Bringing the mountain to the student: developing a fully integrated online volcano module

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Abstract

Fieldtrips are a crucial and established component of teaching in the Earth Sciences, providing an effective means of turning theory into practice. Increasing class sizes, 'exotic' locations and the associated costs, however, often make it impractical to take the students into the field. In an attempt to reconcile these issues, we have started exploiting technology to develop a new module entitled 'Volcanoes, Humans and Environmental Catastrophes' for which five 'virtual' field trips were integrated within the University's Virtual Learning Environment. The fieldtrips were formed around online interactive maps that allowed the students to explore the field study environment by streamlined film footage, high quality images and text. This paper explores the advantages of this approach and identifies problems that are likely to be of relevance to colleagues developing similar resources in their own speciality.

Introduction

Fieldtrips are seen as an essential component of the degree programme for many disciplines, developing a range of general and discipline-specific skills (Ford 1999). Nowhere is this more relevant than for archaeologists and palaeoecologists where the very nature of the work requires field experience to look at past human and environmental change. Unfortunately, however, with the increasing demands made by larger student classes (and associated financial constraints), it is becoming more problematic to undertake fieldtrips for lower-level undergraduate modules to the likely detriment of the learning experience. Fieldwork encourages the development of a wide variety of skills, including observation, independent learning and experiencing 'real-world' issues. In particular, by grappling with 'real-world' issues it is considered that students are more likely to engage with a topic. To avoid having to remove the fieldtrip elements from teaching, technology offers an exciting possibility to continue teaching many of the principal skills of fieldwork to students. It is becoming increasingly apparent that technology offers exciting possibilities in supporting effective learning (if utilised thoughtfully), encouraging relevant student learning (thereby reaching a wide range of teaching aims and outcomes) (Woodley 2001; Williams 2002; Biggs 2003) and developing an additional set of skills, in particular confidence within an electronic environment. An exciting possibility therefore exists to develop computer-based 'virtual' fieldtrips that fuse the principles of fieldwork with technology, carefully aligned to the learning outcomes of the module. Ultimately, such virtual fieldtrips must aim to engender intrinsic motivation in students. Questions, however, must be set to tasks to directly assess whether the learning outcomes are met.

Within Northern Ireland, there is a Level 0 entrance for students who have insufficient or inappropriate qualifications (or grades) for immediate entry into the conventional three-year degree pathway. The Level 0 route of entry provides an alternative option for students who would not generally be admitted into University. As a result, these students can be considered more susceptible to failing to make the transition from 'A'-level to university degree level. Within this context, and as part of the inherent expansion in student numbers, a new Level 0 module has been developed at Queen's University Belfast entitled 'Volcanoes, Humans and Environmental Catastrophes' (herein referred to as the 'Volcanoes' module). In its first year, 75 students were registered for the module, from a wide variety of degree pathways within the University, including palaeoecology, archaeology, geography and biology. Crucial to the success of the module and the students' successful University career is to engage candidates in developing their own independent learning. This module has been developed to allow students to return to resources repeatedly (if necessary) if they feel the pace of teaching is too fast. As part of the development of this module, we outline the wider developments made in e-learning which support this module and in particular we highlight the advantages but also some of the problems associated with this virtual approach.

The Volcanoes module

It was decided to use innovative approaches to develop more effective teaching, empowering students to develop deep learning while at the same time providing more reflective time that traditional approaches do not always make possible. As a result, the University's Virtual Learning Environment (called *Queens-Online)* was integrated within the module to support teaching and learning.

Students are introduced to the basic principles of volcanology, followed by the effects on human evolution and early civilisation, the effects on ecology and climate, the effects on modern civilisation, and how man can mitigate the effects of volcanoes. The module has been designed around a blended approach to teaching using traditional ('conventional') and innovative methods. Lectures are given in a conversational style to engage with the students and allow for spontaneous questioning. Technology is used to support teaching and learning in all spheres. For instance, lectures are supported by webbased resources available through *Queens-Online* and are therefore accessible off-campus, allowing learning to continue 'anytime, anyplace'. E-mail is also used for two-way communication with students. Embedded within the lecture programme are five integrated 'virtual' fieldtrips ('AD79, Pompeii and the Plinys','Santorini and the collapse of the Minoans', 'New Zealand', 'Australian volcanoes' and 'Volcanoes in present day Campania'). The fieldtrips are accessed through *Queens-Online.* Assessment of the module comprises completion of all practicals and fieldtrips (worth 30%), a mid-semester test (20%) and a final exam (50%). The mid-semester test is undertaken through *Queens-Online.*

The 'virtual' fieldtrips form a major part of the module as a means of allowing active learning. These have been developed in contrast to conventional fieldtrips to allow large student numbers to be taught, to keep relative costs down (particularly to the student), and to provide students with exposure to internationally-exciting 'real' examples and issues. There are an increasing number of virtual field trips and courses available over the web. These vary considerably in quality (Stainfield, Fisher, Ford and Solem., 2000; Shroder, Bishop, Olsenholler and Craiger, 2002) from those that provide descriptions of an area in text and pictures to those that provide a highly interactive problem based approach such as the Virtual Montana project (Donert, 2003). At Level 0, however, we anticipated a diverse range of student knowledge and skills and wished to make the fieldtrips as simple as possible, using software that they will routinely use at a later stage in their University degree, regardless of their degree pathway.

