Project Link: Linking Teaching with Research and Consultancy in Built Environment Disciplines (2000- 2004)

http://www.brookes.ac.uk/schools/planning/LTRC/

This is an FDTL 4 project being undertaken by Oxford Brookes University, The University of the West of England, University of Westminster and Sheffield Hallam University (UK).

The project is investigating the 'what, where and how' of Linking Teaching with Research and Consultancy in the disciplines of Planning, Land and Property Management, and Building: in 2003-4 it is being extended to other disciplines in the above institutions.

The website contains examples of course design strategies, institutional and department change strategies,reports of focus groups,links to web sites worldwide etc.

A US Centre focusing on Linking Teaching and Research in 'Research Intensive' Universities

The 'Reinvention Centre' at Stony Brook is a national centre focusing on undergraduate education at research universities. http://www.sunysb.edu/Reinventioncenter/

The Centre was born out of the national and international interest generated by the Boyer Commission Report, Reinventing Undergraduate Education: A Blueprint for America's Research Universities (1998). http://naples.cc.sunysb.edu/Pres/boyer.nsf

The US Council On Undergraduate Research

The US Council on Undergraduate Research helps to strengthen the research programs of faculty in predominantly undergraduate institutions. Specifcally, it promotes research by undergraduate students in all branches of science, mathematics and engineering education.The Council believe that education is best served by faculty-student collaborative research combined with investigative teaching strategies. The Council provides avenues for faculty development and helps administrators to improve and assess the research environments of their institutions. The Council also generates awareness and national support for undergraduate research. http://www.cur.org./

Part B
Pedagogic Research

'Enhancing Fieldwork Quality through Pedagogic Research'

Helen King writing on behalf of Mick Healey and Alan Jenkins (research programme leaders); Liz Beaty and Glynis Cousin (pedagogic research consultants); John Bradbeer (researchers); Jenny Blumhof, Brian Chalkley, Steve Gaskin and Geoff Robinson (group members).

An Introduction to the LTSN-GEES-funded Programme

Introduction

Between June 2001 and January 2003, the UK Learning and Teaching Support Network Subject Centre for Geography, Earth and Environmental Sciences (LTSN-GEES) ran a national programme of discipline-based pedagogic research, funded through the LTSN Development Fund.The main aim of the programme was to develop the capacity of staff in the GEES higher education (HE) communities to undertake research into learning and teaching through working together on a set of small projects focused around the common theme of fieldwork.

Rationale

The rationale for the programme was based on the increasing growth of interest in developing the scholarship of teaching, including staff researching their own teaching (e.g.Healey, 2000;2003; Yorke, 2000), in tandem with the greater importance given to discipline-based approaches (e.g. Rust, 2001; Healey & Jenkins, 2003).

There has been increased emphasis in higher education internationally on the need for learning and teaching developments to be supported by evidence-based practice. In the UK this has been associated with the Dearing Report (1997), the founding of the Institute for Learning and Teaching in Higher Education (ILTHE, 1999), and the establishment of the Higher Education Funding Council for England's (HEFCE)'s Teaching Quality Enhancement Fund which included the development of the LTSN (1999/2000). However, it has been recognised that one of the challenges facing the enhancement of this evidence base in UK higher education is the development of the capacity of academic staff to engage in pedagogic research (e.g. Beckhradnia, 2000).

Such capacity building has so far tended to focus on high level research which is generic in character. However, to raise the capacity of staff to research their own teaching means that this work must be embedded in specific disciplines,as it is in their discipline that academics have their principal communities of practice (Wenger, 1998). Interest in discipline-based approaches to educational research is international as exemplified through the activities of the Carnegie Academy for the Advancement of Teaching in the USA and many of the projects funded by the Committee for the Advancement of University Teaching in Australia.

The interest in pedagogic research within geography, earth and environmental sciences has been widely articulated, for example through the emergence of education sessions at discipline-based research conferences (such as the Geological Society of America and the International Geographic Union), through the development of international organisations (such as the International Geoscience Education Organisation,and the International Network for the Learning & Teaching of Geography in HE), and also through the convening of

pedagogic research workshops and seminars (e.g.Research on Learning in the Geosciences, Wisconsin, 2002; International Geoscience Education Symposium IV, Calgary, 2003).

Theme

The fieldwork theme for the LTSN-GEES programme of pedagogic research was selected for three main reasons:

1) *Fieldwork is central to the culture, practices and pedagogy of the GEES disciplines* (Jenkins,1997; QAA Benchmarking Statements for *Earth Science, Environmental Science and Environmental Studies*, 2000a;and *Geography*, 2000b).Fieldwork,in the context of student learning, can be described as any structured experience that takes students out of the classroom to a situation where what they study (e.g. a town centre layout or a geological formation) is also where they study.

2) *Fieldwork is, as yet, little theorised*. Despite its central and costly role within GEES higher education curricula, there is a lack of firmly grounded general principles on fieldwork pedagogy that are soundly derived from research investigations (Gold et al, 1991; Winchester-Seeto & Hart, 2000).

3) *Fieldwork lends itself well to a range of pedagogic research methodologies and techniques*. In order to develop pedagogic research capacity in the disciplines, it is important to choose an area that might require a range of research methodologies. Fieldwork lends itself to both qualitative methodologies (e.g. focus groups of students, interviews with staff, and naturalistic observation methods) and quantitative analyses (e.g. questionnaires, web counts to analyse on-line learning)(e.g. Cottingham & Healey, 2001).

Process

The LTSN-GEES pedagogic research programme was led by Mick Healey (Gloucestershire) and Alan Jenkins (Oxford Brookes) and overseen by an LTSN-GEES management team. Liz Beaty and Glynis Cousin, then both from Coventry University, provided specialist educational research advice and guidance.

An open invitation was sent to all academic staff in UK HE geography, earth and environmental sciences to attend an introductory workshop in June 2001. The aim of this first workshop was to introduce the research programme to the communities, to discuss an overall theoretical framework, to begin devising some appropriate research questions and to identify those who wished to be involved.

A single, overall theoretical framework was implemented in order to support the newcomers to educational research in developing the necessary capacity to undertake that research,and to facilitate effective dissemination (cf Gibbs, 1992). The theory of constructive alignment (Biggs, 1999) was selected as it draws together a range of key research frameworks in higher education.The theory examines the 'goodness of fit' between the aims of a course, its assessment procedures and the nature of the learning environment, student cultures, motivations, learning styles and approaches.

Working within this overall framework, the programme participants identified four main areas around which to base their research projects:

- Student views of fieldwork;
- Fieldwork's role in the curriculum;
- Fieldwork education and technology;
- The impact on the learning and teaching experience of the removal of fieldwork from academic programmes (as a result of the UK Foot and Mouth Disease crisis which severely restricted access to field sites).

In addition to these four fieldwork research projects, an overview group ('Learning to do Pedagogic Research') was formed to handle the evaluation of the project as a whole.

Around 60 academics working in higher education and one member of staff from the Field Studies Council expressed an interest in the programme. Of these, about half came to the June 2001 workshop, with a similar number then going on to be actively involved in the research projects.The remainder were invited to act as reviewers and commentators, although in the event, this did not always take place. A 'listserv' was established to facilitate communication and discussion between all the participants, and a web-site was set up to provide access to resources and information.

In September 2001, a second, two-day workshop was held to consolidate the project groups and to support the development of experimental designs and project plans.This event also benefited from an overseas contributor, John Carpenter (University of South Carolina), who has extensive experience and expertise in conducting geoscience-based educational research.

The four groups then worked on their research projects over a period of approximately 16 months to January 2003 when a final de-briefing workshop was held. Support was provided to them through mentors (members of LTSN-GEES staff), the listserv and web-site, a staff development workshop on qualitative data analysis, their peers within their groups and, most strategically, through the specialist educational research advisors.The role of these advisors was to help ensure that the research carried out was of a high standard. Liz Beaty and Glynis Cousin were appointed due to their specialist expertise in higher education. As well as having the requisite background in research methodology, the advisors were chosen to help the programme to situate its constituent projects in the wider higher education literature and communities (Beaty, 1999; Cousin, 2000; McGill and Beaty, 1997). Developing discipline-based pedagogic research capacity is not only about knowing and using the relevant methodologies, it is also about discipline-based pedagogic research communities recognising and using the wider and generic literature regarding learning in (higher) education (Weimer, 1997).Therefore, it was perceived that if the LTSN-GEES project was to be a success, the GEES discipline communities needed to learn from, and work with, generic educational researchers (Redish, 1996; Healey & Jenkins, 2003).

Publication Outputs

The next five research papers in this special edition of PLANET represent a summary of the outcomes from each of the four research projects,together with an overview of the programme as a whole from the 'Learning to Do' project. All of these short papers either have been, or soon will be, written up more fully in peer reviewed international journals.

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Helen King
LTSN-GEES
hking@plymouth.ac.uk

Fieldwork is Good? The Student Experience of Field Courses

['Student Views of Fieldwork' project]

Alan Boyle (Liverpool University), Stacey Conchie (Liverpool University), Sarah Maguire (University of Ulster), Adrian Martin (University of East Anglia), Clare Milsom (Liverpool John Moores University), Rhu Nash (Southampton Institute), Steve Rawlinson (University of Northumbria at Newcastle) ,Andrew Turner (Coventry University), Sheena Wurthmann (Glasgow Caledonian University)

Abstract

This paper describes the results of the 'Student Views of Fieldwork' project, as part of the wider LTSN-GEES pedagogic research and fieldwork programme. Research was conducted across Geography, Earth and Environmental Science disciplines to examine the effect of fieldwork on students' affective domain. The project aimed to monitor changes in student's attitudes to learning that occurred as a result of attending residential field courses. In addition, the changes in how students value the fieldwork experience were examined and differences in attidudes and values between different groups of students (for example age and gender) were explored.

