GIS DAY ACTIVITIES AND THE ConTIG PROJECT
Using Geographical Information Technologies in Middle and High School

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Abstract: In November 2008, ISEGI-UNL (Instituto Superior de Estatística e Gestão de Informação – Universidade Nova de Lisboa) hosted a GIS Day inviting seven secondary schools to use and experience Geographical Information Systems (GIS) and Global Positioning System (GPS) technology. Sixteen teachers and about one hundred and twenty students from 7th to 12th grades were able to try and learn about Geographical Information Technologies (GIT). This event is one of the activities that are being developed by ISEGI-UNL in a partnership with ESRI Portugal and two Portuguese high schools since 2007. During the 2007/2008 school year, ISEGI-UNL had a grant from the Portuguese program "Ciência Viva" (from the National Agency for the Scientific and Technological Culture) to develop several learning experiences with the aim of promoting a learning process centred on experience, in which the focus is given by the use of geographic information technologies (the ConTIG project). During the current year (2008/2009), the project continues, but open to any school that wants to try the learning experiences (that are available online) and also share their own experiences. GIS Day is one of the ConTIG events. Other activities will also include courses for teachers to learn how to use the technologies and practical activities with students in their schools.

1 INTRODUCTION

Since 2007, the Instituto Superior de Estatística e Gestão de Informação from the New University of Lisbon, (ISEGI-UNL) is coordinating a Project (named ConTIG) that aims to promote experimental teaching in basic and secondary education through the use of Geographical Information Technologies (GIT). The project's general goals are the following:

- Awareness to the importance of geographic information in daily life,
- Develop spatial analysis skills in students,
- Develop research and group work skills,
- Develop critical sense about spatial planning,
- Create maps for various purposes,
- Share these learning experiences and all the materials,
- Disclose the project results and some of the students work in seminars and in teachers meetings.

Among the different activities of the ConTIG project are the GIS Day events. These were held in ISEGI-UNL's campus in order to get teachers and students of non university levels in contact with GIT and with people that use them daily. It is also important to show how GIT have real-world applications and how important they are to our every-day activities.

Other activities of the ConTIG project are teachers training, production of educational materials to use in the classroom, preparing field trips with the aid of GPS and ArcPad®, supporting teachers in different activities in and outside the classroom.

2 THE *ConTIG* PROJECT

The ConTIG project, supported by the National Agency for Scientific and Technological Culture ("Ciência Viva" program) until 2008, was carried out by ISEGI-UNL and three partners: ESRI-Portugal and two schools in the Lisbon area (Escola Secundária com 3ºCiclo do Ensino Básico de Pinhal Novo and Escola Secundária Maria Amália Vaz de Carvalho, in Lisbon). Two other schools (Escola Secundária de Palmela and Escola Profissional de

Ciências Cartográficas in Lisbon) also participated in some activities, developing exercises in the classroom, using Geographical Information Systems (GIS) to create maps and carrying out other assignments for different classes.

One of the goals of the ConTIG project is to help teachers organize the *curricula* according to the guiding principles of the Portuguese standards and national *curricula* that, among other things, state that one must use a diversity of methods, activities and strategies in education, especially using information and communication technologies, to promote skill development in a lifelong learning perspective (MINISTÉRIO DA EDUCAÇÃO, 2001).

The ConTIG activities involved students from different levels and teachers from different subjects: Geography, Biology, Geology, Physics, Chemistry, Economics, Philosophy, Computers, Project and specific subjects from professional courses in Gardening and Tourist Technician. About 120 students from the 7th to the 12th grades were involved in the project, during 2007/2008.

The ConTIG project also created a web page (http://ubu.isegi.unl.pt/labnt-projects/contig) that provides free access to all the materials produced, such as the learning experiences with the geographical data, teacher and student's guidelines and also the results (such as maps and reports) produced by the students (Figure 1).

Figure 1: The ConTIG web page.

In this web page it is also possible to read all the news about the activities, the seminars on which the project is being presented and a web-GIS platform in which some of the learning experiences can be carried out. The learning experiences can include classroom activities, field trips planning, reports, simple research tasks, among others.

