



Teachingearthscience: a Website for Teachers

Lorenzo Lancellotti, Chiara Invernizzi, Eleonora Paris

School of Science and Technology, Geology Division, University of Camerino (Italy)

lorenzo.lancellotti@unicam.it

Abstract

In the last decades the development of virtual and useful tools for teaching science at school has increased really fast and “even without going totally virtual, the Internet can provide a rich and valuable learning environment for anyone interested in the sciences” [1]. Anyway the largest part of the web production is in English and it seems not to be really well known and regularly in use by Italian teachers. The purpose of this research is: 1) to evaluate Earth science teachers’ attitudes towards digital tools; 2) to understand the need for appropriate digital tools for science teachers in Italian; 3) to select the main topics it should deal with; 4) to build it; 5) to test it on in-service teachers. The aim of the project is to develop a website to host a repository of the most interesting and useful Earth science tools currently available, adapted for Italian schools. This will provide effective support to Italian science teachers without a geological background.

The first part of the research is about understanding teachers’ needs and selecting the themes to work on. It has been carried on using a questionnaire sent to the teachers who inscribed their schools at the 2012 Natural Science Olympiad (more than 400 schools). Analysis of the data indicated which topics were of most importance and a pilot session has been developed in order to test it and to analyse its effectiveness. At the moment the pilot session is ended and its under evaluation by the starting sample of teachers, but also to new ones. For the feedback an adequate questionnaire has been written in order to analyse the website’s effectiveness.

1. Introduction

Even if Earth science is a discipline essential for the development of the society, unfortunately this seems not to be the perception of more and therefore the teaching of this subject at school is often overlooked. The results of such an attitude is directly seen in the small numbers of students enrolled in Earth science university courses: Italian students enrolled in Geological Sciences degree courses during the academic year 2012/2013 were only 1540 of a total of 228208 newcomers, less than 0,7% (www.anagrafe.miur.it). Moreover the results achieved by the Italian students in OCSE-PISA science texts in 2006, 2009 and 2012 show, especially in the context of Earth sciences, scores below the average (<http://www.invalsi.it>). The little sympathy for the Earth sciences observed in the Italian schools and universities is mostly related to the fact that “the widely held perception of science being difficult and not relevant to the lives of most people.” [2]. It should be remembered that “science is a socio-cultural activity [...] Any nation’s schools have a duty to develop scientific literacy among its pupils so that they can participate in democratic debate on scientific matters of significance. Citizens also need the skills to discuss the nature and purpose of science, skills that can be developed in school” [3]. This statement is true for all the sciences taught at school, but it seems to be even more important for the Earth sciences, because “geosciences helps to create a planetary perspective” [4].

2. Methodology

On the basis of this premise we can affirm that “Earth science educators have the great responsibility to transform geoscience education into a process that must go beyond mere teaching and learning the facts, laws and theories; it must involve understanding the nature of geoscience and its relationships with society” [5]. Literacy shows as “field activities are essential to geological teaching because they



play a basic role at the different school levels” [6], and that “the readily accessible contexts for learning Earth sciences may introduce young adolescents to features of scientific reasoning such as observing, hypothesizing, and drawing conclusions from evidence” [7]. But if we analyse the present Italian situation we notice that this teaching approach is not the most common one, for example we know that “most of the Italian student are interested into laboratory activities, but they enter in the labs rarely” [8]. At the same time analysing the international Earth sciences teaching web-tools it is easy to find numerous interesting publications, events and websites dealing with that. Thus the questions are: how much these web materials are really exploited by Italian teachers? What could be done for engage more teachers in their use? Would teachers like to have more materials in Italian for teaching Earth science? Would these materials really help the teaching and the learning process?