Introduction

Fieldwork features prominently in both QAA subject benchmark statements for Geography and for Earth Sciences, Environmental Sciences and Environmental Studies (ES3). As such,most GEES courses incorporate a fieldwork element with a commonly shared belief amongst academic staff in the disciplines that fieldwork is an essential part of the undergraduate curriculum. Gold *et al.* (1991) and more recent reviews about fieldwork (Kent *et al.* 1997;Winchester-Seeto and Hart, 2000; Healey and Blumhof, 2001) have, however, highlighted that there is only anecdotal research evidence to support this commonly held view. In the current climate of budget constraints, field courses are increasingly a target for reducing costs.There is a clear need therefore for research to investigate the assumptions about the educational benefits of fieldwork. As part of the LTSN-GEES pedagogic research programme, the "Fieldwork is Good?" (FIG) project addressed this need by conducting research across all GEES disciplines to examine the effect of fieldwork on students' affective domain which deals with processes of emotions, feelings and values.

There have been relatively few studies of the impact of fieldwork on students' affective domain. In one study, Kern and Carpenter (1984) found that fieldwork significantly enhanced the affective responses of students in a section of an Earth Sciences course in the USA. Where field activities were included in the curriculum, students enjoyed the course more, felt it was more interesting and attached greater importance to their work. There is evidence that student motivation is primarily a product of the affective responses of students toward the learning experience (see Kern and Carpenter, 1984 and Biggs, 1999) and that successful learning is partly dependent upon motivation. This LTSN-GEES project aimed to monitor changes in student attitudes to learning that occur as a result of the field experience and examine if changes occur in how students value the field experience as a result of attending a residential field course. In addition, the responses of different subgroups of the student population (e.g. gender and age) to fieldwork are examined.

Methodology

Questionnaires were given to students before a field course experience (the pre-questionnaire) and on their return (the post-questionnaire) across 7 UK HEIs covering Geography, Earth and Environmental Science departments, including both pre-and post-1992 universities.The field courses surveyed included examples held in the first, second and final year of undergraduate degree programmes. Field courses held as part of the first-year induction programme were also included in the survey. All the field courses were 'process-orientated' and involved students in active learning covering project planning, data collection, interpretation and presentation. The questionnaires were designed and piloted by the research group before full use on field courses from 2001 – 2002.

The pre- and post- fieldwork questionnaires comprised a number of sections which examined the following aspects of students' attitudes, perceptions and feelings towards the fieldwork experience (their 'affective' domain):

1. Feelings. Students were asked to rank three out of 10 descriptions which best described their feelings before and after going on a field course.
2. Knowledge. Students were asked whether they agreed with a series of statements relating to the development of subject knowledge during a field course experience. Responses were recorded on a 5 point Likert scale (totally disagree to totally agree).
3. Anticipation. Students were asked to comment on the anticipatory aspects of fieldwork and the accuracy of these feelings post-fieldwork.A three-point scale was used to assess views that included, getting to know staff, visiting a different place and sharing rooms.
4. Perception. Students were asked to comment on the perceived usefulness of fieldwork. A five point Likert scale was used to assess agreement with a series of statements relating to problem-solving, career choice and enhancing understanding of the topic/subject.
5. Student Collaboration. Students were asked to comment on the level of collaboration, enjoyment and motivation on fieldwork. Assessed using a three-point scale (agree – neutral – disagree), students indicated agreement with a series of statements relating to collaboration, enjoyment and motivation.

Open questions were also included in the post-fieldwork questionnaire including "What was you most memorable fieldwork experience?" and "How has your relationship with the other students and with staff changed as a result of the field course?".

All the questionnaire responses were inputted to a standard office database and analysed with SPSS statistical software using appropriate parametric and non-parametric statistical tests.

Summary of Main Findings

In total, 300 students completed the questionnaires.

Although, prior to going on a field course, approximately one third of students ranked being "*apprehensive*" in their top three feelings, students were more likely to select feelings of "*relaxed*" and "*happy*" as those best reflecting their feelings.Those least likely to be selected were "*concerned*", "*worried*" and "*don't want to go*". After attending a field course, students are more likely to select "*thoroughly enjoyed it*", "*worthwhile*" and "*learnt a lot*" as those best reflecting their feelings. Those least likely to be selected included, "*didn't enjoy the fieldwork*", "*lived up to my fears*" and "*wish fieldwork was not compulsory*".

The questionnaire responses show students have more positive than negative feelings about fieldwork both before fieldwork. An important finding was a significant difference between males and females for the feelings "*worried*" ($p=0.026$) and "*don't want to go*" before fieldwork ($p=0.032$). Females were significantly more apprehensive than males. These initial concerns were not apparent in the post-field course feedback with no significant differences found between males and females in their rankings of feelings after fieldwork. As such, we are able to infer from these data that the fieldwork experience changed some students' overall views on the value of fieldwork, in a positive direction.

Moreover, after the fieldwork was complete only 5% of students (<20) did not enjoy the experience. Over two thirds of the students indicated that they thoroughly enjoyed the experience and perceived that they learnt a lot.

The overwhelming sentiment from the student feedback was that fieldwork was useful and beneficial which was perceived in a number of ways such as: learning a lot, group work and putting theory into practice. After a field course, students were significantly more positive in their attitudes to "*liking challenges in their academic work*", "*being confident in working with others*" and "*coping with the physical challenges*" (Table 1).

Question	Before	After
Achieving the academic demands of the work	58%	72%
Getting to know other students	81%	92%
Getting to know staff	71%	86%
Coping with the physical challenges	65%	76%

Table 1. Self-confidence in aspects of fieldwork:a comparison of before and after the course. For each row the change in response is significant ($p<0.001$).

An important finding was that fieldwork boosted confidence, with students indicating that they were much more confident in meeting academic challenges. Perhaps the most beneficial aspect of fieldwork was evident in how relationships between students and between staff and students changed as a result of going on a field course. When responding to the question: "How has your relationship with other students and with staff changed as a result of the field course?" the responses of the students indicated a high degree of social integration during the field course (Box 1).

"Bonded more with both groups - students/staff"

"I have got to know the staff a lot more. Good friendships have been made with people I have hardly spoken to before"

Developed closer relationships with both friends and staff. Got to know people who I haven't met before"

"I have got to know the other students better and staff. I feel I have worked well in a team"

"Got to know people a lot better and have not experienced any conflict. Think maybe the fieldtrip could be closer to the beginning of the year, so that working relationships are better."

Box 1. Selected typical student responses to the question "How has your relationship with other students and with staff changed as a result of the field course?"

In terms of the knowledge gained during a field course, students indicated that they expected that fieldwork would increase their knowledge and this was reflected in the post-questionnaire responses. The significant positive shift in attitudes to fieldwork and learning in general was evident in every section of the survey.

The benefits of induction field courses

A separate analysis was undertaken of a subset of 50 students (out of the total 300) who attended an induction week residential field course. Results indicated that prior to attending the field course the feelings most students were likely to select were "*don't know what to expect*" (58%), "*relaxed*" (56%), "*happy*" (46%), "*eagerly anticipate*" (42%) and "*apprehension*" (36%). After the fieldwork was complete; "*thoroughly enjoyed it*" (66%), "*worthwhile*" (66%), "*learnt a lot*" (48%) and "*glad we had to go*" (46%) were those most likely to be selected as representative of students' feelings. Despite 36% of students listing apprehensive as one of their main feelings before fieldwork, in the event, only 4% of students did not enjoy the field course. The levels of anxiety were significantly higher than that expressed by non-induction students attending other field courses. Analysis of responses to the questions on memorable experiences and skills learnt during the field course indicate that meeting new people and forming new friendships was a particularly key aspect of the student experience on an induction field course (Boxes 2 and 3). Familiarisation with members of staff and group work were other common responses.

"meeting new people"
"working in groups, meeting new people"
"ecology and meeting new friends"
"making friends"
"geology - enjoyable but challenging"
"groupwork especially in Donegal"
"meeting people/making friends"

Box 2. Typical student responses to the question "What was your most memorable experience?" after attending an induction field course.

"meeting lecturers, classmates and insight into course"
"new friends and met new classmates"
"easier settling, meet new people"
"meet new people"
"meet colleagues, staff and introduction into course topics"
"new people and insight into what standard expected at uni."

Box 3. Typical student responses to the question "What skills have you learnt or developed during the fieldwork?"after attending an induction field course.

Implications for Fieldwork Policy and Practice

In addition to enhancing subject knowledge and understanding,the field courses studied during this project were highly effective in achieving academic and social integration. This may be important in addressing the major issues of student retention and progression. Yorke *et al.* (1999) suggest that the reasons given by students who drop out from University are as much about affective (social and personal) as academic reasons. If an early field experience could assist students in the transition process to HE, then the significance of this work might have implications for retention and progression. Sellers and van der Velden (2003) have provided a series of principles that underpin their work on student retention which include motivation, socio-educational networks, academic confidence building and targeted learning support. When the results of the questionnaires are considered and student reflection reviewed, common features with these principles can be identified from this study.

Prior to attending a field course, many students were clearly anxious about the experience and did not know what to expect. Room sharing and accommodation were among the contributory factors to this anxiety. Of clear importance is the need for effective pre-field course briefing and preparation in which students should be advised of the situation regarding accommodation. Maguire (1997) has previously reported on gender differences in confidence about physical fitness necessary for fieldwork that may partly explain the increased level of worry expressed by female students in this study. A useful strategy in the briefing process might be to use students who have previously attended the field course to share their experiences to alleviate worries and fears.

