with accurate scientific contents and good quality imagines by which you can quickly download documents in pdf format.
The research was born to join the informatic dissemination in geography teaching to the knowledge of the tools and method to reading the landscape and analyzing the territorial evolutions in its urban and rural reality, in order to a correct estimation of the conditions and the characteristic of the ecosystem.
The CATGIS website (http://www.dista.agrsci.unibo.it/catgis/) is organized into 5 scientific and humanistic themes (cartography, aerial photogrammetry, remote sensing, census data, GIS) , opened by web link in sections. The GIS topic is interactive and present an informatics reading of the Italian territory, divided into Regions trough the analysis of 5 geographical topics: morphology, hydrography, land use, city boundaries and landscape units.
It promotes a global approach to the environmental problems, acquiring critical knowledge by geographical reading of land, studying relationships between human and natural environment; knowing and using new technologies and the web site production to support training, diffusion and data interchanges with interested didactic users.

1. The aim of the project

Italy has a great cognitive estate made of documents, pictures, maps, aerial and satellite images, census data and statistics tables enabling us to analyze the ecosystem.
Today this national wealth is not well known as we can see in the didactic programs at School and at the University. In most didactic courses cartography, aerophotogrammetry and remote sensing are less important and are normally optional.
At the same time the European Community focuses on a best diffusion of informatics in the didactic career of every order and degree.
As we know many informative systems are geographical and territorial so the knowledge of these subjects is absolutely necessary.

[1] Dipartimento per la Programmazione il Coordinamento e gli Affari Economici – Servizio per lo Sviluppo ed il Potenziamento delle Attività di Ricerca (SSPAR) PNR 2001-2003 (FIRB art. 8) D.M. 199 Ric. Dell' 8 marzo 2001.

This scientific project would be a didactic instrument for the education and dissemination at school, University and for everyone interested in the informatics technologies application of either professional or didactic plane.
The aim was to develop a prototype for a new didactic methodology, far from the mnemonic teaching of the geography opened to a different educational graduation (school, university) and also to the refreshing on cartography, aerophotogrammetry, remote sensing and Geographical Informative Systems (GIS).
The research was conceived to join the informatics dissemination in geography teaching to the knowledge of tools and methods to read the landscape and analyze the territorial evolutions in its urban and rural reality, in order to a correct estimation of the conditions and the characteristic of the ecosystem.
The CSSAS, founded in 1982, attends to the environmental and pedological analysis for territorial planning and management. The CSSAS, experienced in territorial analyses dissemination, had worked at the Environmental Education Project coordinated by Emilia-Romagna region and by the local education office as a partner of the Environmental Protection Ministry Triennial project.
During this project, from 1989 to 1991, the CSSAS provided the classroom lessons to teaching instruments and methods for soil and cartography studies.
Also, the CSSAS planned the school project entitled "Plan without frontiers" whose aim was the cartography and remote sensing dissemination in the didactic programs of every degree. For over three years (2005) the CSSAS has opened an informatics didactic laboratory for geographical and environmental teaching and dissemination.

2. The educational prototype structure

The CATGIS website prototype is an approach to the knowledge of the physical and human characteristics of Italy.
Due to the complexity of the coexistence of natural and antrophic elements, a multidisciplinary approach was important: cartography, aerophotogrammetry and remote sensing improve the geography teaching, linking scientific subjects and humanistic, are a new instrument of territorial transformations.
The project has been organized into five Work Packages (WP):
WP 1 – GIS Dissemination inside the scholastic and university programs;
WP 2 – Database organization and management;
WP 3 – Gradual Introduction of GIS in scholastic and university programs;
WP 4 – Multi thematic environmental analyses
WP 5 – Educational exercises trough informatics.
The resulting educational prototype is made of paper cards and available on the website, with the same didactic and scientific content.
Concerning to papers, the CATGIS website also presents the interactive characteristics, so that the user can easily familiarize with the content and trains himself all geographical and environmental themes using cartography, aerophotogrammetry, remote sensing and GIS.
The CATGIS website (http://www.dista.agrsci.unibo.it/catgis/), as you can see the in the Figure 1, is organized in to 5 topics under the toolbar with different colours:
1) cartography (light blue);
2) aerophotogrammetry (dark green);
3) remote sensing (light green);
4) census data (pink);
5) GIS (yellow).
Each topic, except census data, is clearly showed into three sections with icons on the left:
a) the text, divided into chapters, developing and refreshing the specific subject;
b) the didactic files, summarizing the previous section;
c) the atlas, including cartographical, aerial and satellite images.

