



Viewpoint

Fieldwork in Ecology as a Form of Experiential Learning: First-year university students' experiences of a short experiential learning intervention

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Abstract

The small-scale research study reported on in this Viewpoint paper was conducted to determine the extent to which experiential learning in the form of fieldwork contributes to learning in Biology. The participants in the study were 36 first-year students registered for a module on Ecology. The conceptual framework that framed the study is experiential learning, which proposes that students learn more effectively through first-hand experience. The methodological approach to this study was interpretive as it attempted to interpret students' responses to a survey as well as interview. It also attempted to determine whether students believed the fieldwork experience benefited them. The findings suggest that students who have very little prior experience of fieldwork do not benefit significantly with regard to understanding of scientific concepts, as is evident from students' performance in the module. While a substantial number of students indicated in the questionnaire that they benefited from experiential learning, the benefits appear to be largely in the affective domain, rather than in the cognitive domain. The findings have implications for the expectations we have of experiential learning in first-year Biology courses. The paper is published as a Viewpoint paper, as the views developed through this small-scale study can be further analysed and tested through further research. It is a useful 'first step' in exploring a complex topic, that if it is to be fully understood would require further research into the issues raised by this small-scale study.

Introduction

Experiential learning in Biology is not a new concept. It is generally accepted that first-hand experience enhances learning and should be encouraged (Lakin, 2006). Disciplines such as Biology and Geography are traditionally regarded as ideal areas in which to implement experiential learning to enrich the learning experience. This is indeed the approach followed in the School of Science, Mathematics and Technology Education (SSMTE) at the University of KwaZulu-Natal in South Africa, where this research was conducted. The course in which the research was conducted was designed within the framework of experiential learning.

The question that this research attempts to answer is: How does experiential learning influence students' learning of Ecology?

Theoretical Framework and Literature Review

Kolb's Experiential Learning Theory (ELT) (1984), which proposes that students learn more effectively through first-hand experience, served as a conceptual framework for the study. The theory of constructivism underpins experiential learning as it assumes that learning occurs best if it is grounded in the learners' own experience. Kolb's interests lay in the processes involved in making sense of concrete experiences and the different styles of learning that may be involved. In this he makes explicit use of the work of Piaget, Dewey and Lewin (Smith, 2001). Kolb's experiential learning cycle is an appropriate learning theory as it views experiential learning as the process that links education, work and personal development. This concept, as conceptualised by Kolb (HEQCOM, 2006), views learning as a cyclical pattern from experience through reflection to conceptualising and action, returning to further experience.

The term experiential learning is specifically chosen to differentiate it from other learning theories such as cognitive learning theories that focus on cognition, rather than the affective domain, or behavioural theories that deny any role for subjective experience (Kolb, Boyatzis & Mainemelis, 2000). This experiential learning theory model portrays two dialectically related models of how we grasp experience: concrete experience and abstract conceptualisation; and two dialectically related models of transforming experience: reflective observation and active experimentation. Immediate or concrete experiences are the basis for observations and reflections. These reflections are assimilated and distilled into abstract concepts from which new implications for action can be drawn (Kolb *et al.*, 2000). At the heart of this model is a simple description of how experience is translated into concepts that can be used to guide the choice of new experiences (Atkinson & Murrell, 1988). While some people perceive new information by experiencing the concrete qualities of the world, relying on their senses and immersing themselves in concrete reality, others tend to perceive, grasp or take hold of new information through symbolic representation or abstract conceptualisation – thinking about, analysing or systematically planning rather than using sensation as a guide. Similarly, in transforming or processing experience, some people tend to carefully watch others who are involved in the experience and reflect on what happens, while others choose to jump in and start doing things. A person's background, their past experiences and present environment causes them to choose a particular way of learning (Kolb *et al.*, 2000). Conner (2007) describes Kolb's four-step process of learning as watching, thinking (mind), feeling (emotion) and doing (muscle); but learning requires more than seeing, hearing, moving or touching. We integrate what we sense and think with what we feel and how we behave. Without this integration, students remain passive participants and this passive learning alone does not engage higher brain functions or stimulate senses to the point where integration occurs.

