The new syllabus and educational tools developed in the framework of EPEAEK project of the Geology Department, Aristotle University of Thessaloniki

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Abstract: - The Geology Dept. of the Aristotle University of Thessaloniki has proceeded in specific actions, in the framework of an overall reformation of its syllabus. The effort was partially financed by the EPEAECK project which runs under the Greek Ministry of Education. Initially, several classes of the old syllabus were terminated and new ones were introduced. These new ones aimed to deliver the basic principles and educate the students on modern technologies and mathematical tools, necessary for the contemporary market of geological services. Thus, courses on GIS, satellite image processing, statistics and data analysis in Geology and programming through Matlab were included in the undergraduate program of studies. A new lecturing room was constructed to suit the needs of the new courses. A local network of 17 computers is hosted there who are all connected to internet.
A total number of 28 courses, from the 86 overall offered by the Department, are now taught through the electronic notes available with free access in the web. Many of these notes contain animations and video clips of actual field procedures. Real surveying, data processing and interpretation examples are also included. Further, new educational modules were developed, aiming to visualize physical processes and perform their evolution in space and time. In the same context, 6 laboratory classes with virtual exercises have been prepared and they are hosted in the web pages. The effort is complemented by the preparation and release of two data bases for seismological and meteorological data. These data are used for the virtual classes and also comprise a valuable tool for the graduates of the Department. A series of lectures on modern technologies and recent developments in Geology was also organized. The action is particularly addressed to the graduates of the Department and received favorable comments from their side. An average number of 120 graduates participated, who in turn expressed their will to continue the action and help to direct the content in particular aspects if possible.

Key-Words: -Geological education, Geology electronic teaching material, Geology virtual Labs.

1 Introduction

The Department of Geology, Aristotle University of Thessaloniki, has attempted a major reformation of its syllabus. New courses have been introduced aiming to cover fields of modern technologies and to focus on the mathematical tools more frequently used by geology practitioners. Furthermore, the context of electronic teaching has been introduced in about 30% of the courses offered by the Department. A relatively small number of the practical exercises are also performed in the virtual context. The last one proved to be the most difficult task since it demanded a big effort, despite the small number of the exercises.

Under the same reformation framework, two data bases hosting seismological and meteorological data were prepared and released for public use. The intention was to offer a tool to our graduates which could be used for various studies wherever needed. On the other hand, the data bases are also used for laboratory exercises.

The effort was completed with the establishment of short courses for the graduates of the Department and professional geologists of the Region of Macedonia and Thrace in general. Recent advances in Geology were taught in these courses. Furthermore, introduction lectures were presented concerning the fields with which the majority of the graduates are not familiar because the relevant courses were not available at the time of their

graduation.

2 Electronic Courses

For the 28 courses, notes and other teaching material that can not be included in printed forms were prepared and put in the relevant space in the web site of the Department. In many cases, this material is of enormous volume, which of course can not be presented in the classes. Some of the material is in the form of video clips and animations which give an immediate sense of the evolution in time and space of various physical processes. Also, measuring procedures have been included, which are often time consuming and perhaps difficult to be explained in oral presentations or even in terms of practical exercises. In this respect, the students have the opportunity to study a particular course surfing in the web pages of the class, somewhat like homework. The time limits of the classes are expanded in this way and classroom time is reserved for essential questions.

For example, Figure (1) shows some pages of the lesson "Mineralogy" [1]. It is well known that the macroscopic appearance of minerals varies in a wide range. In this respect only a few samples can be presented in the framework of the limited time of the course. In the web pages of the lesson, one can find a large collection of photographs of samples from all over the globe. Furthermore, one can search for particular properties and view all the minerals who have the specific properties. Thus, one starts with the initial page of the lesson (upper part of Figure 1) where he has various options including tutorial notes, lists of properties, notes on provenance of the particular minerals, etc. For example, suppose that we are seeking for sulfide minerals and in particular for forms of Baryte. Clicking in the relevant entry we are presented with the list of the sulfides shown in the lower part of Figure 1. We seek for the entry of Baryte and the result is the display of the image of Figure (2). In this display one can find general information about the mineral plus a collection of photographs of samples. The image in figure (2) is a truncated form of the web page and the collection is much larger than the one shown in the figure.

Another example is shown in Figure (3) where the current flow in the subsurface is depicted with respect to the spacing of the probes on the surface [2]. The example is an animation where probes of increasing spacing are shown and the successively deeper current flow is depicted.