By the end of the "Ciência Viva" program in July 2008, the balance was very:

- Two workshops for teachers were completed;
- Several teachers created learning experiences and tried them with their students successfully. These learning experiences are available at the ConTIG's web page with free access to all the materials (including geographical data, tutorials etc.).
- The web page works as a tool to help teachers and students use the technology (ISEGI-UNL was responsible for producing tutorials) and also as a dialog platform, where registered users can publish news and materials to share;
- Some equipment (including PDA, GPS and GIS software) were acquired for both schools that were partners on the project;
- The project was presented in several GIS and education meetings, in Portugal and in the USA.

In 2008-2009, although there is no longer funding from the "Ciência Viva" program, the ConTIG project continues to carry out its activities with the support of a high school teacher on a sabbatical license. The sabbatical allows this teacher to be fully dedicated to the project, maintaining the information on the portal up to date, organizing the activities, producing materials and data to be used in classes, following up the activities in different schools, supporting and training teachers, etc. This work, supported by ISEGI-UNL (who is still coordinating the ConTIG project), is very important to keep teachers from different schools in contact with each other and to maintain their involvement in the ConTIG activities, by supporting them when needed.

2.1 GIS Day (2007 and 2008)

ISEGI-UNL has experience in organizing GIS Days since 1999 and the high school teacher responsible for the project is also organizing these events since 2005.

GIS Day is a world wide event that is integrated in the Geography Awareness Week, sponsored by the National Geographic Society. This week aims to promote "geographic literacy in schools, communities and organizations, with focus on the education of children. GIS Day is held on the Wednesday during Geography Awareness Week" (ESRI, 2008). GIS Day is sponsored by several organizations (including ESRI, Association of American Geographers, the United States Geological Survey, the Library of Congress, Hewlett

Packard, etc.), and provides an international forum for GIS users. GIS Day is important to demonstrate real-world applications of these technologies.

According to the GIS Day sponsors (ESRI, 2008), participating in a GIS Day will benefit students in different ways:

- Exposing students to cutting edge technology;
- Helping students understand real-world problems using data analysis;
- Developing appropriate curriculum that will keep students' interest;
- Preparing and point students toward GIS jobs and career options;
- Sharing information across multiple disciplines and promoting a holistic approach to learning;
- Building alliances with other schools and organizations.

One of the first activities of the ConTIG project was the celebration of GIS Day in the ISEGI-UNL campus in November 14th 2007, showing how GIT works and some of its possibilities. Students and teachers from both partner schools were present to meet each other and got to do a hands-on activity with GPS and GIS technologies. The activity consisted on a *Geopaper* on the ISEGI-UNL campus. The students had to find clues with the help of a GPS receiver and ESRI's *ArcPad®* technology (Figure 2 and Figure 3).

Figure 2: *Geopaper* activity during GIS Day2007.

Figure 3: Learning to use *ArcPAD®* during GIS Day2007.

This event is an opportunity to help expose students to GIT (including GIS and GPS), educate other teachers and also build alliances between schools and organizations. Students benefit from GIS Day because they have the opportunity to contact directly with the technology and with instructors and professionals that can help them.

In November 19th 2008, ISEGI-UNL organized a similar activity. This year, 123 students and 16 teachers from seven different schools attended the event (Table 1):

Table 1 – GIS Day 2008 participants at ISEGI-UNL.

School	Teachers present	Participating students
Centro de Educação e Desenvolvimento de Maria Pia (from Lisbon's Casa Pia)	4	21 (7th grade)
Escola Secundária/3 Seomara da Costa Primo	3	21 (8th grade)
Escola EB2,3 com Secundário de Santo António (Barreiro)	2	19 (9th grade)
Escola EB Cidade de Castelo Branco	3	20 (9th grade)
Escola Secundária da Amadora	1	14 (10th grade)
Escola Secundária Maria Amália Vaz de Carvalho (Lisbon)	1	20 (11th grade)
Escola Secundária com 3º Ciclo do Ensino Básico de Pinhal Novo	2	8 (12th grade)

During the day, teachers and other ISEGI-UNL's collaborators were available to help the students. But there was no helping on finding the locations. Almost everyone was able to successfully finish the assignments. But it was also noticeable that some students still have problems with orientation and finding their way on the map. It was also noticed that there is some confusion between Latitude and Longitude. The most common error was North and South Longitudes and East and West Latitudes. One of the teachers said the experience was useful for her to realize she needs to do more practical activities to consolidate certain basic spatial skills.