As a result of the above, we have developed a relatively simple model with fieldtrips being formed around online interactive maps that allow the students to explore the environment by streamlined film footage, high quality images and text. Students access the fieldtrip using their candidate number and password, via the relevant fieldtrip link provided in *Queens-Online.* This presents the user with a world map showing the different tectonic plates and the location of the individual fieldtrips (Figure 1). The fieldtrips can be accessed via the volcano icon on the map or via the title of the trip at the base of the screen and the structure allows the students to explore their environment independently of others (Figure 1A), though

informal contact with colleagues on adjoining workstations is encouraged. In the fieldtrip for the AD79 eruption of Mount Vesuvius, the students are immediately taken to the Bay of Naples (Figure 1B), where they can chose to read the description of the eruption by Pliny the Younger from different geographical locations and explore a number of archaeological sites, including Pompeii (Figure 1C) to see the devastating effects of eruptions (Figure 1D). Furthermore, movies can provide a powerful tool for enhancing student learning, allowing them to appreciate the scale of their environment and in many instances collect primary data (not often possible using still images). For instance, in one fieldtrip entitled 'Volcanoes in present day Campania' students can model an evacuation of Naples by measuring traffic flow out of different zones in the city in real time recorded on a Friday evening rush hour. The seamless links between the fieldtrips and *Queens-Online* means that the students gain confidence in an e-environment. Such an approach, however, does not preclude developing group working skills by the use of on-line discussion pages that can be set up for each session, thereby allowing greater consultation between class members during the fieldtrip.

Students are issued with copies of the fieldtrip questions prior to the beginning of the session and are required to consider the questions during the trip. By using technology it was possible to utilise Computer Assisted Assessment (CAA), with the latter carefully aligned to the aims and objectives of the module (Maier, Barnett, Warren and Brunner 1998). CAA not only thereby provides immediate feedback but can also help guide student reading. Furthermore, by providing a virtually instantaneous marking of fieldtrip submissions and other elements of assessment (e.g., a mid-semester test), time was 'created' for the lecturer to reflect on which components of the module have been little understood and which students were at risk from poor attendance and/or poor grades which could be addressed in subsequent sessions. Once the fieldtrip is completed, students access the relevant 'Assessment' option for the fieldtrip through *Queens-Online.* The questions are given as multiple choice options and the selection is made online.

The online questioning allows students to consider concepts and think about the wider issues, thereby helping them to develop deeper learning rather than just answering comprehension and/or factual points only. In addition, because the marking is undertaken through CAA, the load on the lecturer is negligible (although there is a short period of time required for entering the questions and answers into *Queens-Online).* The above is complemented by the mid-semester test of 50 multiple choice questions that is undertaken under exam conditions using exactly the same (online) assessment format as the fieldtrip.

Evaluation

All aspects of the module were evaluated and have been considered successful. Student feedback provided an overall module score of 4.43 (out of 5) with a lecturer score of 4.59. In addition, the virtual fieldtrips were an innovative development, thus ongoing monitoring of the fieldtrips is being undertaken. Evaluation of the module highlighted the importance of attendance and regular access of the fieldtrips as an educational resource (Table 1). Indeed, it was clear that many of the

students were using the fieldtrips as revision aids in the run-up to the exams, with some students accessing the fieldtrips up to 38 times prior to the final examination. 69% of the entire class who attended all of the practicals, and/or accessed the resources repeatedly, had an overall course mark of 55% or above. In contrast, 16% of the entire class who did not attend or access all of the practicals failed the module with an average score of 24% (Table 1). In the 'volcanoes, humans and environmental catastrophes' module, the virtual fieldtrips were a key element of successfully passing the module, with most students who passed accessing the material for revision purposes following direct assessment (69% of the class). This was a crucial and conscious decision by the module co-ordinator to help develop students as independent learners and provide them with confidence within an e-learning environment. Comments from students at the end of the module support the above.

Table 1. Overall module grades and attendance on fieldtrips for 'Volcanoes, Humans and Environmental Catastrophes' module. The number of successful and failed students have been identified according to whether they attended all the formal teaching sessions where the fieldtrips were supervised and assessed. Attendance was monitored by submission of work via the University virtual learning environment (n=75).