An important postscript is that whilst the overwhelming majority of students had a positive field course experience, there were a small number of students who did not enjoy the field course socially or academically and further research is required to identify whether there is any pattern amongst students who do not enjoy the experience. Field course design and operation needs to address the issue of the minority that do not enjoy the experience or fail to find it valuable.

The findings of this study have clear implications for policy. There is a strong case for maintaining field courses as a key element of courses in the GEES disciplines and field courses should be considered for inclusion in other subject areas that traditionally have not included a field course element. In induction programmes, a mix of academic and social activities is standard but the residential element and the selection of the student groupings makes the field course different. With the development of e-learning and distance learning, this social part of learning and education is often neglected. Salmon (2000) has shown that this is part of the "shared learning" experience that needs to be developed for these learners.

This work has demonstrated that field courses are an important mechanism for developing subject knowledge and understanding and many of the skills detailed in the Geography and ES3 subject benchmark statements. The study has also shown the key role that fieldwork has in achieving student academic and social integration. With student retention a key issue nationally, field courses could be an important mechanism to aid retention.

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Andrew Turner
Educational Development
Coventry University
a.p.turner@orange.net

Carrying out Pedagogic Research into the Constructive Alignment of Fieldwork

['Fieldwork in the Curriculum' project]

Jim Andrews, University of Southampton
Pauline Kneale, University of Leeds
Wendy Sougnez , Martyn Stewart and Tim Stott,
Liverpool John Moores University

Abstract

This paper describes the results of the 'Fieldwork in the Curriculum' project, as part of the wider LTSN-GEES pedagogic research and fieldwork programme. This project sought to understand to what extent current practice in fieldwork reflects Bigg's constructive alignment model (Biggs, 1999) in which teaching methods and assessments are closely aligned with intended learning outcomes. The overt curriculum of field skills, hands-on experience and linking the real world and the classroom, appears to be well defined and well developed. However, learning outcomes reflect a 'hidden curriculum' (e.g. group work) which is considered important but which does not generally appear to align closely with teaching content or with assessment.

Context and Aims

This project is nested within the Pedagogic Research and Fieldwork Programme funded by the LTSN-GEES. It investigates the degree to which teaching in the field (and pre- and post-fieldwork activities) are compatible or aligned with curriculum objectives via related teaching and learning activities and assessment tasks. Particular attention has been paid to staff perceptions of the role of fieldwork in the curriculum,the extent to which departments design or adopt fieldwork strategies and the degree to which fieldwork is integrated into the wider curriculum.Biggs'(1999) concepts of constructive alignment have been employed to inform the analysis.

The project was undertaken in two strands, the first being a questionnaire sent to the subject representatives in each GEES department in the UK. This was followed up by a series of in-depth interviews with a selection of these staff. Parallel development of pedagogic research capacity amongst the investigators has been an important additional outcome of this project.

Phase 1 Data Collection

The first data collection phase used a short, semi-structured questionnaire. The first and second questions concerned perceptions of the present and future role of fieldwork in the wider curriculum, and the degree to which fieldwork is currently integrated into the curriculum. Respondents were also asked to indicate their perceptions of the relative importance of various aspects of fieldwork in the wider curriculum. Following on,two open questions sought opinions on how the respondent considered the role of fieldwork in the curriculum might develop over the next five years and what they considered would be the most notable impact on students'learning were fieldwork opportunities to be reduced. 40 questionnaires were returned representing 20% of the GEES departments surveyed nationally. Responses were coded for analysis according to institution type (pre-1992, post-1992 universities, and Further Education colleges) and the three GEES disciplines.

Two types of data were generated by the project's first phase. Responses recorded on a 3- or 5- point scale were statistically summarised, but responses to 'open' questions required qualitative data analysis using techniques unfamiliar to the team. To facilitate this, a social science researcher (Sougnez) with experience of interpretative methods in educational research joined the group.

Phase 2 Data Collection

The intention of the second phase interviews was to uncover depths of understanding that may otherwise have been inaccessible. The first phase data analysis was used to inform the structure of these interviews. The in-depth interviews with members of academic staff who had returned the original questionnaires were designed to explore in detail issues raised in the questionnaire and to further investigate departmental strategies for fieldwork management.

Each of the four field-active investigators undertook two semi-structured, 30-45 minute, taped interviews in a schedule designed to cover all three GEES disciplines and old university, new university and FE provision. Most interviews were conducted during the Summer of 2002.

Capacity for qualitative data analysis was enhanced after two members of the team attended the LTSN-GEES Data Analysis Workshop in May 2002 supporting the overarching project (Coventry, May 2002).

Critical Reflection

The first phase questionnaire was useful in collecting quickly a large amount of data from a range of HE providers. While a 20% return rate was lower than hoped for, the returns were an adequate base for selecting a maximum variation sample for the second phase. This enabled the researchers to construct an interview schedule covering the full range of HE providers.

The questionnaire was used to inform the operation of the second phase where data were collected from a range of interviews.A number of issues emerged that merit further exploration. For example, one question asked: *Is there a conscious effort to generate and then map a portfolio of field-skills and experience across various field courses?* The responses are typified by: *In construction of documentation conscious mapping takes place but field courses were designed on the basis of what generations of geographers feel makes a good field course.* This example suggests that policy and practice may be at best only loosely-coupled and this has implications for alignment.

Discussion and Conclusions

The data gained from the questionnaire and interviews lead to the following general observations, which will be evaluated and discussed in more detail elsewhere.

- The overt curriculum which includes field skills, hands-on experience and linking the real world and the classroom appears to be well documented and supported by a range of relevant activities. However, there was also evidence of a 'hidden curriculum'where outcomes are claimed by the academic staff but are not necessarily explicit in the course documentation, the teaching or the assessment.The hidden curriculum includes team working, the development of interpersonal skills, self management and lifelong learning skills.
- Although the issue of assessment of transferable skills was claimed to be addressed through assessment procedures, there was relatively little evidence that these have been carefully designed or regularly reviewed for effectiveness.
- Learning outcomes reflecting the hidden curriculum (e.g. group work) were considered important but their allegedly key role was not generally reflected in existing assessment procedures.
- More positively, linkages between fieldwork locations and staff research areas imply a strong synergy between teaching and research,as does the investigative nature of many level 2 and level 3 field courses.

Further Work

There is considerable scope for extension of this study to explore some of these issues in more detail.This could be achieved by careful selection of a sample for further interviews with a less structured format. It would also be interesting to revisit interviewees to follow up emergent findings. Additionally, supporting evidence is certainly needed to validate the conclusions. Indeed, the current project might best be considered as a pilot in that it has revealed a number of issues that need clearer understanding if constructive alignment in the fieldwork curriculum is to be realised more fully than appears to be the case at present.

Acknowledgement

Vince Gardiner was a key player in the initiation of this project at the LTSN-GEES pedagogic research and fieldwork programme meeting in September 2001.Through illness he was unable to participate further and his untimely death last year denied to the team the contribution of an enthusiastic and dedicated researcher. There is an appreciation to Vince in Planet, Issue 5.

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Jim Andrews
School of Ocean & Earth Science
University of Southampton
jra2@soc.soton.ac.uk

Pauline Kneale
Department of Geography
University of Leeds
p.kneale@geography.leeds.ac.uk

Wendy Sougnez
Educational & Environmental Research,
Keswick/Liverpool John Moores University
Wendy@ecss.fsnet.co.uk

Martyn Stewart
Learning Development/School of Biological & Earth Sciences
Liverpool John Moores University
M.Stewart@livjm.ac.uk

Tim Stott
Outdoor & Environmental Education
Liverpool John Moores University
T.A.Stott@livjm.ac.uk

Technology before Pedagogy? A GEES C&IT perspective

[Fieldwork education and technolgy group project]

Steve Fletcher, School of Maritime and Coastal Studies, Southampton Institute
Derek France, Department of Geography, University College Chester
Kate Moore, Department of Geography, University of Leicester
Geoff Robinson, School of Geography and Geosciences, University of St Andrews

Abstract

This short paper summarises the initial findings of the Fieldwork Education and Technology group of the LTSN-GEES pedagogic research and fieldwork programme. The project investigates the relationship between C&IT and fieldwork education as used in the undergraduate curriculum in Geography, Earth and Environmental Sciences. A postal survey was sent to all relevant UK higher education GEES departments and a workshop and focus group was held at the University of Leicester in May 2002.Salient points from the questionnaire and the expert-group discussions provide insights into trends, driving forces, hindrances and impacts of C&IT within fieldcourses.

Introduction

Communications and information technology (C&IT) is a central component of the HE GEES experience. During the last decade technological developments in computer hardware, software and networks combined with the increasing pressures on staff and students have led to the rise of the use of C&IT within learning and teaching environments in general. This paper explores the relationship between C&IT and fieldwork education as used in the undergraduate curriculum in geography, earth and environmental sciences (GEES).