The activities, similar to the ones in the previous year, were carried out in four shifts: 10H, 12H, 14H

and 16H. In each shift, there were seven teams of four or five students that received some information about GIS, GPS and how to use the ArcPad® (Figure 4).

Figure 4: *ArcPAD®* with the information for the GIS Day2008 *Geopaper*.

Then, each team had to search for places and answer a geographical question in each place (Figure 5 and Figure 6).

Figure 5: *ArcPAD®* and question sheet for the GIS Day2008 *Geopaper*.

Figure 6: Using *ArcPAD®* on GIS Day2008.

The activity consisted on examining a map placed on the GPS receiver equipped with *ArcPad®*. The map represented ISEGI-UNL's campus and had three points indicating the locations to search. Each group had three different points. The students had to use their orientation abilities and also their map reading skills to get to the points. At each location they had to determine the geographical coordinates and answer a simple question. These questions appealed to their orientation skills and were also

useful to determine if they were at the right place. It could be a question about something written on a sign or a specific orientation of landmarks.

Coming back, as quickly as possible with the right answers, there was a winning team in each shift. After presenting the results and giving out the prizes and some gifts to all, there was time for a snack. Figure 7 shows the sequence of the activities of each shift.
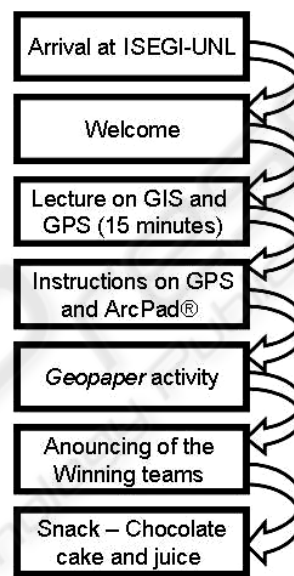

Figure 7: GIS Day 2008 activities.

A few weeks after GIS Day, a simple opinion questionnaire was made to the participants. Teachers and students representing grades 9th to 12th answered. The results show that most students and teachers enjoyed the activity and would like to repeat it or even have a similar one at their schools. Students had the perception that the activity was useful for learning new things like using new technology (on a scale of 1 to 4, the average answer was 3) and they also think the activity contributed to understand better Geography subjects (on a scale of 1 to 4, the average answer was 2,7). As for teachers, they all responded that they would like to organize more activities of this kind and said that GIS-Day was an important way of detecting missing skills in students, giving them an indication of what subjects need to be enhanced in the classroom.

These results showed us that it is important to pursue investigating in this field to identify the real impacts that practical orientation activities using GPS and GIS technologies have in learning. We can certainly conclude that these are motivating activities.

2.2 Teachers Training

"Geographic information systems (GIS) technology and methods have transformed decision-making in society--in government, academia, and industry. Some educators consider GIS to be one of the most promising means for implementing educational reform" (KERSKI, 2003). In 2004, Steven Palladino stated that the use of GIS in secondary levels is not that important to create new knowledge, but it "should allow for a more sophisticated form of enquiry in secondary school geography (and in other subjects). This enhanced ability to stimulate critical thinking and problem solving is one of the great promotions for the use of GIS in the secondary schools" (PALLADINO, 2004).

Teachers can use technology in the classroom as a way of getting the students to develop better spatial skills. GIS software can help educators and students answer community and global questions. GIT can be a good tool to help understand the world around us. It promotes critical thinking and solving problem skills in students. It has been pointed by the report from the American National Research Council (NATIONAL RESEARCH COUNCIL, 2006) that it is important to install spatial thinking skills across subjects and into the lives of learners of all ages. GIS can help doing this because not only it can help develop spatial skills, but also can promote interdisciplinary teaching. It's possible to create learning experiences with GIS that involve different subjects. GIS can manage a great deal of information and link together different maps and data.