Each faculty member responsible for a particular course was of course free to use any sort of material that he found appropriate for his educational purposes. A large portion of the material was found from other Earth Sciences Departments and Research Institutes, a fraction of which was free. However, a large part of the material was prepared by the faculty members and it is entirely new. Links and references are also occasionally provided for each course to facilitate web surfing and study.

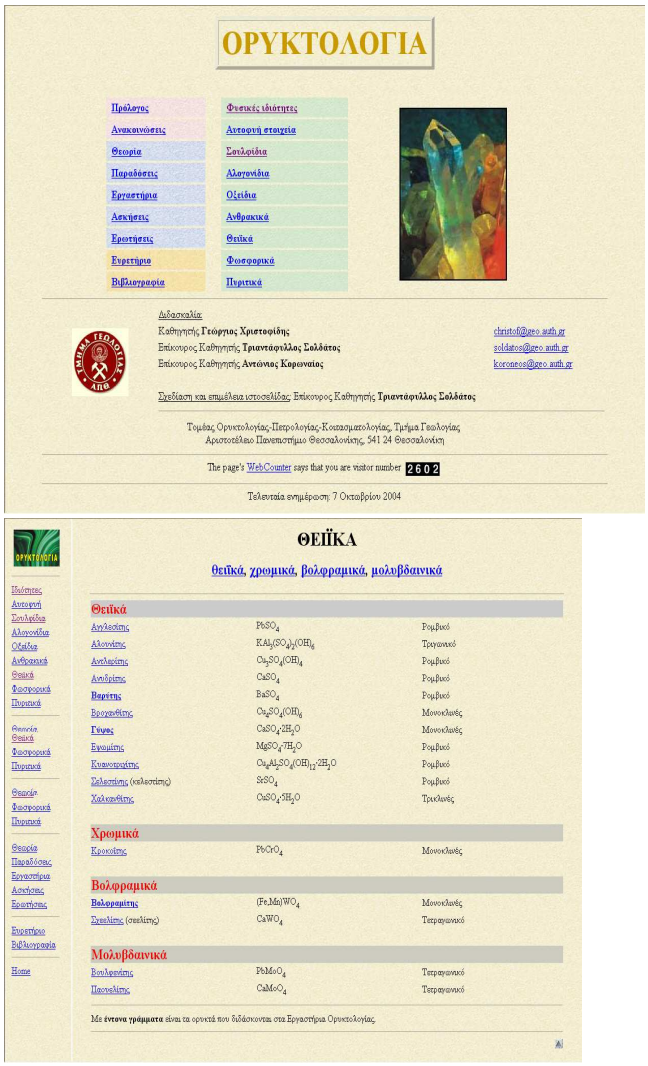

Fig. 1. Initial page for the course "Mineralogy" in the upper part and the page listing the sulfides in the lower [1].

3 Virtual Laboratory Exercises

As referred to, this was a difficult task but its benefits are multifold. Laboratory classes are given to small groups of students because of the limited resources. This is an important problem if we have to handle a large number of groups, as it is the case in the Geology Department. Therefore, the creation of virtual classes saves time, effort and reserves the space for other uses.

