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ScienceDirect

Procedia - Social and Behavioral Sciences 191 (2015) 63 – 67

Procedia
Social and Behavioral Sciences

WCES 2014

A Field-Based Approach To Teach Geoscience: A Study With Secondary Students

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Abstract

Many geoscience fieldworks are not aligned with the curriculum contents reflecting the need to develop more research related to the outdoor learning environment. The purpose of the study was to verify if a fieldwork organized in accordance with Orion's model (1993), could be assumed as an integral part of formal school science curricula. A fieldwork has been carried with a sample of 115 secondary science students from a rural school in Portugal. A mixed research method was carried out. Short questionnaires were applied to students and to a participant observer, and the researcher wrote reports. Evidences indicated the relevance of geological fieldworks for geoscience education. This study highlighted the relevance of fieldwork as an integral component of the formal curriculum.

Selection and peer-review under responsibility of the Organizing Committee of WCES 2014

Keywords: field trip; formal activity;outdoor environment; secondary students

1. Introduction

Many current science education reforms over western countries urge science students to be frequently and actively involved in exploring the natural world in order to develop inquiry activities. However, as the outdoor learning environment is not yet commonly used as an integral component of the learning process, fieldworks are generally neglected in formal education. As such, many geoscience classrooms are still centred in textbooks readings and in some practical work undertook in indoor environments (Esteves et al., 2011). Although practical work, namely modelling activities, is used to mirror scientists' activities, the field ***is*** and will always be the natural environmental to research geo-scientific issues. Nevertheless, many doubts and criticisms arise from curriculum

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Selection and peer-review under responsibility of the Organizing Committee of WCES 2014
doi:10.1016/j.sbspro.2015.04.323

designers, teachers and school directors, on this respect. Lack of time and financial constraints are the main reasons evoked. Other barrier that arises in the use of a field-based approach is the lack of teachers qualified to mediate the process, since there is insufficient knowledge related to the organization of fieldwork and the unravelling of difficulties inherent to its alignment with science syllabus objectives. In fact, literature indicates that connecting fieldwork to the classroom curriculum is an important issue to stimulate and encourage teachers to consider outdoor environment in their teaching plans (Esteves et al., 2013a; Kisiel, 2005). Within this framework, the purpose of this study was to verify whether a fieldwork, organized in accordance with Orion's model (1993), could be seized as an integral part of formal school science curricula. Given its potential contribution to the development of diverse competences directed to the conceptual knowledge comprehension and scientific reasoning, it was hoped that evidence resulting from the fieldwork would encourage curricular designers to incorporate fieldwork as a compulsory activity in geo-science teaching.

2. A model to organize fieldworks

Outdoor environment provides students with opportunities to be involved in tasks that resemble how scientists work, a requirement that is needed in almost every science syllabus. As stated previously, sometimes teachers have difficulties to overcome the organization of this kind of activities. As such, the availability of a model that helps teachers in its organization becomes fundamental. Amongst many models that may be used to organize a fieldwork, this study option resorted to Orion's model (1993), due to its simplicity and well-structured design. Furthermore, over the years research has revealed Orion's model to be a meaningful tool in the promotion of inquiry activities, group social interaction and a strong commitment between students and nature (Esteves et al., 2013b). Orions' model is herein presented as an alternative to traditional activities, which are focused both in the teacher and the information that is communicated, resorting to the natural context and phenomena only to illustrate and confirm the geological data (Lima et al., 2010). As stated by Orion (1993, 2007), the concepts to be learned in the field are classified according to their level of abstraction, and the organization has to consider three units: preparation unit (before the field trip); the field trip; and the summary unit (after the field trip). The curriculum materials developed to the fieldwork include a teacher field guide for the preparatory unit, a student's field guide directed to their individual research in each study station, and a series of mini-posters to help teachers explain observations during the group discussion that usually follows the individual investigation (Orion & Hofstein, 1994). Reducing novelty space (cognitive, psychological and geographical factors) is a priority task in the preparatory unit. The idea of novelty space emphasizes the importance of reducing to the minimum the factors that can difficult the meaningful learning during the field trip (Orion, 1993). The same author refers that the summary unit includes the more complex concepts, which demand higher abstraction competences and higher level of concentration from students. It is the unit that has to promote reconceptualization and consolidation of knowledge, as well as the emergence of new research questions. In the end of the fieldwork students much be well acquainted with the geological story of the area and they must have developed knowledge and understanding of all of the geological phenomena and processes in study. According to Orion (2007), integrating the outdoor environment as an integral and central component of the learning process is essential when considering an Earth science holistic approach that aspires to achieve the "science for all paradigm". Unfortunately, many students do not have access to such learning experiences, especially due to a lack of a challenging curriculum that incorporates out-of-school activities (Luehmann & Markowitz, 2007). Developing organized fieldwork according to a proved successful model may encourage its development among geoscience teachers.

2.1. The fieldwork carried out on River Minho's left bank

In this study a field trip has been carried out on the left bank of River Minho, with a sample of 115 secondary science students from a rural school in Portugal. The field trip included five study stations where the vast local geo-diversity could be observed and its geological aspects taught to students. The fieldwork was organized in accordance to the three units mentioned in Orions' model and specific and varied curriculum resources were built for each unit: a students' field guide, worksheet, mini-posters and PowerPoint presentations.

The preparatory unit was developed in the classroom and aimed to reduce the *novelty space* - the cognitive, psychological and geographical factors inherent to the specific outdoor environment to be visited. The aim was to