Methodology

In 2002 all relevant UK GEES departments in HE institutions were surveyed on their use of C&IT in fieldwork teaching and learning, as exemplified by one or more 'typical' fieldcourse modules. This survey involved the design of a questionnaire which was interrogated electronically. Additionally, a thematic one-day workshop (see Fletcher *et.al*.,2002) provided a forum for participants to display, exchange and develop ideas on the pedagogic use of C&IT with fieldwork. The workshop presentations demonstrated, in particular, the use of multimedia and the Web as a successful teaching, learning and assessment tool in association with fieldcourses (see http://www.gees.ac.uk/pedresfw/citfw/fetwkshp.htm). Participants in the workshop then convened as an expert group led by Alan Jenkins (Oxford Brookes University) to discuss related pedagogical issues and to distil the major themes and impacts of C&IT in fieldwork teaching. A series of questions were posed and answered individually in an initial round. Small groups then formed to discuss the ideas about the key impacts that were generated.The following day the group findings were further discussed at a meeting of the Fieldwork Education and Technology project team, members acting as a tighter focus group to refine the summary points from the workshop.

Results

The national postal survey had a response rate of 22% (43 module/unit returns from 36 HEIs) with pre-1992 universities accounting for 57%, post-1992 universities 29% and Higher Education Colleges accounting for 14% of returns. The responses provided a 'snapshot' of 'typical' modules with substantial fieldwork elements, demonstrating the nature of hardware (Figure 1) and software that are used (Figure 2).

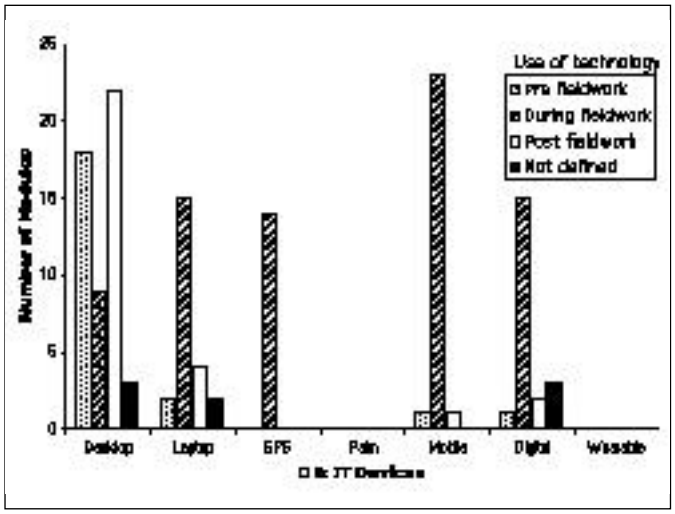

Figure 1. Usage of Hardware Devices in relation to Fieldwork Education.

Abbreviations denote: Desktop =Desktop Computer; Laptop=Laptop Computer; GPS=Global Positioning Systems; Palm=Palmtop / Handheld Computer; Mobile=Mobile Phone; Digital=Digital Camera; Wearable=Wearable Computing.

The use of technology in fieldcourses, as reported in the postal survey, (see Figure 1) demonstrates the highest pre-fieldwork technology (over 80%) was the desktop computer. The use of the mobile phone during fieldwork accounted for 30% of responses, with all other technologies recording approximately 20%. Only the Palmtop computer and Wearable computing produced no returns within the fieldwork experience.

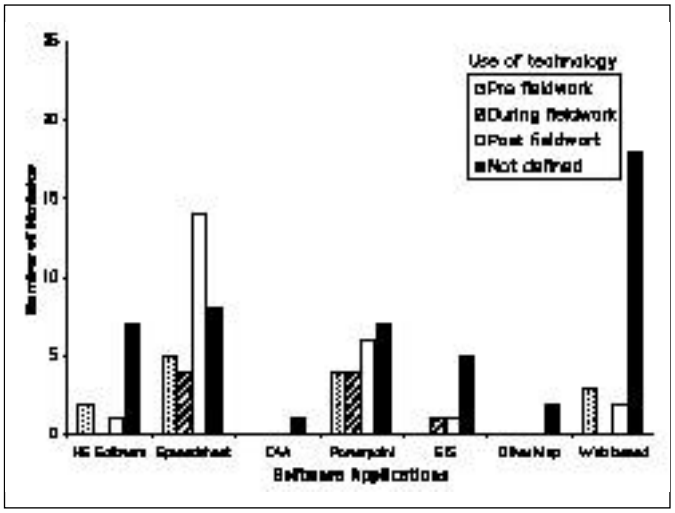

Figure 2. Usage of Software Applications in relation to Fieldwork Education. Abbreviations denote: HE Software=Higher Education generic software; Spreadsheet=(e.g.) Excel Spreadsheets; CAA=Computer Assisted Assessment; PowerPoint=PowerPoint presentations; GIS=Geographical Information Systems; Other Map=Additional mapping software; Web based=Internet based software.

The reported use of software applications in the postal survey (see Figure 2) varied considerably, with only partial usage of generic HE software, in the pre- and post-fieldwork experience. Spreadsheet applications and PowerPoint presentations are used throughout fieldwork; over 50% of post fieldwork software activity can be attributed to spreadsheets whilst over 40% of during fieldwork activity can be attributed to PowerPoint. From the results, there was limited reported use of GIS (~10%) and almost no use of Computer-Aided Assessment.

The 12 presentations at the May 2002 workshop clearly reflected the rise of the use of C&IT within learning and teaching environments.Use of IT to deliver course notes and computer-aided learning packages has proliferated. Computer-based testing is now a regular mode of assessment in many institutions (though not necessarily in fieldwork modules). Computer technology is able to provide more than just passive teaching. Its strengths lie in the ability of students to benefit from interactive and dynamic virtual environments. The workshop presentations demonstrated, in particular, the use of multimedia and the Web as a successful teaching, learning and assessment tool in association with fieldcourses

Here we summarise the major pedagogical findings obtained from the postal survey and the May 2002 workshop.

Central trends in the use of C&IT in fieldcourses

There is an expanding use of C&IT with fieldcourses. Of the 20 workshop participants, 15 noted that the web features prominently, with resources becoming increasingly interactive rather than passive information providers.Typical areas of application included:

- using 'web-type' technology to present and integrate a variety of information types (e.g. to integrate student collected data in the field; or the compilation of long-term datasets resulting from successive field visits);
- producing web-resources to direct or support fieldcourses (e.g. to enable students to rehearse field skills; or to reduce student anxiety by demystifying aspects of the fieldcourse);
- replacing staff-time in the field through 'virtual' re-creation of the field activity experience of materials. There was also evidence that in some cases, virtual field courses were used as *additional* field opportunities rather than to replace field-work.

It was clear that a wide range of multimedia and virtual environments are also being used, together with GIS and other visualisation tools (as shown in Figure 2). Furthermore, data is used in the field to a great extent. Integration of primary (student-collected) and secondary data (e.g.satellite imagery or geological maps) is undertaken at the fieldwork base. Field-mapping projects are good examples of this where data can be integrated reasonably easily using C&IT. In the field, the increasing use of laptops, mobile phones, digital cameras and GPS is clearly identified in the postal survey (see Figure 1) as facilitating this trend.

Central factors driving the integration of C&IT in fieldcourses

Cheaper hardware, software and data are now readily available and our research suggested that there is a desire to use them to good effect with a variety of educational aims,such as improving training in the field. This was evident both through the postal survey and at the workshop. There was also recognition, particularly at the workshop, that care has to be taken that the driving force is not totally technology led, but that the use of IT has definite pedagogic benefits. This technology drive can be linked with a wish to make more effective use of student time, particularly time spent in the field, which was perceived to be at a premium.This was evidenced by the qualitative comments recorded by participants in the workshop and the national questionnaire:

- *"students are far better prepared – compared with students on the same fieldcourse before C&IT support packages were used. Not only in terms of background information but also on what to expect in the field".*
- *"in the light of increased class sizes and diminished resources, achieving the maximum student benefit for the time in the field".*

Accessibility, on several levels, is a key factor. Legislation requiring provision of opportunities for people with special needs (e.g. SENDA) and the obvious problems encountered with visiting dangerous, physically inaccessible or distant sites were all seen as factors supporting the use of IT with fieldcourses.

Central factors hindering the integration of C&IT in fieldcourses

During workshop discussions, it was apparent that all of the positive factors in support of C&IT could also be viewed in a different light as possible hindrances. Costs of hardware and data for use in the field were identified as prohibitive to some institutions and the use of cutting-edge technologies to many more (particularly where the full cost of fieldwork was borne by the students). Transport of computer hardware to fieldwork areas may also be a problem. It was interesting to note that no institutions represented at the meeting or in the postal survey (see Figure 1) were yet using Palmtop computers. Motivating staff to undergo skills training and ensure that IT skills are integrated into fieldwork training for the students is another perceived need. A concern highlighted through the workshop was that additional time is needed for staff development and skills uptake to implement the use of new technologies. It was commented that without this support, it is likely that the development of C&IT in fieldwork would be restricted to a motivated minority. Time is also needed, particularly in the initial phase, to develop learning and teaching materials for use on-line. The combined cost issues and lack of relevant skills may lead to a widening gap between institutions with funds and skills and those without them.

Central educational impacts

The educational impacts of C&IT for staff and students seemed less easy to identify than the ergonomic impacts.The expectation of gains in time was reported to be illusory in the initial phases, as it takes considerable time to develop skills and resources. However, it was evident that the goals and learning outcomes of fieldcourses have not changed significantly as a result of C&IT playing a more significant role; what has changed are the skills to be developed, for example, using GIS/GPS instead of maps and compass.Students are more aware of the fieldcourse topic or region through more structured preliminary training.As C&IT becomes more embedded in the curriculum, the use of the technology becomes more transparent (just another tool). However, there is a danger that fieldcourse venues will become 'fossilised' over time, as teaching materials become dated.There is more emphasis on self-learning and problem-based learning than formal lectures and 'Cook's Tours'. Students therefore become more responsible for their own learning.

