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Virtual field trip in the Mirandela region (NE Portugal)

An example of how to improve Geoscience education

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ABSTRACT

Key-words: Field trips, Internet, CAL, Geosciences education, Geomorphology

New tools to improve Geoscience education can be produced using the possibilities of the Information and Communication Technologies. In this paper, the methodology used for the production of a virtual field trip in Mirandela region (NE Portugal) is presented. Techniques of virtual reality are used to show 360° panoramic views and to illustrate outcrops of sedimentary deposits.

RESUMO

Palavras-chave: Visita de campo, Internet, Ensino da Geologia, Geomorfologia,

Visita de campo virtual à região de Mirandela (NE Portugal). Um exemplo de como melhorar o ensino das Geociências.
As potencialidades das tecnologias da informação e da comunicação permitem que sejam criadas novas ferramentas para melhorar as condições de ensino/aprendizagem das Geociências. Neste trabalho é apresentada a metodologia utilizada na produção de uma visita de campo virtual na região de Mirandela (NE de Portugal). De salientar a utilização de técnicas de realidade virtual na apresentação de panorâmicas a 360°, ilustrando aspectos relacionados com a geomorfologia e com afloramentos de depósitos sedimentares.

INTRODUCTION: FIELD TRIPS IN GEOSCIENCE EDUCATION

Nowadays it is consensual that field trips are important in many aspects of Geoscience education (Compiani & Carneiro, 1996). Field trips allow working with scales not reproducible in laboratory. For instance, reading and interpretation of landscapes is rather difficult to achieve inside the classroom.
In spite of the importance of field trips, generally the number of actions undergone is rather limited. This fact can be explained by several reasons:

- The weekly students shedule is over-filled with ordinary classes;
- High cost for trips lasting for more than one day;
- The teachers availability is usually low because these activities are considered non-remunerated extra work;
- Difficult access for big groups or for students with locomotion problems;
- Weather constraints.

The reasons mentioned above are those that are usually invoked for not doing field trips. Taking these reasons into account, what can be done?

- In spite all the difficulties, all planned field trips are made;
- Only some trips are carried out (the subjects and aims of the field trips that don't take place are eliminated from the course or are replaced by other strategies, like video projections, computer simulations, etc.);
- No field trip is accomplished and other strategies are used.

Field trips have many purposes. Nevertheless, these actions must be carefully organised in order to maximise

the investment (work, time and money). During the preparation of the field trip, the students must contact with elementary theoretical concepts and backup materials, such as geographical and geological maps, cross-sections, and numerical data, among others.

The use of photos and videos as tools for field trip preparation is recognised as important and widespread. Also important, is the use of these tools for consolidation of learning, after field trips are made. As we have already said, videos and photos are also of great utility when field trips can not be performed. The technological advances allow the use of new tools in the teaching/learning process (CAL). Multimedia contents can be easily distributed by Internet, allowing students to prepare field trips in advance or to consolidate aspects unnoticed during the trip (Ford, 1998).

With this paper, we don't propose the replacement of field trips by other solutions. Indeed, we want to stress the importance of field activities as a means to improve teaching and enhance public awareness of natural heritage.

COMPUTER TOOLS AND VIRTUAL FIELD TRIPS

The large use of Information and Communication Technologies (ICT) must be taken into account when planning any teaching/learning or divulgation activities (Brilha *et al.*, 1999). The main advantages in the use of ICT for teaching/learning and divulgation of geological subjects are, among others:

- Divulgation addressed to a wide audience geographically dispersed;
- Instant content update and its use in real time;
- Production and divulgation costs very low when compared with traditional media;
- Integration of multimedia contents, facilitating the visualisation and understanding of geological features and concepts;
- Development of interactive contents, surely more stimulating for a non-specialist public.

In spiteof these characteristics, one should consider that:

- Internet access is not universal and, in real conditions, the connection speed is very low discouraging the linkage to sites with high graphic density;
- The necessity of updated versions of the browsers and particular plug-ins for viewing the full content of certain pages can be a disadvantage for low--experience users.

The development of a divulgation or teaching geological project by electronic media needs its own methodology:

- Organisation of available information already published;
- Collecting complementary information (field data, mineralogical and petrological studies...);
- Definition of the site structure;
- Production of HTML pages;
- Set-up of the information structure and its transfer to the Internet server.