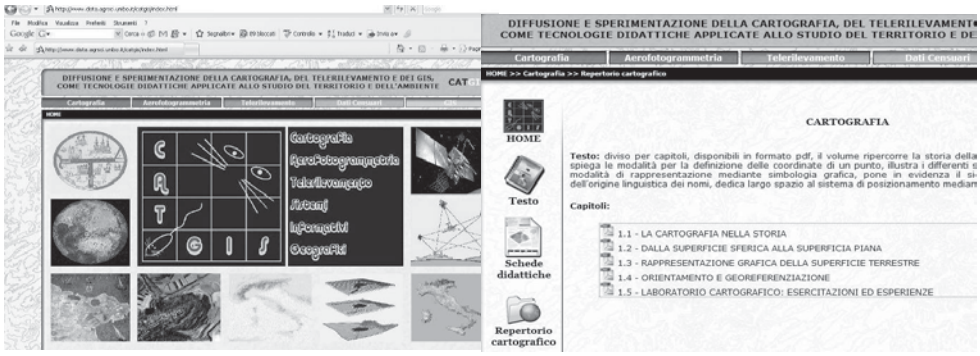

Fig. 1. The CATGIS website (left) and the three (text, didactic files and image atlas) link sections.

When surfing the CATGIS website, the user can choose studying a single topic or all the themes showed; he can download texts, didactic files and images available for the download in pdf format.

2.1 1st topic: cartography

The cartography text section is divided into 5 chapters, available in pdf format.
It runs over the cartography history till nowadays; it explains how to define the geographical coordinates; it shows the different projection systems; it deals with the graphic representation; it talks about the name's origin in toponymy and the satellite positioning system (GPS).
All the content are synthesized into the didactic files, that could be used at school for the geography and history teaching. Also the didactic files examine closely some particular subjects, such as the nautical cartography and the solar system.
The didactic files proposes practice applications of cartography; trough developed exercises, by which anyone can apply the basic knowledge.
There are many exercises showing how to:

- construct the altimetrical map from elevation points and from contour lines of a Technical Regional Map;
- construct a plastic model using a relief map;
- get the geographical coordinates of a point from a map;
- read the territorial changes by the overlay of different historic maps.

The practical exercises could be used by teachers not only for the geography laboratory but also for the historic one.
That's the evidence of the multidisciplinary approach.
The exercises are basic examples, by which the teacher can start with others at a deeper level, like the specific area of the school or by which the professional man or the historic can refer as a study methodology to solve individual technical problems during the working day.
The cartography theme finishes with the cartographic atlas containing the chief towns grouped by Regions; each chief towns is compared with the cartographic representation of the half XX century and the end of XX century at the 1:25.000 scale, realized by the Italian Geographical Military Institute (IGM).

2.2 2nd topic: aerophotogrammetry

Aerophotogrammetry represents the whole techniques to obtain reliable measures for the taken subjects – respect for shape, dimension and position – in a reference system linked to the earth by the using of aerial photography.

The aerophotogrammetry text section, divided into four chapters, explains the photographic systems technique on a flying aeroplane; it underlines the different photographic films; it illustrates the meaning of stereoscope and the photointepretation, useful instruments and technologies to identify and classify the objects on the terrestrial surface.
Also this topic there is exercises and research experiences collection, that clearly shows the practical applications:

- to read the natural and/or antrophic elements changes;
- to refresh the basic carthography;
- to realize the real land use map.

The didactic files synthesize the previous subject, like a teacher's guide for the geography and natural science laboratory's activity.
In the atlas there are more than 400 coloured aerial images, chosen by the aerial shooting called 2000 Italy.

2.3 3rd topic: remote sensing

Remote sensing represents the whole techniques and instruments which allow the qualitative and quantitative information by distance acquisition on objects or on natural phenomena, without a contact with them.
The text section, divided into seven chapters, explains remote sensing fundamental principles and concepts, it also talks about the remote sensing instruments, data and methods and then it encloses some application cases on water, soil, glacier and vegetation study.
The text shows the example of the south Italian Alps, where using Landasat-MSS images in the infrared bar you could single out linear elements and mechanic deformation suffered by rocks. The result is the mainlines map that could be analyzed and interpreted.
In the satellite images atlas there are more than 40 images coming from different satellite platforms that cover all the Italian area, from the geographical scale representation to the half detailed geographical ambits. Every satellite image has its own legend in order to set it against the territory.

2.4 4th topic: census data

As regards to the other scientific themes in the CATGIS, the census data is organized only in didactic files. Census data represents the complete survey's result of a sector (industry, agriculture, population,…) variable in time numeric consistence and characteristics.
The census data main distinctive features are the universality, the simultaneity and the periodicity. In Italy the Statistics Central Institute (ISTAT) normally makes population's, agriculture's, industry's and trade's surveys every ten years. These data could be analyzed for specific statistical elaborations and for graphics representations (for example, a student learns to study population trends by the comparison of historical and present census data).
Census data can also combined with the other instruments and technologies (cartography, GIS…).
The didactic files explain, by practical cases, how the census data can be analyzed to study the territorial evolutions and how they can be compared. In the files there are the evaluation of the statistic processing for six Italian Region and their Provinces compared with the demographic census of the beginning ad finishing of XX century. There are also the dynamics of the land use (residential vs. productive areas) of some chief town compared with demographic density.
In this way the didactic files guide the student or the user toward a study methodology, useful also for a teacher to prepare a practical lesson.