Implications for fieldcourse practice and policy

Evidence from the workshop illustrated that the fundamental basis of using C&IT successfully in fieldwork education is that its use must be appropriate, i.e. that teaching methods are aligned with the intended learning outcomes of the fieldwork. Indeed, it was clear that traditional styles of fieldwork teaching required reconsideration given the new opportunities offered by C&IT. Accessibility and disability issues of fieldwork may also be more fully supported with an integrated C&IT approach. The integration and application of C&IT in fieldwork education requires co-ordinated staff development. Ideally, technology will be more fully integrated in the whole experience of fieldcourses and at all stages: pre-, during and post-fieldwork. If implemented well, C&IT can generate a greater feeling of engagement with and understanding of the topic or region. Therefore, C&IT can provide a platform to extend the learning experience, leading to an independent-learning culture.

Conclusions

In conclusion, this research provides a first insight into how GEES practitioners' use of C&IT is driven by technological developments, rather than new pedagogic thoughts generating novel ways of teaching fieldwork. The general trend of the postal survey and the expert discussion at the workshop was that many of the responses were still very technology-biased. Nevertheless there is evidence that the educational benefits are there and increasingly being identified.

Further Research

The postal survey conducted in this project was necessarily limited in scope. A comprehensive survey/census of C&IT use in fieldcourses for Geography, Earth and Environmental Sciences is still needed to establish the baseline for monitoring future developments.

More student-focused research could also investigate perceptions of the benefits and disadvantages of C&IT in fieldcourses; student experience and performance in response to the increased use of C&IT in fieldcourses and incoming undergraduates' C&IT experience and skills in relation to fieldwork.

Recommendations

One of the aims of this research project was to enhance our capacity to undertake pedagogic research. It is therefore appropriate to reflect on how this research progressed and to identify any suitable recommendations for others. Firstly, it is pertinent to comment that the research team had limited previous experience of both pedagogic research and qualitative research methods. This was overcome through the assistance of colleagues familiar with pedagogic research who provided guidance and advice on methodological and analytical considerations. A recommendation is that support be built into future projects through the construction of research teams that include pedagogic research specialists. Secondly, it was clear that with appropriate support,pedagogic research capacity developed reasonably quickly and was enhanced by team working. This capacity was then transplanted into our own specific teaching and research contexts. For example, members of the team have carried out pedagogic research into their own teaching practices, adopting techniques acquired throughout this project (e.g.) France and Ribchester (in press).

Acknowledgements

The authors would like to thank LTSN-GEES who funded and helped to co-ordinate this research project as part of their 'Enhancing Fieldwork Quality through Pedagogic Research Programme' and all colleagues who completed the postal survey and /or presented at the Fieldwork Education and Technology workshop in May 2002. Thanks also to Karen Lawson for transcribing the associated expert and focus group discussions.

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Steve Fletcher
School of Maritime and Coastal Studies
Southampton Institute
steve.fletcher@solent.ac.uk

Derek France
Department of Geography
University College Chester
d.france@chester.ac.uk

Kate Moore
Department of Geography
University of Leicester
mek@leicester.ac.uk

Geoff Robinson
School of Geography and Geosciences
University of St Andrews
geoffrey.robinson@st-andrews.ac.uk

Perceptions of Geography and Environmental Science Fieldwork in the Light of Foot and Mouth Disease, UK, 2001: What do Students Really Think?

[The 'removal of fieldwork' project group]

Ian Fuller, School of People, Environment & Planning, Massey University (New Zealand)
Steve Gaskin, LTSN-GEES
Ian Scott, St Bartholomew School of Nursing, City University

Abstract

This project forms part of the wider LTSN-GEES pedagogic research and fieldwork programme. The paper investigates the student perceptions of geography and environmental sciences fieldwork in the light of its absence in many UK GEES departments in the spring/summer of 2001,due to Foot and Mouth disease.

(Please note that a full version of this paper has already been published in the *Journal of Geography in Higher Education* and can be found in the reference at the end.)

Introduction

"Fieldwork is widely recognised as an essential part of undergraduate education in geography (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" (Kent *et al.* 1997). This, by and large, is an internationally held view about fieldwork in the Geography, Earth and Environmental Science (GEES) disciplines. However, the position of fieldwork as central to the teaching of geography and environmental /earth sciences,and in the enhancement of student learning, is largely assumed (e.g. Jenkins, 1994; Gerber and Chuan, 2000),and lacks objective evaluation (Kent *et al.*, 1997; Fuller *et al.*, 2000). Precisely because fieldwork is perceived amongst geographers (and earth and environmental scientists) as being so important, few have been willing to undertake an objective experiment that requires comparison of the student learning experience with and without fieldwork (Fuller *et al.* 2003). As such, objective experimentation comparing student learning experiences with and without fieldwork is rare. Using a systematic and objective methodology, this project examines through a multi-institutional approach, the conception of geography and environmental science fieldwork as being of significant value for the overall student learning experience.

Context

During 2001 in the UK, fieldwork was withdrawn from many GEES university degree programmes as Foot and Mouth Disease led to a government ban on access to the countryside. This restriction provided an unexpected opportunity to assess student perceptions of fieldwork in the light of its absence and to review those alternative learning strategies which were put in its place (where appropriate).

Methodology

Information on student perceptions of the value of fieldwork was obtained using Nominal Group Technique (NGT). NGT is a focus group research method which can be used in educational environments to obtain information from a group on a specific topic

(Delbecq *et al*., 1975). Focus groups are useful as they allow information to be yielded from a group within a 'permissive and non-threatening environment' (CHED, 2002) and NGT's main advantage is that it focuses on participant (e.g. student) rather than evaluator (e.g. staff) interests. For further information on NGT and some recommendations on the potential use of NGT in an educational context, see Gaskin (2003).

In this study, NGT was applied to five groups of final year students from five separate UK Universities and it elicited almost 300 responses from 33 students representing a high level of group consensus on the issues involved.

These responses were in answer to the questions:

- Q1a: *In the light of any previous field experiences, how could fieldwork have made this unit better?*
- Q1b: *In the light of any previous field experiences, how could fieldwork have made this unit worse?*
- Q2: *What impact do you think the loss/withdrawal of fieldwork had on your experience of the unit and understanding of the subject?*

Rationalisation of student responses to these questions then took place with each response being assigned to one of 12 categories reflecting and amplifying Gold *et al.*'s (1991) suggested key educational objectives addressed by geography fieldwork (e.g. experiential, technical,analytical, environmental, financial). Further details on this application of NGT can be found in Fuller *et al.* (2003).

Results

The votes for each NGT response were converted to percentages to standardise the results, and also weighted according to group size. This generates a statistic (% Weighted Total Available Vote) which provides an overall picture of aggregated student responses to each of the three NGT questions posed. Further detail on the derivation of the statistics are found in Fuller *et al*. (2003). In short, the higher the % WTAV, the stronger the overall group's commitment across all five universities to that (category of) response (Figure 1).

Overall, there was a strong indication that the perception of field experiences by students is overwhelmingly positive and the positive perceptions (Q1a) far outweighed the negative perceptions (Q1b). In addition, NGT responses to Q2, concerning the impact of the withdrawal of fieldwork on student's understanding of the module, were virtually all negative.

On the positive side, and in response to Q1a the student groups identified the experience of reality (e.g. "*putting theory into practice*"), developing subject knowledge (e.g. "*more likely to remember fieldwork than coursework*"), acquiring technical (e.g. "*get experience of using equipment to build up field skills*"), transferable and holistic skills (e.g. "*more confidence in exams and writing essays*") and working with peers and lecturers, as being the most important perceived benefits of fieldwork.

The negative tone of the student responses to Q2 can also be used in part to reinforce the positive perceptions of fieldwork in response to Q1a. The actual loss/withdrawal of fieldwork adversely affected those components of fieldwork most positively held by the students. Results suggest that withdrawal of fieldwork had a substantially negative impact on module experience, in the context of the following issues: experiential (e.g. "*didn't leave the classroom to see theory put into practice*"),technical (e.g. "*techniques and ideas learnt may have helped us when doing final-year project*") and subject-specific knowledge (e.g. "*less understanding of channel morphology*").

The negative impacts of fieldwork considered by the students interviewed in this study, in response to Q1b, included time constraints (e.g. "*more time spent on data analysis which is often tedious*"),teaching / delivery (e.g. "*missing parts of other lectures*"), assessment / workload (e.g. "*more work*"), specific subject knowledge (e.g. "*not many detailed notes*"), technical ability (e.g. "*may have found using equipment difficult and therefore not obtained accurate results*") and finance (e.g. "*expensive*"). However, to re-iterate, these negative issues are far outweighed by the positive issues raised by the students