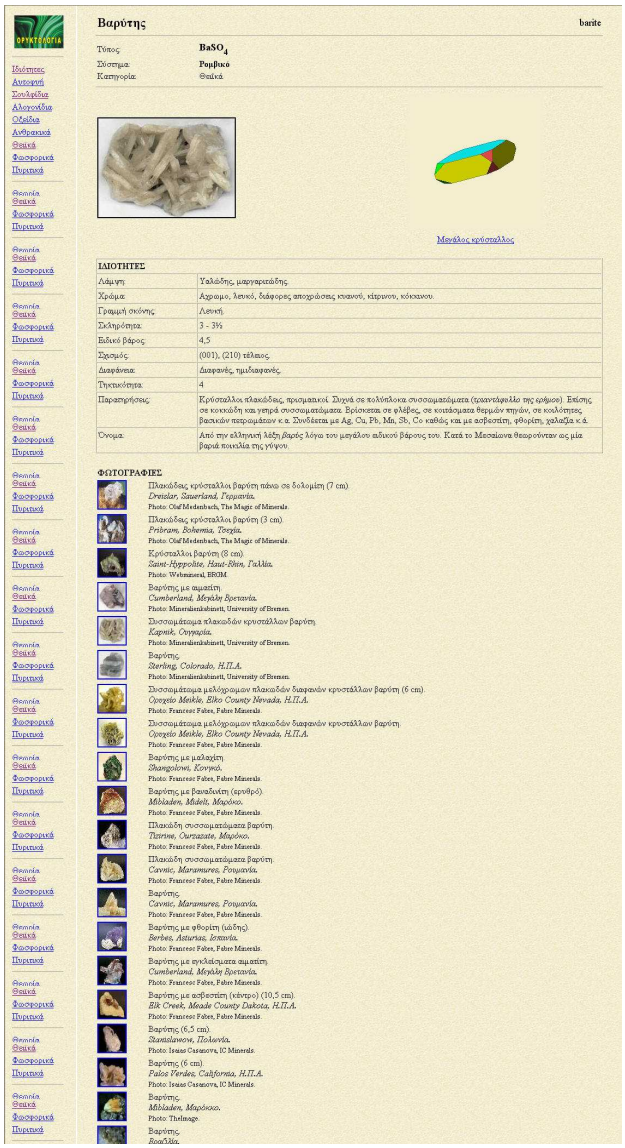

Fig. 2. Page of the web material of the course "Mineralogy" referring to the mineral Baryte [1].

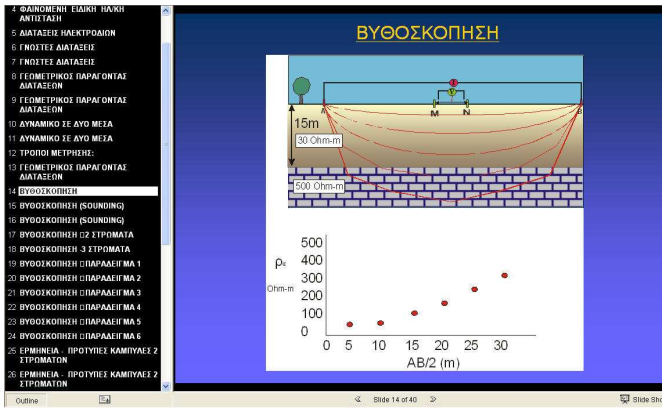

Fig. 3. Page of the web material of the course "Electric and electromagnetic prospecting methods" showing the current flow in the subsurface and the produced sounding curve [2].

Fig. 4. Examination in the computer room of the Geology Dept. Univ. Thessaloniki.

The ultimate goal is to create realistic simulations of actual field and laboratory conditions. An alternative is to show how the measurements are taken using visual aids and next give the data that could had been produced. The exercise is then entirely based on these data. The tools needed for any manipulation are also provided through the web. The students should proceed to various actions and produce an essay on the results. The essays are submitted through the web and the corrected versions are returned to their personal email addresses, if they have such. If they do not have private internet access, they can use the working positions of the Departments computer room. It is evident that the second approach is much more convenient by any means. Nevertheless, is not as effective as is the first one from the educational point of view.

For the needs of this action, a new lecturing room was constructed and equipped. Audio and visual means were installed, as well as a local network of 17 computers. Figure (4) shows a photograph of the room during the final examination of a group of students in a new course introduced in the framework of EPEAEK (Analysis of Geological Data). It should be pointed out that the specific room is not only used for the virtual labs but for other purposes also (exams, additional teaching that requires use of computer, etc.).

4 New Courses Introduced

All the new courses are aiming to introduce modern technologies and mathematical techniques used in geological practice. Therefore, we introduced classes on remote sensing, geographical information systems (GIS), computer programming and data

analysis in Geology. The new courses are taught mainly in the computer room and emphasis is put on the interactive action of the students. In this respect we use computer programs designed either for educational or for professional purposes. Part of this software is available free from various sources while the rest was purchased in the framework of the EPEAEK or other projects.

The primary target of this action was to equip the new graduates of the Department to meet the market requirements in their carriers. On the other hand, we also intended to make an integrated syllabus in the context that our graduates should be capable to incorporate geological products to GIS. Further they should be capable to perform efficient mathematical processing and computations on geological data for practical applications.

5 Data Bases and Graduate Seminars

Many graduates of the Department are working in various private and governmental positions, where they have to perform studies for very divergent purposes. Often, they come back to the Geology Department, looking mainly for data which are necessary for their studies. This led to the initiative to construct databases for seismological and meteorological data. Both these categories belong among the most frequently demanded data, useful for a variety studies. Hence, the databases were constructed and can be found at the following addresses:

http://seismology.geo.auth.gr/the_seisnet/gr/index.htm

http://meteo.geo.auth.gr

These databases also serve the educational procedures of the Department, allowing the students to have real data sets for their exercises.