Experiential education is not a new concept. In fact, numerous theories have focused on the importance of experience in learning. The theory of experiential learning has been adapted and applied as a process model in numerous fields and training endeavours. Experiential learning is learning that involves a 'direct encounter with the phenomena being studied rather than merely thinking about the encounter or only considering the possibility of doing something about it' (Borzak, 1981), the focus being on engagement (Osman & Castle, 2006). This sort of

learning is sponsored by an institution and occurs within a structured, formalised framework. It is essentially different from informal everyday learning. Experiential learning in this context refers to fieldtrips where students move out of the classroom and learn in the environment. It is the type of experiential learning associated with ecological studies in biology courses. This view of experiential learning is consistent with a total learning environment philosophy that takes into account both content and context. The education process is about more than cognitive factors such as intellect – it includes emotional intelligence, social interaction and classroom culture (Hawtrey, 2007).

A substantial body of research has reported on the benefits of experiential learning in a wide range of disciplines. The research reported on in this paper was based on experiential learning, where the experience was expected to compliment the academic learning the student experienced in the classroom. The experiential learning occurred during fieldwork, which is regarded in many circles as central to the teaching of disciplines such as Geography (Gold *et al.*, 1991; Jenkins *et al.*, 1994; Kent *et al.*, 1997; all cited in Fuller, Rawlinson & Bevan, 2000) and Biology. The assumption is that first-hand experience enhances learning of concepts and principles of a particular discipline. The research reported by Black (2005) confirms this as the 'learning expeditions' researched by Black led to deeper understanding of important concepts. It is worth noting that these excursions were 12-week experiences. Ernst and Stanek (2006) point to research that supports the effectiveness of direct exposure to strengthen knowledge. Their findings support the view that students learn more effectively within environmental-based programmes than within a traditional educational framework, leading to increased performance, enthusiasm and improved attitudes. Mc Lure (2002) contends that science will make a deeper impression if students engage in fieldwork.

While Smith (2004) reports on the decline of fieldwork in schools in the United Kingdom, practical experience in the form of fieldwork is widely advocated in the Life Science document of the South African National Curriculum Statement (NCS) (DoE, 2003). Nevertheless the majority of students who enrolled for this course had very little experience of fieldwork. Engaging in a module where fieldwork constituted a major part of their work and was assessed rigourously, was a new experience for most of the students. Fieldwork was regarded as an essential component of this course and is based on the notion put forward by Rickinson *et al.* (2004) that fieldwork benefits the cognitive as well as the affective domain. If the statement by Slingsby (2006) that all science has its roots in first-hand experience of the environment is supported, it is even more important that a first-year module should focus strongly on first-hand experience of the environment. While the intention is that students develop an understanding of concepts and skills during fieldwork, an important goal is also that they become responsible caregivers of the earth (Johnson, 2004).

In contrast, Pace and Tesi (2004) report that little research has been done to determine the effectiveness of fieldtrips on students' long-term interests, education and overall perceptions. In spite of little empirical evidence to support the exact value of experiential learning, the assumption appears to be that learning would be enhanced if students engaged in experiential learning. Prokop, Tuncer and Kvasnicák (2007) report on improved attitudes towards Biology and the natural environment, as well as a better understanding of Ecology. Fieldwork should

essentially be a means of acquiring knowledge by observation and gathering information (Clark, 1996). Lakin (2006), in her discussion of science learning beyond the classroom, emphasises the fact that not only are learners' attitudes and feelings affected by learning outside the classroom, it enhances social and personal development, as well as knowledge and understanding. Lakin (2006) however stresses the fact that experiential learning outside the classroom should be a continuous process. Outdoor education should become embedded into the routine expectations and experiences of the school so that it becomes an established and normal part of 'what we do here' (Dilon, 2006, cited in Lakin, 2006). The work of Boyle *et al.* (2007) focusing on the effectiveness of field courses found little improvement in the knowledge domain, while the affective domain was positively affected.

Background to the Study

The School of Science, Mathematics and Technology Education is a school located in the Faculty of Education at the University of KwaZulu-Natal in South African. The school offers modules on subject-specific methods as well as content modules for a number of subject specialisations. The participants in the study were first-year student teachers who registered for a module in Ecology, which is part of the Biology Education Programme for students registered for the Further Education and Training (FET) (Grades 10–12) band. Student reflections from previous years indicated that students generally enjoyed excursions and found them useful, but their examination results did not support this. This research was conducted to try to understand what the reason might be for the apparent disjuncture between the students' experiences and actual performance in the module.