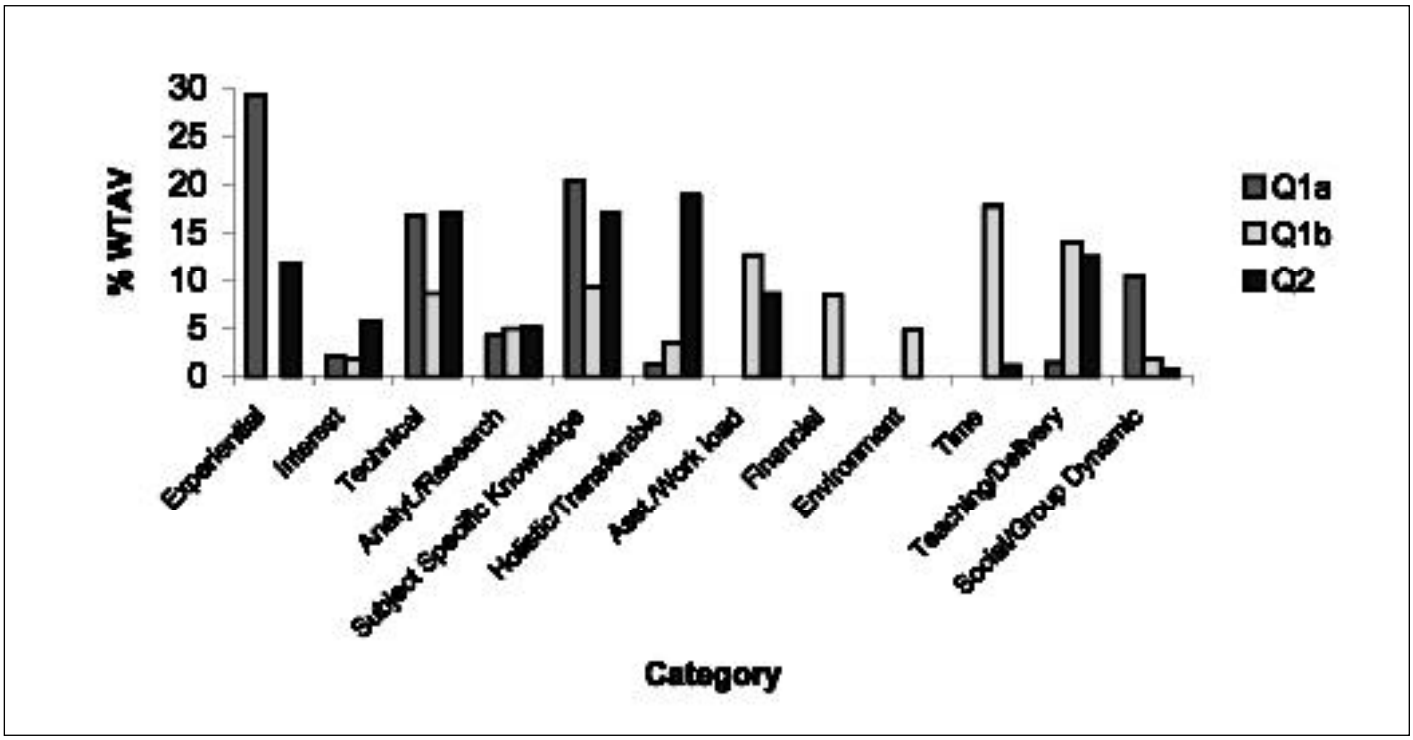

Figure 1. Student votes for each category across all 5 universities, expressed as a percentage of the weighted total available number of votes (WTAV) (after Fuller et al., 2003) in response to questions Q1a and b and Q2 (see main text).

Conclusions

The results in this study show that there are many positive attributes of fieldwork and that most students consider it to be a much-valued student learning experience. In addition, the positive aspects of fieldwork outweigh the negative aspects. "Given that anecdotal evidence suggests that the provision of fieldwork is under pressure from higher education managers, it is important that the high level to which students appreciate the learning and value added derived from fieldwork should be communicated to the wider HE community. To maximise the effectiveness of fieldwork, however, and to minimise its disadvantages, requires careful planning and time utilisation (at an institutional and departmental level), as poorly planned fieldwork may deprive students of the opportunity to attend some lectures. The loss of one learning opportunity because of another could and should be avoided. More appropriate planning and flexibility in traditional linear programmes and greater co-ordination and appreciation by university staff of the range of pedagogic techniques used within a Higher Education environment would benefit those utilising modular degree schemes" (Fuller at al. 2003).

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Ian Fuller
School of People, Environment and Planning
Massey University, New Zealand
I.C.Fuller@massey.ac.nz

Steve Gaskin
LTSN-GEES
sgaskin@ plymouth.ac.uk

Ian Scott
St. Bartholomew School of Nursing
City University
iscott@city.ac.uk

Learning to do Discipline-based Pedagogic Research in Geography, Earth and Environmental Sciences

['Learning to do Pedagogic Research' project]

Helen King, LTSN-GEES

Abstract

This article describes the experiences of participants involved in the LTSN-GEES fieldwork pedagogic research programme, as researched using a grounded theory approach utilising questionnaires, interviews, focus groups and observations. Analysis of the participant responses and comments suggests that the programme has proved successful in the short-term at least, not only in beginning to develop the participants' capability to undertake pedagogic research but also in producing an enthusiastic practitioner network. The learning experiences that brought about this development came through actually undertaking pedagogic research and through opportunities for discussion and professional development. The participants were then able to build on their prior research experiences and construct a personally meaningful framework for their understanding of pedagogic research. This collection of small-scale and introductory research projects might be considered relatively basic by the standard of full-time educational researchers but collectively nevertheless they represent a much desired step forward for the GEES disciplines.

Introduction

The overall evaluation of the LTSN-GEES pedagogic research programme was conducted as a research project in its own right: 'Learning to do Pedagogic Research'.The project group consisted of the programme Management Team plus two researchers who undertook the data collection and analysis. The researchers, John Bradbeer, University of Portsmouth, and Helen King, LTSN-GEES, studied the experiences of the Management Team and the project participants respectively, with a view to addressing the question *"how far and in what ways has the programme succeeded in developing capacity to undertake pedagogic research in the disciplines?"*

In investigating this question, inferences could be made about the learning process that the participants undertook by themselves and through interactions with their project group, colleagues and advisors. This article discusses the experiences of the programme's 30 or so participants in undertaking discipline-based pedagogic research, and suggests a model for the learning process they underwent.

Methodology

In order to address the research question a *"grounded theory"* approach was taken to study the participants' experience. This is an emergent approach that is, rather than trying to prove or disprove a hypothesis, the data is allowed to 'speak for itself'.

A variety of data sources were used to build up a profile of the participants before, during and towards the end of the pedagogic research programme. Some of the data were quantitative (pre- and post-programme skills audits) but most were qualitative (questionnaires, interviews focus groups, observations).The data were brought together to provide a broad representation of the perspectives of the participants.It should be noted that the information came from the particular perspective of this programme that involved a set of people who are demonstrably actively interested in discipline-based pedagogic research.The findings,therefore, should not necessarily be generalised to the GEES disciplines and their staff as a whole.

Participants' Attitudes at the Outset of the Programme

The attitudes and perceptions of the participants towards discipline-based pedagogic research at the beginning of the programme were studied through the first, written questionnaire completed around the time of the first development workshop in September 2001. Six structured interviews were also conducted and these served to back-up the findings of the questionnaire and to provide additional information on the programme as a whole.

The main *interest* of the participants in undertaking discipline-based pedagogic research was related to 'professionalism / scholarship'.This category (over 60% of the responses) included concern for enhancing student learning, providing an evidence base for curriculum development, and developing oneself as a teacher; for example:

"[Pedagogic research] can only serve to improve [the] quality of [the] learning experience for our students. What is [the] 'best' approach, most fruitful etc. [It can help us] understand / [give] insight into the needs of students of different abilities."

"As I am actively involved in curriculum design and development, I would very much like to engage in research which could underpin and inform [the] curricula change myself and my colleagues undertake."

"[I am interested in pedagogic research in order] to become more aware of the pedagogic basis of teaching and learning through involvement rather than being passive.To improve my teaching."

The *confidence* of the respondents to undertake discipline-based pedagogic research was roughly divided into two categories:those who considered themselves 'OK' and those who admitted to being 'unsure'. All the respondents had had experience of research in their own discipline area and, hence, the two main reasons for those who were unsure appeared to be little experience / knowledge of *pedagogic* research and scepticism towards its 'social science' methodologies. There was no significant relationship between age (years teaching / researching) and confidence but there was a clear link between discipline and confidence with 73% of Geographers 'OK' compared to 31% of Earth & Environmental Scientists.This might reflect the nature of research undertaken within some parts of Geography that is more qualitative than that undertaken in other GEES subject areas.

The *concerns* of the participants in undertaking discipline-based pedagogic research were categorised into three areas: the status of pedagogic research,the methodologies,and 'personal'concerns (such as time constraints).The status of pedagogic research was regarded as low in relation to other (discipline) research priorities, particularly as it was not seen to be taken seriously by the RAE. It was suggested that this status issue may hold serious consequences for individuals interested in embarking on pedagogic research:

"*pedagogic research does not carry much weight in the Research Assessment Exercise and as a result is not particularly encouraged by my institution."*

"teaching is not as valued as research and younger staff should be concerned about the effects on their careers of researching new teaching."

Participants' Attitudes towards the End of the Programme

The participants undertook small-scale pedagogic research projects in teams over a period of approximately 16 months.During this time, they were given discipline-based and generic advice and support through mentors, and offered training and development workshops to help develop their project plans and analyse their data. At the end of this period, in January 2003, a second Questionnaire and Skills Audit was circulated to all members of the project teams.The participants were first asked what new skills they had learnt and what previously existing skills they had developed. The majority of responses indicated an enhancement of specific research methodologies particularly in the areas of data collection (e.g. focus groups, questionnaires, interviews) and data analysis (e.g. use of software). These responses were reinforced in the second Skills Audit and mirrored the methodologies used by the projects; in particular the use of focus groups had considerably increased. Dealing with qualitative data was also an important new skill for many respondents, and some mentioned the process of conducting research in a group as a new experience.

In contrast to the beginning of the programme, rather than seeing pedagogic research as completely different, there was a general feeling that the research skills it required were comparable to those of 'traditional' discipline research, but in a different context. All the participants reported an increased confidence in undertaking discipline-based pedagogic research ("*because I have done it!*"), though some qualified this, for example, "*I became aware of what I didn't know*."