To get students to use GIT, it's important that the teachers can use them well. So, one of the priorities of the ConTIG project is to train teachers not only on how to operate the computer programs, but also on showing them how they can develop activities for the classroom. Workshops and courses were prepared in order to achieve these goals. Some of the teachers involved never worked with GIS before so it is important to begin training by the fundamentals of GIS knowledge. Most of the teachers that attend these trainings are Geography teachers and some already use online resources like Web GIS and programs like Google Earth in their classroom. These training sessions were important to lead to the production of educational materials that are online at the ConTIG web page.

After the two workshops that occurred in 2007/2008, the ConTIG team is preparing some specific training in GIS. This will be held in the first trimester of 2009 to prepare teachers to better use the GIS technology. This training will be officially credited by the Scientific and Pedagogic Council for Continuous Training (official organism that credit Portuguese teachers for their life long training) and by the Portuguese Association of Geography Teachers through the Professor Orlando Ribeiro Training Center. Geographic inquiry consists on five steps which are (MALONE *et al.* 2002):

1- Ask geographic questions
2- Acquire geographic resources
3- Explore geographic data
4- Analyze geographic information
5- Act upon geographic knowledge.

This mode of thinking allows students to think spatially and investigate with the same methods as professionals in different areas.

We hope that this training will not only get teachers to have a better domain of the software, but also promote ways of teaching in an inquiry based learning (MOTA, 2005).

2.3 Support Teaching Activities in Schools

The "Learning to Think Spatially" report (NATIONAL RESEARCH COUNCIL, 2006) states that it's important to have support systems including *curriculum* and teacher training. The ConTIG project is committed to help teachers with their training but also within the classroom. Some high school classes were given with more than one teacher at the time, so that the students can have a better support of teachers while using the GIS programs. These classes are supported by the ConTIG project, that provides someone available to prepare materials (theoretical and also data sets and GIS projects) and exercises for the students. The results of these actions are being positive because when students use the software for the first time, it's important to have more than one teacher to solve small problems if they occur. The 90 minutes of a regular class in Portugal, can be better managed and the students can profit better from having two teachers there. It's also important when teachers are not so at-ease in a computer room and this can occur if they are not yet very comfortable with the software (if they are still in training themselves).

The ConTIG team is also available to give lectures in different schools (to teachers and/or students) to promote the project, and trying to get more teachers to participate.

It is also part of the activities planned for 2008/2009, to work with elementary schools. Of course, in this case, the lessons will be prepared with

much simpler software, but the "thinking spatially" philosophy will still apply. We are eager to try and see the results.

3 CONCLUSIONS

Due to the advantages (demonstrated through out the bibliography) of using GIT in the classroom, we believe the ConTIG project can alter the way people are teaching Geography and other subjects, bringing benefits to student's spatial analysis skills. Different phenomena, with a common spatial scenario can be analyzed and explored together. It's possible to find patterns and it's easier to observe relationships between them. The use of Communication and Information Technologies (computers in general) is frequently a motivating factor for students in middle school and high school levels.

Activities such as GIS Day are fun but are also important to alert to the importance of Geographical Information in different contexts. They are a starting point to get teachers to use Geographic Technologies (GT) as tools for teaching experimental sciences. From the questionnaire made to the GIS-Day participants we conclude that organizing such an event is not enough to get teachers involved in using GT in the classroom, but it certainly can be a stating point. It seems to be an activity that gets teachers aware of the possibility of doing these kinds of practical activities and detecting missing skills.

We believe that the technology is not necessary to acquire orientation skills. However, it can be a much more appealing way of reaching youngsters interests. It's also a good way of getting student's attention to the fact that Geography can be helpful and useful. From the student's opinions, we learned that they liked to participate and that they believe they understand better some Geography subjects.

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