The ERASMUS programme applied to improving the training of geological engineers in Germany: An intensive course on natural hazards

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Abstract

In this paper, we present a pioneering initiative in the European teaching cooperation for the university training of geological engineers. This activity was carried out within the framework of the ERASMUS programme for lecturers; the first author, who is a lecturer at the University of Granada (Spain), travelled to the TFH George Agricola University in Bochum (Germany), with the aim of teaching Engineering Geology undergraduates for a week. The theme of the course was Geological Hazards and Risk Management, which is a “hot topic” due to the great number of disasters that have been happening around the world and the importance of their consequences (human and material losses). This course was considered very appropriate, as it is broadly related to the Engineering Geology Degree and there were no contents concerning Natural Hazards in these studies. We describe the parts of the intensive course and present the evaluation-test results. This test was focused on the students’ opinion and acquired knowledge, in terms of connecting the course contents with other topics and real life. Moreover, the innovative didactical method used was much appreciated, including the techniques that stimulate responsibility, group cooperation, educational self-management and the students’ awareness and control over their own knowledge. The planning and development of the course led to productive and interesting debates among several lecturers from different European universities who attended the classes. As a result, an international network of university lecturers was also constituted and currently continues working.

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1. Introduction

A stay in a foreign university is an excellent experience for exchanging research results, methodologies, opinions and teaching contents, and thoughts on life, in an approach to the European High Education Area (EHEA) materialization and its application to the new university degree studies.

The first co-author of this work made a teaching stay in the University TFH George Agricole of Bochum, (Germany) within this framework, developing a one-week intensive course for Engineering Geology Degree students. The planning and development of the course generated productive debates among several lecturers from various European universities.

We consider that to reach EHEA consolidation university educational co-operation is very important in degree and master’s training programmes, and of engineers as a group have a major role to play to achieve this goal. Engineers are one of the groups with the greatest transformation capacity in Europe. To transform a set of countries with different cultures, languages and socioeconomics into an Economic and Social Union is a challenge that has been proposed in Europe. It will be achieved only if countries join each other at a social and professional group level. If the beginning of that union starts in the technological and scientific training placements such as the universities, we will gain a network of ideas and sharing competences which are the glue for the social union and the sociological base of the economic union. With these beliefs, we started an educational co-operation network between different university departments which work in research and primarily in educational activities with common objectives, sharing methodologies with lecturers who know each other and who discuss and think about their mission in higher education and the knowledge society together. This network started with an exchange agreement based on innovation training between the University of Granada (Spain) and TFH Bochum (Germany).

2. Educational research proposal: Methods, course programme, contents and activities

The main objective of the course was to give the students certain knowledge about Geological Hazards and Risk Management as a subject highly related to their professional performance as a Geological Engineers. This subject is not currently included in their official study plan. A course was proposed that included different types of activities, taking into account that the students had no previous training in these topics and that students from different semesters would be able to attend the course.

In addition, due to the type of course (intensive and concentrated in only one week) the knowledge gain in each session had to be “instantaneous” to be able to continue with the sequential planning. The method proposed included the portfolio technique.

The portfolio provides new ways of gaining access to information sources, different from the magisterial lesson, and an evaluation resource to better understand how the students learn (López, 2007). Klenowski et al., (2006) considered the portfolio as a learning, evaluation, and professional instrument being developed in higher education, the same as Cano (2005), Hernández et al., (2006) and Gracia Morán and Pinar, (2009) in the university context. In general, all of these authors agree that the portfolio is a didactic technique that includes instruments that make it possible to compile all the effort and work that students process to reach the objectives proposed in their professional preparation, the students themselves being the ones who build their learning. In this construction of student knowledge the lecturer is a guide who prepares and provides the materials and diversifies the knowledge sources.

The course structure was the following:

1. Master lectures or theoretical lessons (40% of the total time of the course), with audiovisual support, consisting of digital slide presentations specifically designed for this course in English, animations, and videos. The theory lessons were divided into an introduction (20% total time), with the concepts and general outline of the topic, and the application of specific techniques, including theoretical foundations of the techniques as well as examples of their application (20% total time).

2. Practice activities to be undertaken by the students in small groups (40% of the total time). These activities correspond to the portfolio created specifically for this course, which includes 3 interrelated activities. The first consists of an information search for different kinds of natural disasters that have happened in different places around the world. The search is made via internet, selecting diverse types of information: graphic and written, and different information sources: general information sources such as daily newspapers, research articles, and reports of
centres specializing in natural phenomena and disaster management. Students must analyse the information found in each source and determine whether or not it corresponds to a risk and justify the answer. They must identify the factors involved in each type of risk (Vulnerability, Hazard and Elements at risk). All the information is recorded in a form that corresponds to activity 2, which includes the information analysis. Finally, the third activity consists of creating a distribution map with the world localization of each natural risk and disaster analysed. Each group creates its own map with the Google Earth maps tool, adding not only the location but the basic information about every phenomenon on a label.