The participants did not report any major difficulties whilst undertaking their research projects. Less than half the respondents had problems such as finding time, practical issues (e.g. experimental design, transcribing), and difficulties with negative attitudes from other staff. Three people stated that they had had no difficulties at all.The general tone of the responses appeared to be very positive: this may have reflected the atmosphere in which the questionnaires were completed (at the final debriefing workshop and, in some cases, in pairs).

The Participants' Experiences of being involved in the Programme

The above comments describe the development of the individual participants within the LTSN-GEES pedagogic research programme. However, data from the questionnaires, interviews and, particularly, the focus groups also provide information on the process of the programme as a whole. This information has been categorised into three areas: network approach, research process, and professional development.

Network approach: The network approach to the programme seemed to be a key feature in enhancing participants' confidence, skills, knowledge and understanding. The Focus Groups, in particular, highlighted the sense of isolation that many participants had felt prior to getting involved in the programme. This isolation appeared to be linked to the attitudes of the participants' colleagues, viz.:

- Lack of Support: Several participants experienced no support from departmental colleagues, some of whom were openly sceptical.Other colleagues "*just let you get on with it*" but felt that it was nothing to do with them. These colleagues, however, were helpful in questionnaire distributions and did not obstruct the pedagogic research in anyway. There was also a sense that "*…because of their scientific training they're very sceptical of any other (e.g.) qualitative methods and so if they don't really have a belief in those methods then they're not going to have a belief in the outcomes*."
- Teaching Intuition: Some participants suggested that there was a perception that "*good practice is intuitively felt*" so there is no need to research it. Colleagues have built up their knowledge about teaching based on their experience: "*they think I've taught for 15 years / 20 years so they pretty much know it*".
- Other Research Priorities:There was a sense that colleagues felt that pedagogic research takes you away from what you are supposed to be doing (subject-based research), perhaps with the inference that this might effect the department's RAE score. Several participants expressed *"having to do [pedagogic research] in your spare time*" and, through lack of support from the Head of Department "… *basically it's an undercover activity*".

There was a strong sense that this programme reduced feelings of isolation. From an individual point of view, the network approach gave them more confidence through collaboration. One project in particular experienced good group dynamics which clearly enhanced their experience. Several participants also recommended networking with academics both in the discipline and beyond in order to exchange information and get advice.

Additionally, there was the perception that the network approach had enhanced the research itself. It was suggested that collaboration across the disciplines and institutions improved the quality of the research. Some participants felt that this national context for the research enhanced its credibility. It was also felt that the partnerships with expert educational researchers were crucial in order to provide deeper 'student learning' pedagogy to discipline-based knowledge.

Research Process: Comments by some participants in the questionnaire suggested that the individual project planning stage of the programme may have been rushed and that,as a result, they may have initially been over-ambitious. There was also a sense that, perhaps because the contents of the research projects were new to most participants, the project plans started with the data collection methodologies (e.g. focus groups, questionnaires) in order to answer a research question, rather than starting with the question and then choosing the preferred methodology to answer it. However, these initial obstacles were overcome and the projects all proceeded successfully.

Professional Development: According to the first questionnaire, the majority of participants felt that undertaking discipline-based pedagogic research was an important component for enhancing student learning, providing an evidence base for curriculum development, and developing oneself as a teacher. This latter factor was extensively discussed by one focus group which noted the impact undertaking the research had had on their perceptions of pedagogic research and on their teaching:

- Their ideas about 'hard core' science versus social science had changed – they now accepted the value of qualitative evidence;
- Their involvement in the project enhanced their confidence in interacting with students (particularly in getting feedback from students) and engaging them in their own learning;
- They used a more scholarly approach to their own teaching – for example, one participant said that the theory had provided a structure to match their previously held philosophy.

Discussion: Inferences about the Participants' Learning Process

The above analyses suggests the LTSN-GEES programme had a significant impact on the participants' capability to undertake discipline-based pedagogic research, as evidenced by their enthusiasm and their enhanced confidence and skills. Additionally, for many participants, involvement in the programme had a positive effect on their teaching practices, and an enhancement of their professional life in general through collaboration with like-minded colleagues from other institutions and disciplines.

There is clearly a step-change from the attitudes of the participants at the outset of the programme compared with their feelings towards the end.The inference from the data is, perhaps not surprisingly, that the increase in confidence is linked to an increase in knowledge and understanding of pedagogic research developed through opportunities to practise, (i.e.) experiential learning.

However, increased confidence through having actually done the research can only account for the participants' enhanced pedagogic research capability in part. For some participants, at least, overcoming initial concerns and scepticism about the methodologies also played a significant role.

Comparison of the two questionnaires suggests that the participants may have broken down their conceptual barriers between their discipline research and pedagogic research. Responses to the first questionnaire indicated unease about pedagogic research particularly for those for whom the methodologies were new (mainly 'hard' scientists). In contrast, the responses to the second questionnaire suggest that the participants had made connections to their discipline research, had higher confidence in conducting pedagogic research and had experienced relatively few difficulties along the way.

This process of conceptual development was connected with the issue of translation from one culture of inquiry to another. Some of the translation was about breaking down the jargon and introducing a theoretical underpinning: it was observed during the final workshop that the participants appeared much more comfortable using educational terms and were asking probing questions of each other's research; some was about demonstrating validity and robustness of design; and much, as with many forms of cultural exchange, was about overcoming prejudice.

The role of specialist educational research advisors was important in this process to support the generation of conditions for learning within the project groups. As well as acting as trainers, the advisors provided understandings about the cultures of inquiry across the discipline specialisms and pedagogic research. Therefore, the programme's workshops, which were provided to support the actual practice of discipline-based pedagogic research, provided much more than simply training in methodologies. Through collaboration, discussion and the opportunity to work with data in a supportive environment, the participants began to build their own understandings of pedagogic research and to make connections to their prior experiences. At the beginning of the programme, the questionnaire suggested that these connections had already been made by many of the geographers. However, the 'hard scientists' perhaps needed more time to experience the different research culture and to develop their own connections. Such connections between geoscience and pedagogic research, discovered by the participants, have also been articulated elsewhere:

"Although most scientists are used to thinking about data qualitatively, the geosciences actually have a long history of using data and analytical techniques which are similar to [qualitative methods]. For instance, paleontologists spend a significant amount of time describing (i.e. observing) the features of fossils, and determining the fossil's systematic position…..Stratigraphers also spend a significant amount of time observing outcrops and taking field notes." (Libarkin & Kurdziel, 2002)

"We [geoscientists and learning scientists] share a common culture of asking questions, collecting data, and drawing rigorous conclusions. Geoscientists are used to working with complex systems, limited data collection opportunities, proxy data,and complicated inferences – we share this in common with much of learning science. Geoscientists tend to be great observers as well, seeking pattern and questions from complex interwoven types of observations. It should be possible to adapt this training to observing our students, collecting data, and drawing more rigorous conclusions about the impact of our teaching on their learning." (Manduca, 2002)

Conclusion

It would seem that the LTSN-GEES pedagogic research programme has proved successful,not only in beginning to develop the participants' capability to undertake such research but also in producing an enthusiastic practitioner network. Through actually undertaking pedagogic research and through opportunities for discussion and professional development, the participants were able to build on their prior research experiences and construct a personally meaningful framework for their understanding of pedagogic research.

No-one would suggest of course that this research project and the other research projects presented in this edition of PLANET represent by themselves a truly major advance in discipline-based pedagogic research. The work is small-scale and relatively basic in the questions it addresses. Nonetheless, the pedagogic research programme overall represents quite a significant step in a much desired direction in the GEES disciplines and has certainly given those involved at least some elementary training in some aspects of pedagogic research.

Perhaps the most interesting outcome from this programme was the reconstruction of their subject-based research by some of the more science-orientated participants (including myself). Engagement with pedagogic research methodologies highlighted the observational,

qualitative nature of much of earth and environmental science research. This in turn had a positive feedback effect, enhancing the participants' understanding and acceptance of the social science methodologies used within pedagogic research.The challenge for the network now is to communicate these learning experiences, and the results and recommendations from the research, to the disciplines as a whole in such a way as to ensure their wider acceptance and implementation.

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Helen King
LTSN-GEES
h.king@plymouth.ac.uk

Using Pedagogic Research in Course Design: A Geochemistry Example In Distance Learning

Karen Hudson-Edwards, School of Earth Sciences, Birkbeck College, University of London

Abstract

The School of Earth Sciences at Birkbeck College, University of London and the External Programme of the University of London are working in partnership to develop an Advanced Diploma in Geochemistry, which will commence in October 2004. The development of the courses for the Diploma has been informed by a review of existing pedagogic research on computer-aided distance learning, and on related good practice in other distance learning Earth Science courses. Based on this review, and on policies within the Birkbeck School of Earth Sciences, the Diploma will be delivered using CD-ROM-based lectures and a supporting Web-based Virtual Learning Environment. These should assist in promoting deeper student learning and facilitate student and tutor communication. It is recommended that designers of distance-learning courses in other GEES discipline areas take advantage of pedagogic research to design and run their courses.

Introduction

The growing global awareness of the resources, hazards and pollution of the Earth stimulates the development of effective and exciting courses in Earth Science. These courses must reflect the increasingly multi-disciplinary nature of the Earth Sciences by incorporating aspects of chemistry, physics, biology, and the social sciences. In addition to providing a strong conceptual understanding of these principles, scientific skill, decision-making structures and logical thought processes must also be taught. It is generally agreed that students learn Earth Science most effectively when they apply a range of cognitive processes, including memorisation of facts, and the integration of scientific principles to solve unfamiliar problems, during the learning process (Meyers and Jones, 1993; National Research Council, 1996; AGU, 1997). Computer technology offers many different ways to deliver multi-disciplinary Earth Science instruction.

