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GEOSCHOOLS: INNOVATIVE TEACHING OF GEOSCIENCES IN SECONDARY SCHOOLS AND RAISING AWARENESS ON GEOHERITAGE IN THE SOCIETY

GEOSchools: La enseñanza innovadora de las ciencias de la Tierra en la escuela secundaria y la concienciación sobre el patrimonio geológico de la sociedad

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• INTRODUCTION

The teaching of Geology as a separate discipline in secondary school curricula has been progressively reduced during the last 20 years in European countries. This secondary role assigned to Geology is creating serious concern among geologist community due to the substantial drop of geological contents in secondary school curricula. A most worrying situation occurs in Spain, where geological modules have been skipped out from the general proofs of access to university for high-school students. This fact will presumably produce a consequent drop of Geology students in universities and a shortage in the supply of geologists to society (Meléndez *et al.*, 2006; Meléndez *et al.*, 2007).

In an attempt to improve this adverse situation, a proposal was made for an innovative “teaching of geosciences in secondary schools” in the framework of a European research project under the name GEOSchools. By means of a thorough analysis of the current educational situation, the main objective of this project would be to provide the European Earth sciences education community with advice, support, and different teaching aid instruments, a glossary of

geological terms and an interactive website/portal. This might provide a valuable instrument in order to create social and political concern for geosciences and to raise interest in secondary school teachers and students for the knowledge of Earth.

• GEOSCHOOLS PROJECT

GEOschools is a European Union project supported by the Lifelong Learning Programme which brings together geoscientists from universities, museums, Geoparks, teaching training institutions and educators which can best “translate” geosciences into language and learning opportunities that can be understood by school students. The target of the project is to define a “Framework on geosciences literacy principles” for the European citizen, to be applied at least, for the revision of obligatory school curricula for secondary schools for the participant countries. The main aims of the project are: (a) bridging the gap between scientific knowledge and school knowledge in geosciences; (b) increasing the knowledge of teachers and the ability of students in valuing and appreciating geosciences; (c) improving educational skills of geosciences in European school environment; (d) establishing and sustaining a consortium on research and initiatives on geoscience education; and (e) supporting education for sustainability (Fermeli *et al.*, 2011).

The concept of the project supports the European Union (EU) Lifelong Learning Programme objectives, priorities and competences to:

- Contribute to the development of quality lifelong learning and promote high performance, innovation and a European dimension in systems and practices in the field.
- Help young people acquire the basic life-skills and competences necessary for their personal development, for future employment and for active European citizenship.
- Enhance the quality of European dimension of teacher training.
- Improve motivation for learning, and learning how to learn, skills.

A further main purpose of GEOschools project would be to supplement other EU policies like “Culture” and “Environment” providing opportunities for cross-curricula links through a “horizontal”, interdisciplinary use of some key geosciences concepts like geological heritage, which is a fundamental ground concept for other cultural heritage developments of Humanity. This view considers geological heritage as a crucial component of Earth and human history, and as a tool to create linkages with culture, arts, environment and education for sustainability.

The key results to be issued during the development of the project are: (a) a curriculum comparison research; (b) an interest research; (c) a school geosciences dictionary (lexicon); (d) teaching modules on specific subjects, and (e) an interactive website/portal and an e-Newsletter.

a. Curriculum comparison research

Although the knowledge of geosciences is important for the every-day life of all European citizens, in most European countries Geology does not exist as a separate subject in secondary

education. Geology is included, indirectly, through other subjects and educational activities such as Environmental Education (EE). Surveys conducted worldwide and PISA (Programme for International Student Assessment) reveals that 15 year-old students do not have a firm grasp of basic scientific facts and concepts, nor do they have an understanding of geological processes.