This project tried first to understand how much the new teaching web tools are really utilized by Italian Earth science teachers at secondary schools. Thus the first step of the project consisted on the development of a questionnaire for investigating the effective use of educational multimedia and hands-on activities in the Earth sciences teaching. Moreover the purpose of the questionnaire was also to select the Earth sciences topics of greater interests, by crossing the ministry guidelines with individual teachers’ personal impressions. The questionnaire is composed by a series of semi-structured questions, some requiring a yes or no answer, while others asking a grade of agreement based on the Likert scale of (1: strongly disagree, 7: strongly agree).

The sample chosen for the starting analysis was the group of teachers who inscribed their school at the 2012 edition of Natural Science Olympiad. Even we are aware of the fact that it is a specific sample with peculiar features, we selected it because it is:

- large (close to 400 teachers)
- geographically various (spread over almost all Italian regions)
- quite easily reachable
- composed by teachers supposed to be more engaged than the average into update process

3. Results and discussion

After a month from the questionnaire submission we received back 64 questionnaires from most of the Italian regions. The analysis of this first set of data allows us to make a certain kind of considerations.

As it appears clear from Fig. 1, most of the interviewed teachers normally use PC and projector, much more than interactive blackboard. This means that the projector is still the most common technological device in use by teachers during their science lessons. Moreover by the analysis of the qualitative answer regarding the motivation of such an attitude, emerged that one of the reason is the lack of interactive blackboard at school and the difficulties connected to the booking plan for it. Another really interesting consideration about this data is the fact that a really high percentage of teachers affirm to use specific websites for teaching Earth sciences and to do hands-on activities as well.

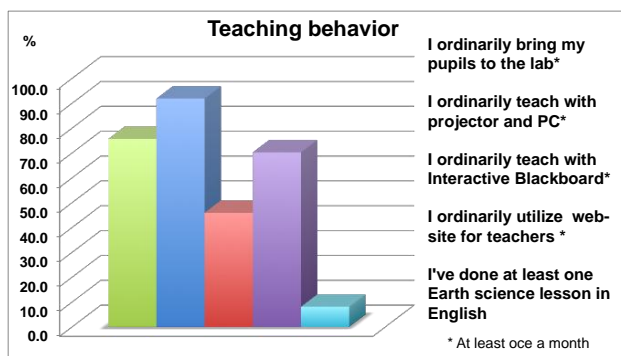


Fig. 1. The percentage of teachers’ behaviour



On the basis of the previous answer is therefore interesting to find out what teachers said when were asked them about their need of new supplementary materials for teaching Earth sciences. In Fig. 2 are reported the percentage of interest shown by the interviewed teachers, a Likert scale is used.

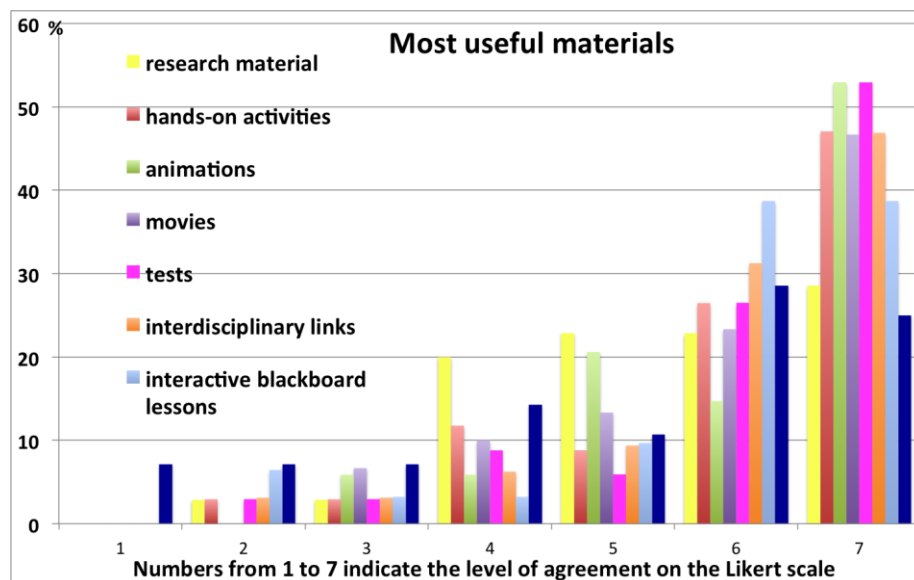


Fig. 2. The percentage of the most useful learning object selected by the teachers

Moreover we asked the teachers to select which items they would prefer to have more materials about (each teacher had the opportunity to choose maximum 5 different items from a set of 12). The results are reported in Fig. 3.

