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Virtual field trips in education of earth and environmental sciences

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Abstract

Laboratory exercises, field observations and field trips are fundamental parts of many earth science and environmental science courses. Field observations and field trips can be constrained because of distance, time, expense, scale, safety, or complexity of real-world environments. During the last decades actual field trips have been losing power and attention because of the limitations mentioned above and virtual field trips have been started to think as an alternative to the actual field trips. The aim of this study is to research the historical background and development of the virtual field trips in education of earth and environmental sciences. It is also discussed the potential and limitations of the virtual reality to provide and support student-centered, meaningful and deeper learning environment.
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Keywords: Virtual field trip, education of earth and environmental sciences, computer aided education, information and communication technology, fieldwork.

1. Introduction

Fieldwork is widely regarded as an essential part of undergraduate education in earth and environmental sciences and lecturers generally agree that it represents one of the most effective and enjoyable forms of teaching and learning for both staff and students. Field studies provide the opportunity to experiment with a wide variety of different modes of course delivery and have a valuable role as a vehicle for the integration of many theoretical and practical concepts taught within a earth and environmental science degree. Field experience is also seen as vital for the development of students as qualified practitioners in all aspects of these disciplines, since a great deal of research in the subject is fieldwork based (Kent et. al., 1999, Gürgen & Çalışkan, 2010). In recent years the number of students gradually increased despite of the decreasing per capita educational resources in the earth and environmental science departments. However the costs of fieldworks have also increased. Since the beginning of the 1990s, as an alternative to actual fieldwork, the virtual reality has been regarded as a cheaper way of doing field trips. Virtual field trips basically emulate the actual field trips. They have a valuable role in supporting and enhancing real fieldwork and empowering students who are disadvantaged financially or physically (Gress & Scott, 1996; Stainfield et. al., 2000; Spicer & Stratford, 2001; Rose, 2003; Hirsch & Lloyd, 2005).

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Since the 2000s, it has been observed that in the education of earth and environmental sciences, applications such as remote sensing and geographical information systems have been commonly used and a variety of special software packages have been developed. Discussions have been commenced on whether the virtual applications which were previously perceived as a part of the preparation and/or presentation dimensions of the real field trips will replace the reality. Initially found as virtual trip-observation, the method has eventually developed to the level of virtual field trip courses. In the virtual field courses where virtual field trips to more than one location are conducted, software packages that enable students to build their own experience can be used (Tuthill & Klemm, 2002; Chang et. al., 2009). Moreover, all the activities that will be conducted on real field trips such as sample analysis, soil survey, drilling or excavation can be put into action in the safe and comfortable environment of a class or home Qui & Hubble, 2002; Hirsch & Llyod, 2005; Ramasundaram et. al., 2005).

2. Characteristics of virtual field trips

It can be put forward that there are two kinds of virtual field trips although they have some similar characteristics. The first of these two trips are the virtual field trips on which students are just observers, listeners and watchers. The second type does not only consist of pictures and films, but rather enable the students to participate in the field trip with the help of certain programs, where they can act in line with their own preferences. During the first couple of years of training in the earth and environmental sciences, it is more plausible to apply the first type which necessitates less knowledge and experience, whilst applying the second type in the following years. Some of the most important features of the virtual field trips have been mentioned below.

- The virtual field trips are carried out by using computers and digital visuality (photographs, videos, audios and 3D models).
- They depend on personal computers and/or internet.
- There are easy ways to access a virtual field trip as CD-ROMs and web sites.
- With the use of virtual reality the field trips can have an extensive variety and comprise all parts of the field.
- The variables which are used are not random, but they demonstrate the characteristic features of the issue.
- The virtual field trips can be designed like computer games.
- Only the senses of hearing and seeing can be applied through visual & audio aids.
- There is no restriction on time, weather, distance and physical strength.

3. Constraints and opportunities of virtual field trips

Field trip plays an important role in learning and research in earth and environmental sciences. However, due to issues in time and budget as well as safety concerns, field trips have not been fully employed as an instructional activity. The use of virtual reality technologies for rich multi-media presentations of the field sites thus becomes a practical alternative (Tuthill & Klemm, 2002; Chang et. al., 2009). However since the recent decades the many of the researchers have thought that virtual reality is most likely to represent an additional source of information to supplement a field visit or to assist with field course preparation (Kent et. al., 1999; Spicer & Stratford, 2001; Hirsch & Llyod, 2005). There are a few researchers who are agreed with this idea but give a more important role to virtual field trips in education of earth and environmental sciences (Kirkby vd., 1999; Ramasundaram vd., 2005; Stumpf vd., 2008; Wrzesien ve Raya, 2010). The advantages and disadvantages of virtual field trips have given in Table 1.

Table 1. The advantages and disadvantages of virtual field trips (Qui & Hubble, 2002).

The advantages of virtual field trips	The disadvantages of virtual field trips
• Integrate diverse types of data in instantly available ways • Present images from a variety of viewpoints and at many different scales • Display non-visual data (geochemistry, etc.) • Helpful for presenting trips to inaccessible areas • Provide an alternative of fieldwork, when time, expenses, and/or logistics are real issues • Enable presentation of extensive field trips and great variety of landform diversity • Enhance and expand students' experience • Enable flexibility of access (time and place) • Provides a repeatable experience which can be used to reinforce concepts in class • Provides an easily experienced preview or review of real field trips • CD-ROMs are convenient to acquire and use • Information rich • Hold abundant materials and information • Offer rich resources of learning and teaching • Available for users of different levels and demands • Interesting and attractive to students and an alternative experience for users	• Do not convey the true three-dimensional nature of objects • Do not convey the non-visual and aural feelings of touch, smell, etc. • Less beneficial than really being in the field • Lack the serendipitous nature of discovery • Having limited interaction with a computer • Not interacting with people in a flexible manner • CD-ROMs can only provide a finite limited amount of information • Visiting a website can be difficult and depends on many factors, such as availability of computers, load on the network, number of connections, reliability of service provision, etc. • Easy for students to get lost among lots of websites • Many websites are ephemeral rather than permanent • Often difficult to find a suitable one for teaching and learning • The abundant websites are not quality controlled • It is easy for students to wallow, or obsess over particular sites, which raises the problem of time management

4. Conclusion

The role of field trips both in Turkey and in the world has been gradually diminishing. On the contrary, computer technology has been improving every day and the computer assisted education applications are getting more enhanced. Therefore, the scope and the depth of virtual field trips have been constantly renewed and improved. In a short period of time, it will be possible to create very advanced and improved virtual field trips which will be able to replace the real field trips. Nevertheless, it remains a question to what extent these experiences will entail enduring knowledge on part of the students, in the lack any contact, taste or smell senses. It is also debatable how successful and productive the geologists and ecologists who are trained in virtual environments in which no real field experience exists will be in their future job as a geologist, biologist, archeologist and geographer.

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