Considering the past year graduates of the Department, seminars were conducted on modern technologies and advances in Geology. The topics ranged from new findings and theories in human evolution, to archaeological prospection and GIS. An average number of 120 graduates participated in this action which took place every Monday of both the winter and spring semesters of the academic year 2004-2005. In general the seminars received favorable comments. Our graduates expressed their strong will to continue the action and help to direct the content in particular applied aspects. Also, they suggested organizing small classes for practical training on GIS tools, if possible.

6 Discussion

The incorporation of audio and visual aids in the framework of electronic teaching seems appropriate for courses in Geosciences. The material for the courses can be significantly enlarged, while at the same time it is not necessary to be presented in the classroom, where only the essential key points can be referred. The students can find additional details by surfing in the web pages of the corresponding lessons. Taking their time, they can study animations of processes and measuring techniques plus other material and reserve the classroom time for essential discussion. In this respect, the lessons become much more comprehensive.

The mathematical tools have long ago been introduced into Earth Sciences. However, nowadays demands are constantly increasing and more and more quantitative methods are needed in practice. Therefore it was necessary that the Earth Sciences Departments should modify their syllabuses accordingly. However, experience from similar attempts led to the conclusion that the delivery of the courses relevant to data analysis in Geosciences should be performed by experts in the field or people who are well acquainted with these topics by using them in practice in the past. It is important for the instructor of such a course to have a personal feeling of the needs of the average geoscientist.

Also, any contemporary geological or environmental work often ends with the incorporation of the outcomes into a GIS system. Therefore, particular emphasis must be put on the capabilities and use of GIS tools.

Directing the exercises into a virtual form enables training of large numbers of students, who otherwise would had no opportunity because of the limited available resources. Thus, organization of time and money consuming actual field experiments is avoided or restricted to those which are absolutely necessary. The use of specifically designed educational software comprises of an alternative solution, which of course must be complemented by exercises which are carried out by contemporary professional tools. The produced essays should be sent electronically to the tutor, corrected and returned. This procedure also saves energy and time. Furthermore, examinations can also be conducted electronically. Of course, the existing educational software platforms facilitate quite a lot the whole

procedure and in general offer the means for a better organization of the teaching material.

Experience and tools should be interchanged between relevant Departments to avoid reinventing the wheel. Some sort of collaboration and information interchange should be established in a permanent manner. In this respect, the conferences on educational tools and methods may prove valuable.

The construction of computer rooms seems necessary for any Department offering education in Geosciences. Furthermore, the tools which are used for teaching and exercising must be as close to the contemporary professional ones as possible. The students should take advantage of these facilities to the maximum extent.

The modern professional environments are rapidly developing and continuously changing Therefore modern education should be understood in a continuously developing context. The Geosciences Departments should conform to this requirement of modern times and offer various alternatives for continuous education to their graduates. The Departments should seek the appropriate linking forms between them and their past graduates. As feed back, they will strengthen their links to the industry and subsequently would become more flexible to modify their plans and syllabus according to the market demands.

The Department of Geology of the Aristotle University organized and released data bases of seismological and meteorological data. We believe that these kinds of data are useful to our graduates because they are necessary for a variety of studies, among those which they conduct. By one way or another, these data comprise the most frequently types requested from the Geology Department. This action, besides being an essential help to the professional carriers of our graduates, creates also a strong link between them and the Department. We intend to organize bases of environmental data and also collections of maps in electronic forms. Moreover, we are open to requests such as organization of small classes for graduates, particularly on modern technologies and GIS. However, these tasks can not be easily accomplished because of the needed extra time for the staff and the available means.

Another link is created by part time employment of the graduates for the needs of research projects carried out by the faculty members of the Department. Also, partial occupation is offered by the Department through the services to third parties. However, these solutions do not solve of course their professional problem but rather strengthen the links.

7 Conclusions

Electronic teaching and virtual aids, as well as the continuous education, comprise the single-way channel for the Earth Sciences Departments. This corresponds to nothing more than confrontation to nowadays scientific trends and market demands. Therefore the relevant syllabuses have to be aligned along these baselines.

References:

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[2] Tsourlos P. I. *Web material for the lesson of Electric and Electromagnetic prospecting methods.* Dept. of Geology, Aristotle University of Thessaloniki, Thessaloniki, Greece, 2004. http://www.geo.auth.gr/gr_proptyxiaka_webcourses.htm