3. Presentation and debate of activities 1 and 2 to the class group (7% total time). Students must present to the rest of the class group the sources consulted, their importance and the information that each one includes as well as the localization map. At the end of all the presentations a new map with all the maps of the different workgroups is created. This new map is the starting point to a new debate on information sources and the distribution of the disasters and the different risk types found from a worldwide perspective.

4. To answer a questionnaire of self-evaluation of the students (3% of the total time of the course). This questionnaire has been designed on the basis of previous evaluations that exist in the literature related with portfolio learning methods.

Two images below show how the course was developed. (Fig. 2.1). Two images below show how the course was developed. (Fig. 2.1).

Fig. 2.1: two components of the course: theory lessons (left) and practice activities (right).

The three-part evaluation was based on the answers to a questionnaire with questions about each activity proposed within the course.

The first was to evaluate the theory lesson, the second assessed the practice activities, and the third appraised the contributions of the students to the course development in the practice part corresponding to the information they worked with and analysed in this section of the course. The intention was for all the students to fill in the self-evaluation questionnaire, but a few of them failed to do so because this activity was not obligatory. Thus, the theory part of the questionnaire was answered by 28 of the 30 students and the practice part was answered by 10 students, resulting in 6 questionnaires because some students did this part of the course in pairs.

3. Results and course data

Thirty students attended the course. Half of them were from the first semester, 13% from the second, and 17% from the third. This means that almost the 90% of the students who attended the course were from the first half of the degree, and they will apply the knowledge acquired in the course in the second half of their formation. (Fig 3.1)
The group mode of the students to perform the practice activities was in pairs due to the low number of students that attended these sessions (10). Consequently, the number of information sources consulted during these activities was lower than expected and the corresponding maps had a lower density of points selected.

We have observational information that supports the analysis and the information provided from the evaluation questionnaire answers.

The students were asked about any previous knowledge they had related to the theoretical sessions, considering the concepts and the techniques explained during the course separately. (Fig. 3.2).
Most of the students had no previous knowledge, either concepts (11) or techniques (15); some of them had some knowledge related to the concepts (9) and techniques explained (5) while very few claimed to have previous theoretical knowledge (3 people in each topic).

They were asked about the relation between theoretical concepts of this course and the concepts of other subjects, in two ways: whether the contents of other subjects helped them to understand the concepts of this course and whether the concepts of this course helped them to understand the concepts explained in other subjects. Most of the students did not recognize any relation between the theoretical contents of the course and the contents of other subjects in either direction (14 and 15 students, respectively), but there were a quite considerable number that did (8 and 6 in each case). This may be because the answers to these questions were related to the fact that most of the students who attended the course were from the first semester of the degree.

In the case of the results concerning the practice activities, all the students answered that they had some previous knowledge and all had understood clearly the objective of the activities proposed, while only a few of them needed (2) some additional explanations. Half of the students answered that they related the practice activities with other activities proposed in other subjects and half of them answered that they related them with professional activities, too. However, only one of them answered that the practice activities were related with daily-life activities.

With respect to the communication established between the students during the sessions, the answers were positive, as half of the students thought that they had been helped by the rest of their colleagues to understand and perform better the practice activities proposed. More than half answered that they had helped the rest in these aspects.

Additional considerations are:

The debates were of high quality. Although shorter than planned, they were long enough to clarify for the rest of the class the ideas and information presented for each pair of students.

The evaluation was undertaken seriously, leading us to believe that the results are valid.

The students’ self-evaluation was not obligatory, and therefore the students who did not wish to answer did not do so. The results from these questionnaires showed a high reliability level of the information presented.

The number of lecturers who attended the course and other associated activities proposed by the university was higher than expected and they were strongly interested in the teaching topic and the methods proposed. There were fruitful informal debates and conversations which were useful for the researchers.

The framework of scientific resources and the social manifestations created a scenario that gave the authors solid references to share and to exchange learning elements in the context of European university teaching.

Finally, from the standpoint of teaching experience, the result was very positive, because the experience encouraged the establishment of new contacts with other lecturers and helped improve the students in a foreign European university who were completing their training.

4. Conclusions

The analysis of the results of the questionnaire and the impressions exchanged during the stay with the students and the lecturers enabled us to establish that the experience was rewarding for the students, providing them with new knowledge and therefore more complete training.

The education-learning system, based on the portfolio use proved to be a highly appropriate teaching and evaluation instrument for the course type proposed. It promoted more enthusiastic involvement of the students than with traditional learning methods. Moreover, for the destination institution, this experience implies an improvement in the training of the students, considering that they were trained in a subject not previously included in their academic programme.

Finally, we would like to comment that teaching the course has been a very positive experience for the co-author that taught the course as she was able to contribute to the learning process of students of other nationalities who study in a foreign university; the knowledge acquired about the functioning and the facilities of the host university as well as the bi-lateral relationships established with other lecturers will result in new professional collaborations in the future.
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