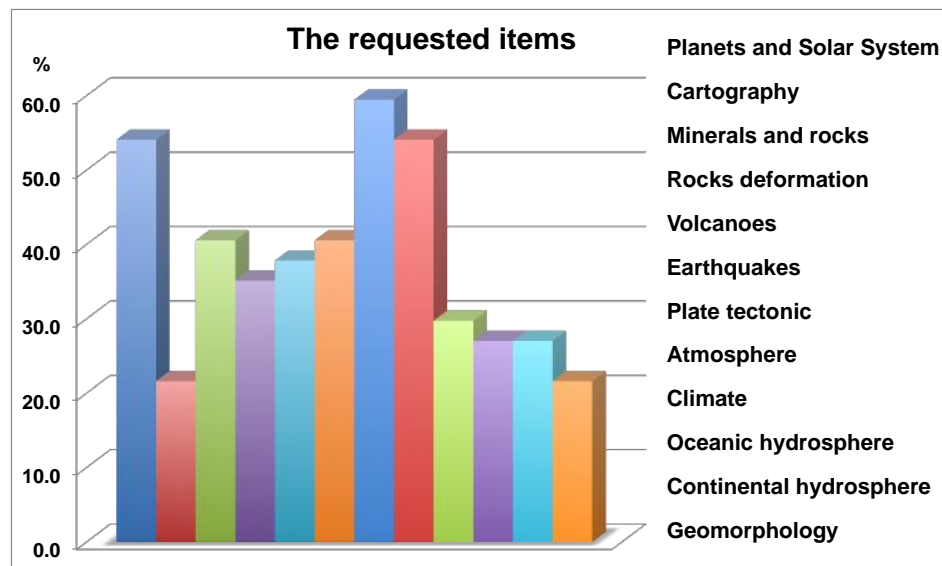


Fig. 3. The items selected by the teachers

The last question of the interview had the purpose to find out teachers' degree of knowledge about e-learning courses and their usefulness as in-service formation activities. Fig. 4 shows that around 1/3 of the sample affirms that e-learning courses could be an effective way to improve the teaching knowledge and to update the professional skills.

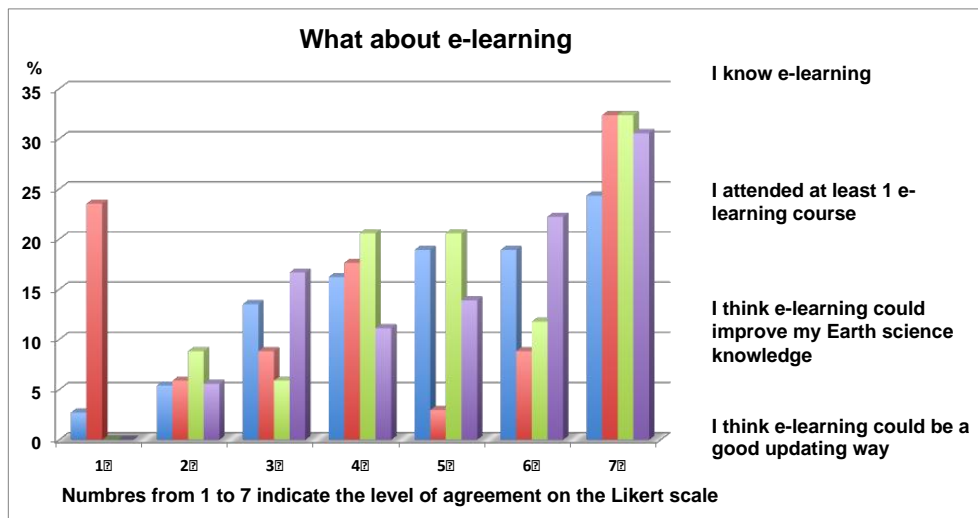


Fig. 4. The level of knowledge and agreement about e-learning courses shown by the teachers