All practical work in this module was field-based, involving students in a three-day excursion away from campus, as well as two local half-day excursions and a campus-based investigation. The campus-based investigation served as an introduction to field-based learning while one local excursion was to a coastal forest ecosystem and the second was to a rocky shore ecosystem. During the three-day excursion students stayed at an environmental education centre where they explored freshwater, dune and mangrove ecosystems. As the various investigations exposed students to the natural environment, there was an expectation that they would develop an appreciation of the natural world and come to understand the rich biodiversity of the South African flora and fauna. However, the main purpose of the excursions was to reinforce the ecological concepts covered during lectures. This approach is supported by the relevant literature and implemented in the belief that fieldwork would facilitate conceptual development.

Methodology

The methodological approach to this study was interpretive as it attempted to interpret students' experiences, in terms of their learning, of field work. This was accomplished through a questionnaire, as well as in-depth interviews.

The questionnaire was used with 36 students (20 female, 16 male), out of a total of 40 who registered for the course in the second semester of 2007 (four were absent when the survey

was conducted). Each student was given a questionnaire at the completion of the course with a number of questions that they were required to answer. The purpose of the questions was to find out how students experienced fieldwork in the module, as well as their school experiences of fieldwork. It also attempted to determine whether students believed the fieldwork experience benefited them or not. It further attempted to find out how students believed they benefited.

This was followed up by interviews with eight (four male, four female) of the participants. The purpose of the interviews was to probe responses given in the questionnaires more deeply in an effort to get a better understanding of students' experiences. The interviews also served as a form of triangulation to confirm the data collected, or to identify conflicting perspectives in the data. In an effort to reduce tension students may have had with regard to providing data to a researcher who was also the lecturer of the course concerned, the interviews were conducted by a fieldworker using a semi-structured interview schedule.

The size of the sample was determined by the number of students who registered for the course. It was a purposive sample as the participants were students who were registered for this specific course. The eight students who were interviewed were selected randomly from this group. Eight was regarded as a manageable group and representative of the group of 36 who completed the questionnaire. Interviewees remained anonymous as the fieldworker selected the participants randomly.

Ethical clearance was obtained from the Education Faculty Research Committee to conduct the research. Once ethical clearance was obtained, students were given letters requesting their consent to participate in the research. All students agreed to complete the questionnaire, while 32 students agreed to be interviewed. The eight who were interviewed were selected from this group.

Results and Findings

Analysis of the questions contained in the questionnaire as well as the interviews provided insight into the students' background with regard to field excursions as well as their perceptions of what they had learnt during the various excursions at university. Table 1 contains a summary of the findings with regard to students' school experience of fieldwork.

Table 1. Students' responses to the questionnaire (n = 36)

Section A: School experience of Fieldwork

Questions	Yes	No
Did you study Ecology at school?	86%	14%
Do you believe that your teacher had sufficient knowledge of Ecology?	63%	37%
Did you do practical work in Ecology at school?	24%	76%
Did you do other classroom-based practical work?	47%	53%
Do you think school Ecology contributed to a better understanding of Ecology in this module?	50%	50%

Analysis of the students' responses show that the majority of students studied Ecology at school and had some knowledge of the discipline when they enrolled for the university course. While 86% is high, the fact that only students who offered Biology as a Matric (the final school year) subject are allowed into the course, the expectation would be that everyone had some background in Ecology. This indicates that some schools do not study Ecology although it is part of the curriculum. The value of students' school experience with regard to Ecology is questioned as few of them remembered studying Ecology at school.

Most students who did study Ecology felt that their teachers had sufficient knowledge of the subject, although only a small percentage (24%) were exposed to practical work and of those, 47% were only exposed to classroom-based practical work. The interviews revealed that students judged their teachers' knowledge of Ecology on the basis of their content knowledge and not their knowledge of the environment. When questioned why they thought their teachers had sufficient knowledge, these were the types of responses that emerged:

'Definitely yes – she was confident, knew her work.'

'I think so – she was interested and we asked her a lot.'

'... because he was teaching properly.'