The first main objective of the project will be to perform a curriculum comparison research based on the review of the geological contents of curricula in secondary schools from Austria, Greece, Italy, Portugal, Spain and members of other European countries. Some countries, such as Portugal, show a relatively important presence of Geology in secondary school curricula. However, in most European countries the Earth sciences concepts are most often absent or “diluted” within other vaguely related disciplines. The inclusion of Geology within other conceptually-related subjects such as Biology, Environmental Sciences, or Geography, apart from being conceptually unjustified, means the actual subordination of Geology, which deals with Earth and geosphere, to other separate disciplines, dealing with separate subjects of knowledge (biosphere for Biology; Earth in relation to Man, and human impact on Earth for Geography and Environmental Sciences). This subordination has produced a misbalance in teaching, both in the share of text for the different matters, the conceptual accuracy of Geology explained, and the appropriateness of teaching staff. Some cases, such as that of Spanish educational system in which the discipline of Geology is excluded from access proofs to university or that of Greek educational system in which Geology is totally absent in the high cycle of Secondary Teaching are particularly alarming. The progressive decrease of the ratio of Geology teaching in schools, both in time assigned and in share of contents in science programs, could bring highly negative consequences to the university background and future research and knowledge of Earth (Meléndez *et al.*, 2007).

Besides comparing curricular contents, this part of the research will also focus on the analysis of geological contents in secondary school textbooks, based on a detail review of the amount and quality of the information given to students.

b. Interest Research

Interest Research seeks to understand the best teaching tools to foster student interest for geosciences. The research will be based on quantitative analysis of questionnaires distributed to at least 20 teachers and filled in by at least 600 pupils in each country.

c. School Geosciences Dictionary

Taking into account that even the noticeable reduction in vocabulary load of science school textbooks; the amount of vocabulary load presented is still too high (Groves, 1995), a School Geosciences dictionary (Lexicon) has been included as one of the main targets of the project. It will be an illustrated online geosciences dictionary especially prepared for secondary school teachers and students. This dictionary must be comprehensive for all geosciences disciplines, mainly focusing on the vocabulary of the curricula of secondary schools under study.

The lexicon content will range from “some clear, basic, geological concepts” like: rock, fold, fault, sedimentary rock, granite, mineral, etc., to “terms more directly related with real life and holding an economic meaning” such as those terms related to geohazards and geological risks, directly leading to life experiences and showing that Geology can be something useful and interesting for the society. Another group of terms will be around the concept of geoheritage, which might open new and exciting fields of knowledge to the school students and can lean them to some issues of Nature protection (geoconservation, geodiversity, natural heritage, etc.)

A special attention is set on the accompanying graphic material for every term, which should be easy to include, as it will be a virtual dictionary.

d. Subject Teaching Modules

The ultimate goal of this part of the project is to find effective ways of engaging students and geosciences teachers in a new learning approach, placing Geology at the same level of other sciences in secondary schools. Geology is a science whose laboratory is Earth. For this reason, “field work” is selected as the main methodological background for the development of this topic.

The project will combine practical (field based) and theoretical studies on geosciences in secondary schools. Results of Interest research on geosciences subjects and acceptable common geosciences framework from all partners will be used when adjusting the teaching modules so the pedagogical tools will work in all the countries.

In order to test and evaluate the proposed modules, some selected activities will be proposed to bring the teachers and practicing geoscientists together. This will include fieldwork in Geoparks, exomuseums and geotopes, as well as teaching activities in museums and in the classroom. Teachers will be also encouraged to generate educational material to be incorporated into the website of the project.

e. Website/portal and e-Newsletter

The activities of the project and its deliverables will be presented and disseminated by a dynamic multilingual website (<http://geoschools.geol.uoa.gr>) in English, German, Greek, Italian, Portuguese, Spanish and eventually French. Similarly, the “e-GEOschools”, an e-Newsletter, will spread the news of the project every four months, getting closer to the teachers involved in the project and all the interested people.

• FINAL REMARKS

The project GEOschools aims to improve the teacher's task and students' geoscientific literacy all over Europe, and make them able to understand the fundamental concepts of Earth's dynamic

and complex systems, to assess scientifically credible information about Earth and take responsible decisions regarding Earth as a system. Moreover, combining educational research and practice in the schools, the ideas, knowledge and skills that this project supports will contribute to the development of a quality lifelong learning and promote a European dimension in systems and practices in the field, helping young people acquire the basic life-skills and competences necessary for their personal development, for future active European citizenship.

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