On the basis of these preliminary results we designed a website trying to respond to all the needs showed by the teachers and we developed new learning objects to upload. At the moment the website hosts different kind of files that undergo the Creative Common Licence, and that are free to be used and even modified by the registered teachers. Within the selected Earth sciences topics we collected the existing web teaching material (hands-on activities, simulations, models, animations, etc.) that best fit the real teacher's needs. In this regard, the selection criteria are defined as the relevance to the selected topics, the scientific validity, the ease of use, the economic and logistical needs, the link with everyday life and the relation with the territory.

Each unit is divided into lessons, each one formed by the following learning objects:

- a power point file, consisting on a key point text flanked by the most interesting pictures and images available in the web. The file is enriched by the presence of a list of web links to the most useful external materials (animation, simulations, etc. ...),
- a pdf file, consisting on the transcript of the whole lesson, which is composed by the same images present in the power point lesson and by a richer text,
- a set of exercises, consisting on a group of multiple choice (from 10 to 20, depending on lesson's length) and a group of 10 open answers questions,
- a video of the whole lesson, consisting on a MP4 file, lasting between 6 and 12 minutes, and describing the entire content of the lesson,
- a set of specific short movies (lasting around 2 minutes) about significant key concepts, thought for explaining in a easy way the most important items of the lesson.

During the experimentation phase science teachers interested in the testing had to register themselves in order to receive the log-in password and get the free access to the material. At the moment more that 100 teachers registered in the website and now they can use the material as they prefer:

- the **ppt** files can be used directly, but can also be modified in relation to specific needs,
- the **pdf** files are thought as a support for the teachers, but could be also study material for the students,
- the **mp4** files are a fast and easy way for the teachers to review the lesson, but they could be used for the students in the "flipped classroom" approach,
- the **exercises** are a suggestion for the teachers who would like to test the students.



The idea is that teachers can find in the website most of the material in the preliminary questionnaire they said were interested about. The unit about the plate tectonic has been the first to be tested and a specific questionnaire has been sent to the teachers. On the basis of their answer three new teaching units has been uploaded. Recently a new questionnaire has been uploaded with the purpose to understand if the proposed material fit teachers' needs and to find out if the website really help to make secondary school science teachers (who are not geologist) more comfortable toward Earth sciences teaching. The results of this analysis will follow.

4. Conclusions

By this first part of the research emerged that teachers mostly use "traditional" digital instrument for teaching Earth sciences at school, such as laptop and projector, and that they usually utilize the web for finding teaching materials. Moreover emerged also that high school teachers are not completely satisfied by the materials available in the web and they would like to have more specific teaching tools, like animations, movies, but laboratory protocols as well.

A website has been built in order to answer these teachers' needs. The first didactical unit has been created according to the selected item and to the preferences showed in the preliminary questionnaire; actually the website is in a experimentation phase and it is going to be tested by in-service teachers, in order to evaluate its usefulness and efficiency. After that a new data will follow to report the results.

It must to be underlined that the chosen sample is representative of a particular kind of teachers, because they inscribed the pupils to the Natural Science Olympiad. But we assumed that the teaching needs of the selected sample can be extended also to most of others science teachers; we made the consideration that, if motivated teachers would like to receive more material, is right to hypnotizes that also others would appreciate the same. Another criticism of this study is certainly the fact that we received little more than the 16% of answers. Even if this result indicate that we had a feedback by one teacher each 7, we must underline that we were not able to contact all the 400 teachers directly, but we asked to the Regional representative for the Natural Science Olympiad to submit the questionnaire to the teachers and it is possible something went wrong during this step.

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