The interviews confirmed that students rarely engaged in fieldwork during their school years, whether on campus or further away. When they were questioned about their experiences of practical work in Ecology, it was noted that half of the students interviewed could not remember if they had gone on excursions. If experiential learning contributes in a major way to students' conceptual understanding, it is significant that these students have no recollection of the events. The following responses came from students who did remember if they had gone on excursions or not.

'No, we never did practical work-never went into the field. Only studied things theoretically.'

'Did work outside, but very minor.'

'No practical work. Studied from the textbook.'

In summary, analysis of the data points to a large number of students in this cohort who have limited exposure to field-based practical work and therefore limited experiential learning prior to joining this course. However, the fact that only 50% of the students believed that their exposure to school Ecology helped them in this course shows that experiential learning was not considered as a possible advantage in contributing to their understanding.

Table 2 contains a summary of the findings with regard to students' experience of fieldwork in the module.

Table 2. Students' responses to the questionnaire (n = 36)**Section B: Experience of fieldwork in the module**

Questions	Yes	No
Did this course contribute to improved understanding and knowledge of the environment?	100%	0%
Did excursions contribute to understanding of the content covered in the module?	97%	3%
Would it have helped you to go on more fieldtrips?	5%	95%
Would your marks have been higher if you had done fieldwork at school? (Answered by those who did not do fieldwork)	100%	0%
Did you think of fieldwork as a different way of learning?	92%	8%
Did you think fieldwork was important?	68%	32%
Did your attitude to the environment change in a positive way after engaging in fieldwork?	91%	9%
How did your attitude change?	With regard to conservation, appreciation of the environment: 91%	With regard to improved knowledge: 9%

While all students believed that the course contributed to their understanding of the environment, they appeared to interpret understanding of environment differently:

'Must not litter.'

'Must not cause fires or destroy food chains and biodiversity.'

'I became very interested in issues such as global warming.'

'I notice many things I would not have noticed previously. I am more aware of what I have learnt.'

'I learnt more things that I never learnt at school because I went on excursions and saw many, many things for the first time.'

A significant response was that most (97%) students believed that experiential learning contributed to improved understanding of the concepts, principles and processes covered in the course.

'It helped me to understand content – the activities.'

'Yes – reinforce understand. See what really goes on.'

'Hands-on experience, easier to know how things work.'

'Yes, I think it did, because learning theory all the time could be confusing.'

All students believed that experiential learning contributed to a better understanding of Ecology and would help them to improve their marks. As the research was conducted before they wrote the examination, their responses were based on their perceptions of their understanding of the content at that stage.

'I think so, because I understood some concepts better after fieldtrips.'

'You remember because you engaged practically. Having observed first-hand helped.'

'I think so – I would not have been able to write about Rocky Shore, etc.'

Although students indicated the value of fieldtrips, most of them (95%) thought they had done sufficient fieldwork and more trips were unnecessary. While a number of students did engage with fieldwork at school and thus had been exposed to experiential learning, those who had not been exposed felt that their marks in this module may have been higher if they had been exposed to experiential learning before this module.

'Yes, because if you do things for the first time, it takes time to understand.'

'If I was exposed to these trips at school I would have found it easier.'

'At school we learnt to pass the exam – the teacher teaches what he thinks you need to know for the exam and then starts looking at questions, they don't look at the broader knowledge.'

Although there was some indication that students realised that it was not only a fun experience, but a different way of learning, the realisation came late to some.

'Yes, but did not realise how much had to be done afterwards. Only after a lot of trips did we realise we were supposed to work on the trip.'

The majority of students acknowledged that they learnt through the experience, as illustrated by this statement:

'Yes, I saw it as a means of constructing my own knowledge. I think it is the best way of learning – hands on. Forget what you read in the book, but remember what you did.'

There was also acknowledgement that they were unfamiliar with this type of learning, and that many were hesitant to go on the excursions, as shown by this statement:

'It was different. It was new. It was a good thing that we were forced to go otherwise many would not have gone.'

A significant number of students (32%) thought that although experiential learning is important, the theory covered in lectures is more important. This may be an indication of how they view experiential learning.

'Fieldwork helped, but was not more important. I take theory very seriously- you need theory more.'

'It is quite important. Knowledge in classroom is also important.'

'Lectures are more important. You have to learn theory.'

When they were asked how their attitudes changed, only 9% indicated a change in knowledge. A total of 91% interpreted attitudinal change as a positive change with regard to better appreciation and understanding of conservation.