2.5 5th topic: Geographical Information System (GIS)

The GIS text is divided into five chapters and it explains the fundamental GIS principles and concepts, it illustrates the data input, the data analyses and then their output.
To teach GIS applications there are some technical studies to solve territorial problems and for land resource assessment: the environmental management, the groundwater vulnerability for wastewater

reuse in agriculture, the particular natural and cultural areas classification (parks, protected areas, SIC).

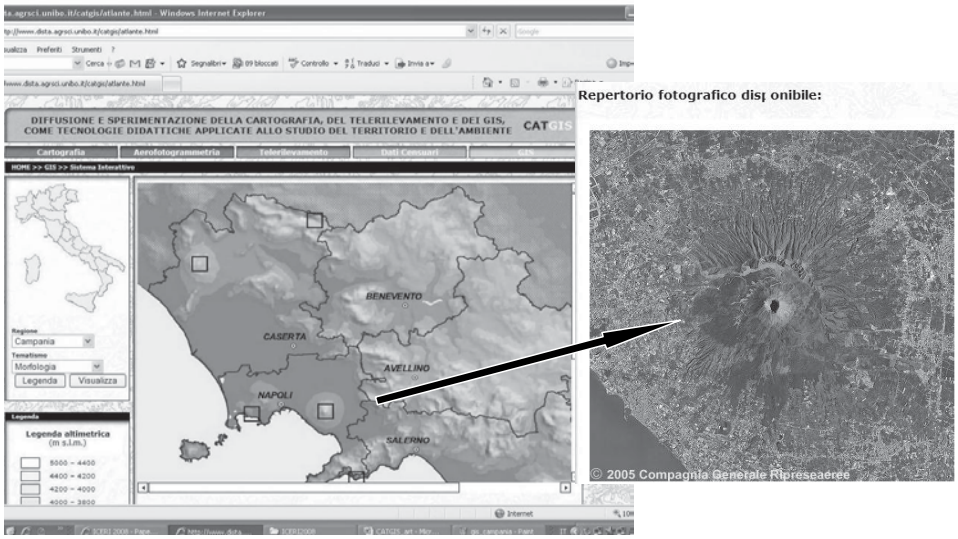

Fig. 6. Example of GIS interactive: the morphology layer of Campania Region in Italy and the Vesuvio georeferenced,aerial image charged by a simple link on the black frame.

The GIS topic is interactive and it presents an informatic reading of the Italian territory, divided into Regions on the ground of the morphology, hydrography, land use, city boundary and landscape units layers. By CATGIS it is possible to surf across Italy through the 119 landscape units in order to discover the main antrophic aspects and dynamics.
For each Region there is also the possibility to open and download a selection of georeferenced aerial images with a short description of the subject.
The user, by an internet workstation, can familiarize with GIS, can easily load the different layers and can see the georeferenced images that show the naturalistic-environmental or architectural peculiarity of chosen area, as the example in figure 6.

3. Conclusion

CATGIS was born and constructed and conceived as a new educational instrument for the teaching of the geographical knowledge and applications, normally not examined or not much developed inside the didactic programs.
CATGIS collects and popularizes (using the website and the didactic papers) all the new trends about innovative tools and technologies and their possible applications for geography teaching.
This prototype, beside the scientific contents, solves practical environmental and territorial problems in order to guide the user trough the cartography, the aerophogrammetry, the remote sensing, the census data and GIS utility.
CATGIS can be easily opened by anyone trough simple surfing, with accurate contents and good quality images by which you can quickly download documents in .pdf format.
Student or teachers can use the developed exercises both a study course and stimulus for a new beginning environmental research on a specific interest area with a didactic or professional aim.
CATGIS refers to a didactic methodology whishing to point out the new technologies and the scientific topics, not only the classic geography handbook, but also opened to an informatics

approach. That it is to charming to the new student generation and it follows the last school trend on the informatics skill.
Then, CATGIS has an other important characteristic: the multidisciplinary approach linking technical scientific topics (geography, geology, natural science…) to the humanistic (history, architecture…) applied to the geographical analysis.
It promotes a global approach to the environmental problems, acquiring critical knowledge by geographical reading of land, studying relationships between human and natural environment, using new technologies and the web site production to support training, diffusion and data interchanges with interested didactic operators.

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