Geologists co-operating with multimedia experts should make the production of educational geological contents in electronic media. Geologists should take into account that this media has different rules in relation to traditional ones. For instance, field texts should be short, simple and without scientific jargon. The maintenance of scientific accuracy makes this a different task that must never be forgotten by the production team.

It is consensual that the best graphic representation of geological features is the use of photographs and schematic drafts. Nevertheless, quite often and due to lens constraints, photos don't reflect all geological aspects of landscapes. Difficulties arise when there is the need to show details of a certain outcrop or to give complementary in formation, like petrological and mineralogical composition. In other occasions, it is useful to show different aspects of a certain geological object (like a fossil or a geomorphological feature) something that is impossible using ordinary photos.

Now there is the possibility to overcome these difficulties by presenting the information in an interactive and attractive way. Virtual reality techniques can be used with great advantages for geoscience divulgation by creating truly virtual field trips. We should strongly reaffirm that, for the moment, these virtual field trips aren't like real trips but they should be considered a great help to any teacher.

The QuickTime® Virtual Reality technology (QTVR), created by Apple Computer©, produces truly realistic images of landscapes and objects from any photographic information. It is possible to produce interactive scenes with high graphic quality, easily read by a simple mouse touch. The QTVR files can be viewed on a normal web page (when the QuickTime plug-in is installed) or on any other support (CD-ROM, DVD-ROM, etc.). Some portuguese examples of the application of this technology associated to geological contents are available on the Peneda-Gerês National Park site (www.geira.pt/pnpg) and Geopor site (www.geopor.pt).

At first glance, a QTVR file is like a small video. Nevertheless, the possibility of interactivity in the last one is very low. QTVR files can combine several panoramic views of a single landscape (in 360°), related objects (for instance, fossil or crystal rotations, simulation of a petrographic observation on the optical microscope) and links to web pages with additional information. This interactivity allows the user to progress through the web pages, stimulating self-learning.

VIRTUAL FIELD TRIP IN THE MIRANDELA DEPRESSION

This virtual field trip was designed specially for portuguese teachers and students, either if they intend to

make a real field trip in the region or if they have no possibility to do so but need to obtain information about the geological characteristics of the region (http://www.dct.uminho.pt/mirandela/).

The objectives of this field trip are the same either for the virtual one or the real one:

1. Main aims:
   a) integration of geomorphological, sedimentological and stratigraphical data in order to understand landscape evolution;
   b) understanding of the formation and evolution of the Mirandela tectonic depression;

2. Specific aims:
   a) Observation and characterisation of several aspects at different scales, namely:
      - at the outcrop scale, observation of different lithologies (hercynic substratum and tertiary sediments), sedimentary and tectonic structures;
      - macroscale observations with cartographic background, identifying the different surfaces, tilting, faults and fluvial network.
   b) Interpretation of:
      - paleoenvironments suggested by the observed geological formations;
      - relations between morphology, substratum lithologies and the geological structures (faults, folds);
      - relative age of the surfaces and the Cenozoic formations, according to their characteristics and field localisation.

The web site offers several alternatives to explore all the available information. The indication of the suggested stops and viewpoints is pointed on an ortophotomap of the region. The general ideas about the geomorphology and sedimentology of the Mirandela depression are also given (Pereira, 1997). These pages are especially useful for teachers who want to understand the regional geology. The overall views about geomorphology and particularly outcrops are illustrated with 360° panoramic views using QTVR files. For each sedimentary formation, information about the lithologies and sedimentary structures is available with commented photos of the outcrops. Text files (RTF, DOC and PostScript formats) of a published paper and of a text with background information about the geological setting of the region are also available for download .

CONCLUSION

The simplicity and creative freedom of the QTVR technology confer it a high potential in the divulgation of the geological heritage to the general public and in the teaching of geological concepts. Therefore, it is possible to imagine many possibilities for the application of QTVR files. Nevertheless, it should be stressed that virtual field trips should be designed as an incentive for real ones and not as a replacement for them.

In spiteof the existence of a few disadvantages, we think that the use of electronic media should be stimulated in any project of geological divulgation. The existence of suitable hardware with Internet access in the majority of portuguese schools is a real advantage and guarantees that students can use these new educational materials.

For the moment, the existence of so very few portuguese sites specially dedicated to educational purposes is discouraging for teachers and students. The geological scientific community should face the production of high quality educational contents as an important task that should be encouraged by national institutions.

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