'Made me more aware. I know about saving the environment.'

'You see the damage we cause.'

'If you understand the environment you respect it and enjoy it more.'

'Makes you more aware and appreciate the environment more.'

The fact that this group of students scored an average of 48% on the examination for this course and 53% scored below 50%, indicated that if they gained knowledge and better understanding during excursions, it was not sustained. There is little evidence from these results that experiential learning, based on this experiential learning intervention, was beneficial with regard to improved knowledge and comprehension, as well as the development of higher order thinking skills such as application and interpretation. Students who obtained a mark above 70% in the examination are students who had considerable exposure to experiential learning during their school years. This may indicate that a longer experience of engaging with diverse ways of knowing may be a more important factor than shorter experiential learning interventions later on in their learning careers.

Discussion and Conclusion

The findings suggest that students who have very little prior experience of fieldwork benefit less with regard to improved conceptual development than students who have experience of fieldwork. This is supported by students' performance in the module. While a substantial number of students indicated in the questionnaire that they benefited from the short experiential learning intervention, the benefits appear to be largely in the affective domain, rather than in the cognitive domain. In fact, Fuller *et al.* (2000) question whether experiential learning stimulates students to start thinking independently in the short term. This certainly appears to be the case with the cohort involved in this research. Although the reflections and worksheets reflect some acquisition of knowledge and skills when experiencing the reality of working in the field, most students are unable to sustain these gains over the long term. A significant number of students had no concrete experience of Ecology and this made it difficult for them to proceed to abstract conceptualisation. As there was no practical experience in the natural environment, students could not develop observational skills in the time allocated, let alone engage in active experimentation. Furthermore, the lack of sustained direct and reflective experiences and involvement with the environment excluded the opportunity for reflection as well.

Interpretation of the findings using Kolb's experiential learning model points to the possibility that students who are exposed to experiential learning for the first time have concrete experiences but fail to reflect on their observations in the field to the extent that their observations are assimilated into the kinds of abstract concepts that are tested in the examinations. The result is an inability to apply what is learnt in one context to another, as well as difficulty in using concepts to guide their choice of new experiences, although this was not tested in this study. While students who have been exposed to experiential learning previously appear to be more able to grasp or take hold of new information through symbolic representation or abstract conceptualisation, those students who are not familiar with experiential learning are more inclined to watch others engaging in the process. This choice is influenced by their background and the environment in which they operated previously. Where learning requires students to integrate what they see, think, feel and do (Conner, 2007), it would seem that students need more time for this integration to occur, without which they remain the passive participants Conner refers to.

In spite of the fact that a number of students did not benefit through experiential learning with regard to conceptual development, all students indicated that fieldwork helped them with regard to aspects such as appreciation and awareness of the environment, responsibility towards the environment, understanding the importance of conservation, as well as understanding environmental issues. It might well be that experiential learning of this nature and duration in this context contributes significantly more to affective learning such as respect for the environment than to cognitive development. Student reflections certainly point to the improvement of their social skills as a result of prolonged periods spent in each others company. The work of Fuller *et al.* (2000) supports the findings of this research which shows that students need to be introduced gradually to experiential learning to enable them to benefit more

fully from the process. As Kolb's model shows, integration of various stages does not occur automatically but requires deep observation and reflection. Bearing in mind that many of these students come from an environment where the transmission of knowledge by the teacher is the only form of learning they are familiar with, more time is required to come to terms with experiential learning as an alternative form of learning that is aimed at developing knowledge and skills to the same extent as classroom-based learning, and not as an informal engagement with the environment aimed at providing only a pleasurable experience.

The findings have implications for the expectations we have of experiential learning in teacher education curricula. While experiential learning is beneficial, it would seem that students need time to internalise this approach and come to accept this as an alternative mode of learning. Students who come from a context where learning is seen as assimilation of information need time to adjust to an approach that requires learners to construct knowledge by experiencing new content in new contexts. The findings of this research may be useful when conceptualising the structure of first-year university courses that include experiential learning. While the nature of the discipline usually determines the structure of the course, it may be prudent to consider the background and learning experiences of the participants more deeply when designing such courses (Cross, 2009), and to make allowance for more regular field-work experiences.

Notes on the Contributor

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