	Final **grade** for students who **attended** all fieldtrips offered as formal teaching sessions (n=-59)		Final **grade** for students who **did not attend** all fieldtrips offered as formal teaching sessions (n=16)	
	Passed	Failed	Passed	Failed
Average grade (%)	54.6%	30.4%	51.3%	23.8%
% of entire class	52 students; 69.3%	7 students; 9.3% of entire class	4 students; 5% of entire class	12 students; 16% of entire class

Comments included:
"The practicals helped me apply knowledge gained in class, helping me to remember topics".

"Practicals stimulated my interest and made me want to learn" and

"I found them (practicals) very useful as it is independent learning you can't just switch off".

There was an almost unanimous response by students that the virtual fieldtrips were the most successful element of the module.

Comments included:
"Using computers for assessment is very helpful, and helped me to gain confidence in using them".

Student failure rates were somewhat disappointing in the student cohort used here (approximately 25%; Table 1), though this is not unusual at Level 0, with the number of successful candidates varying considerably between years. For instance , in the following year of the same module, the failure rate had dropped to 12%.

Further to the above, the mid-semester test undertaken on-line was considered a success by most students. Although few people like taking tests, verbal feedback indicated that students preferred this approach to a paper examination. CAA was also welcomed by the lecturer. Marking time was cut typically from three hours to virtually nothing, and the time taken to transfer the grades into the module spreadsheet dropped from one hour of individual score entry to around 10 minutes copying and pasting the results. This provided more time for reflection on individual questions to identify areas of uncertainty and misunderstanding in the class, which could then be addressed at the next session.

Potential problems and the future

The time commitment by staff in the first year was considerably more than anticipated for all concerned in setting up the fieldtrips. The writing of the text, films and photos took approximately three weeks, and this did not include the development of the web resources. This was not a problem in itself as we wanted the module to be a success and in the future we anticipate this 'front-loading' to be largely negligible. With respect to student learning, students appeared to undertake a strategic approach to the fieldtrips, supporting similar observations by Saunders and Klemming (2003). Students were often observed to be looking for the answers to the assessment component during fieldtrip sessions, and then left when this information had to be obtained. Most students did not appear to take the full time on offer (a maximum of 3 hours) to make notes from the various resource elements in the fieldtrips. This is supported by comments made at the end of the module, such as *"Knowing the questions before the practicals discouraged me to read the whole practical"*. What became clear, however, was that a large majority of students returned to the resource at a later date, indicating that as a resource it was being utilised at a separate time to that formally allocated for the fieldtrip. Furthermore, the students repeatedly referred to the international scope that was made available to them through the practicals (something not possible through field work in the home country). Finally, numerous comments were made by students as to the transferable skills gained by the module, particularly familiarity with computers and *Queens-Online.*

In future, we intend to exploit more fully a 'Discussion' option provided by *Queens-Online* as a forum for discussion during the module, in particular the fieldtrip component. In addition, at the beginning of the sessions, we intend to provide simple generic points students should consider during the fieldtrip. One hour into the fieldtrip, the assessment questions will be made 'live'. Such an approach is aimed at encouraging students to make fuller notes and utilise the fieldtrips as an educational resource during the allocated time, thereby attempting to encourage students to explore their environment more.

The module is not currently available to students outside Queen's University Belfast, but a CD-ROM of the virtual fieldtrips will shortly be available for purchase.
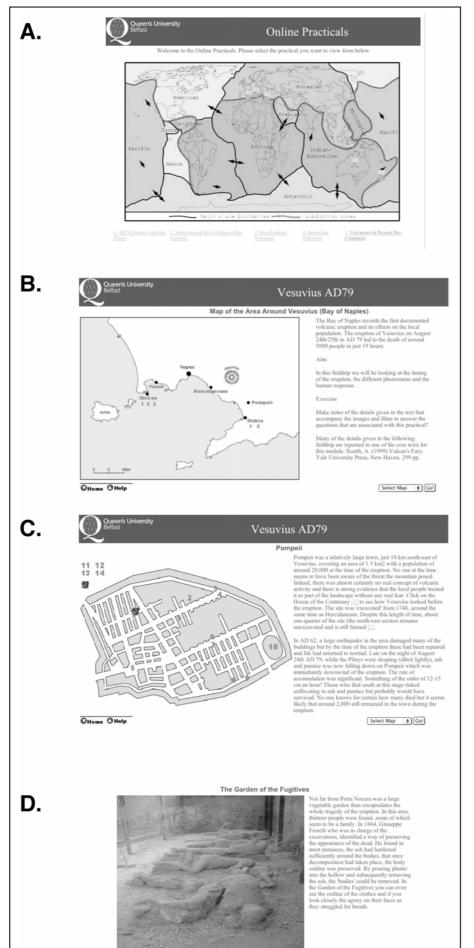
Figure 1: Example fieldtrip 'AD79, Pompeii and the Plinys' demonstrating the structure and options within the virtual fieldtrips, including (A.) world map of tectonic plates, (B.) the Bay of Naples, (C.) Pompeii, and (D.) the human consequences!

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