Birkbeck College, University of London, not only provides a range of full-time postgraduate taught and research programmes for UK and international students, but also fulfils a special mission in meeting the needs of over 5000 mature part-time evening students reading for first or higher degrees. As such, there is a considerable market for computer-aided distance learning courses.

The School of Earth Sciences at Birkbeck, University of London, has long been successful in delivering undergraduate and postgraduate degrees in Geology. Since October 2002, the School has collaborated with the University of London External Programme to develop, market and run four courses and a project for an Advanced Diploma in Geochemistry that will commence in October 2004.The development of this diploma has been based on existing course units in the School of Earth Sciences, and has benefited greatly from a literature review of existing pedagogic research on computer-aided instruction.The review was conducted over several months prior to October 2002.A number of sources were consulted, including general and Earth Science pedagogic journals, Earth Science computing journals, notes from a Professional Accreditation of Teaching in Higher Education course, web-based information and Birkbeck School of Earth Sciences documents. The main objectives of this paper are to (1) summarise the main findings of this review and (2) outline strategies chosen for programme design of the distance learning Advanced Diploma in Geochemistry that were informed by this review based on pedagogic research.

Computer-Aided Learning in the Advanced Diploma in Geochemistry

It was decided at an early developmental stage to use computer-aided learning as the mode of delivery for the Advanced Diploma in Geochemistry. This decision was supported by the pedagogic research review. Previous research has showed that computer-aided learning is convenient and flexible, allows for the highly diverse nature of national and international students and leads to improvement of students' computing skills (Kulik et al., 1983; Bartolic-Zlomislic and Bates, 2000; Sansom and Moss, 2000). In addition, student-to-student interaction and communication in a computer-aided learning environment can promote active learning, encourage deeper-level mental processes and facilitate the manipulation of concepts and thought processes. Having course notes stored on a computer allows a lecturer to revise and update the material quickly, even as the course is in progress. Computer-mediated teaching and communication can result in the sharing of ideas, information and skills between the instructor and the students, to strengthen knowledge building, integration and the application of conceptual information (Farrell, 1999).

The major disadvantages highlighted by the review include the possible high cost to the student of purchasing computer and related equipment, and to the institution for providing the necessary tools to support the preparation and maintenance of the learning materials. After consideration, it was decided that the benefits of computer-aided

delivery far outweighed these disadvantages, and that students must bear the costs of having computer access.As for the institutional cost, the Birkbeck School of Earth Sciences is committed to providing computer-aided distance learning courses and degrees, and therefore has invested in infrastructure to support these activities.

Mode of Delivery and Teaching Methods

The pedagogic research review demonstrated that there are two major ways in which computers are used for distance learning in the Earth Sciences: an interactive World Wide Web environment or a CD-ROM platform, with some Web interaction. Web-delivery methods have included an interactive case study approach for geophysical exploration (Boyd and Romig, 1997), and a lecture-based approach for both palaeontology (Boyle et al., 1997) and petrology (Lamberson et al., 1997). Student feedback was generally positive in all of these cases. Most students thought that the Web-based modules were as good as, or better, than the conventional lectures,and this was largely borne out by examination outcomes.

CD-ROM course delivery has been used by the Open University (UK) in their 'Discovering Geology' course (Easterbrook, 2000), and by Prothero (2000) for a course on oceanography for the University of California, Santa Barbara. The CD-ROMs can employ many different multimedia techniques for teaching (databases, lava flow experiments, virtual field trips, photographs of outcrops, virtual hand specimens, minerals, rock sections). Prothero (2000) supplemented the CD-ROMs with Web technology that provided an opportunity for students to publish their work for peer review, and for networked tutorials.The Web tutorials in turn generated more questions from students, more class discussion, more talk about the meaning and significance of the course content, and higher student engagement overall,than traditional face-to-face tutorials.

Based on consideration of this research, and on the distance learning policies of the Birkbeck School of Earth Sciences,it was decided to use CD-ROMs for delivery of the course lectures for the Advanced Diploma in Geochemistry. The courses for the Diploma require very high resolution photographs and diagrams, and short video clips, that are very time-consuming (and thus potentially expensive) to download with current Web speeds.The courses are therefore being developed using the format for layout of CD-ROMs used for other courses in the Birkbeck School of Earth Sciences. The lectures are delivered using Adobe Acrobat reader with files provided on a CD-ROM.This means that students can (a) access the course material using free software, (b) have access to large amounts of photographic and graphic material rapidly, without the problems of large file sizes associated with Web-based access,and (c) study the material offline without the expense of telephone bills (Roberts, 2001).The students are also able to print the lecture material using simple ink-jet printers, thus gaining high quality notes and images without having to worry about page set-up problems that might occur with Web-based delivery. On the CD-ROM, the lecture notes contain interactive buttons that allow navigation between different pages of the notes, and allow the students to zoom in or out on the high quality photographs and diagrams to conduct their own inspection of materials (Roberts, 2001). As a result of the pedagogic research review, additional features,such as definitions of difficult terms, interactive exercises and assignments and lecture summaries (Lamberson et al.,1997),are also being incorporated in the CD-ROMs for the Advanced Diploma in Geochemistry.

Student Communication

A key theme of pedagogic research on computer-aided distance learning is student communication.The lack of face-to-face contact can lead to insufficient student supervision and feedback,a sense of student isolation and the potential problem that instructors in electronic classrooms cannot adapt to the specific needs of learners at a given time (Kulik et al., 1983; Bartolic-Alomislic and Bates, 2000; Institute of Education, 2000; Sansom and Moss, 2000). Stephens and Roderick (1971) recommended that the loneliness felt by many students can be overcome by presenting instructional material in an attractive manner, personalising the teacher-student relationship, and including some face-to-face learning and counselling facilities.They also suggested that the development of non-written communication (e.g. telephone) between the lecturer and student should be encouraged.

The lessons learned about student communication were extremely valuable in developing the Advanced Diploma in Geochemistry. Prior to the research review, only email was considered as a means of communication with students.As a result of the review, the CD-ROM-based lecture materials will be supplemented with a Virtual Learning Environment (VLE). This will contain course announcements, links to other geochemistry and Earth Science sites of interest, links to the on-line library, on-line formative assessments, the student handbook and many other useful teaching and learning tools. Student communication will be facilitated through a discussion room (for 'social' interaction) on the VLE, and through email contact with tutors. It has been demonstrated that such discussion, or 'chat' rooms are extremely beneficial to learning. Students can learn from Web-based postings and online discussion with other students as well as the instructor, they have the ability to think about a topic, collect and organise their thoughts before responding online, there is more time for discussion because there is no competition for a certain amount of class time, the students take an active part in discussions and the associated anonymity can result in greater participation from all students, including those who may be shy at participating in a traditional lecture class (Stephens and Rodercik, 1971; Boyd and Romig, 1997; Bartolic-Alomislic and Bates, 2000; Sansom and Moss, 2000).

The recommendations of Stephens and Roderick (1971) will be followed to a large degree in that the CD-ROM-based lecture notes are of very high quality and are very attractive, students will have direct email access to tutors and students will be able to post mini-autobiographies as a means of introducing themselves to their fellow students. The development of non-written communication is more difficult, since many of the students are international and timing phone calls to coincide with UK working hours is potentially difficult. Despite this, the programme director will be available at specific times for telephone consultation.

Conclusions and Recommendations

A review of pedagogic research on distance learning has underpinned the development of the Advanced Diploma in Geochemistry at Birkbeck College. Computer-aided distance learning technologies such as the WWW and CD-ROM offer many opportunities for teaching, especially in the Earth Sciences, which require detailed, high quality images to facilitate understanding of Earth System concepts. Courses for the Birkbeck-External Programme (University of London) Advanced Diploma in Geochemistry will be delivered by distance learning using CD-ROMs. A Web-based Virtual Learning Environment, which will contain many teaching and communication support tools, will also be available to students. It is recommended that designers of distance-learning courses in other GEES discipline areas take advantage of the wealth of pedagogic research available on this subject, and make use of the results of these studies to inform, design and run their courses.

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Karen Hudson-Edwards
School of Earth Sciences
Birkbeck College, University of London
k.hudson-edwards@geology.bbk.ac.uk

Reflection, Alignment and Mineralogy

Alan Boyle, Department of Earth & Ocean Sciences, University of Liverpool,

Abstract

Mineralogy was boring according to most stage 1 students at the University of Liverpool in 1998. Since then, a pedagogical research experiment in using multimedia (lectures and web) to deliver material, coupled with continuous refining of subjective and objective assessment tools to improve their alignment with intended learning outcomes (knowledge, skills and understanding) has been undertaken. The experiment has (a) (apparently) made mineralogy more interesting; (b) demonstrated the utility of multimodal delivery and multimodal assessment; (c) demonstrated the need for: "constructive alignment" between aims, outcomes and assessment; and (d) resulted in reflection on actual outcomes and modification of teaching and assessment accordingly. Mineralogy needn't be boring, and a reflective and aligned approach aware of modal learning preferences can be usefully used in other GEES disciplinary areas. Investigating the need for such curriculum changes can be achieved successfully through pedagogical research of this nature and through the use of statistical analysis of studen performance.

The Mineralogy Problem

Mineralogy is boring! Well, at least that was the general opinion of the majority of students taking it at introductory stage 1 in the Department of Earth abd Ocean Sciences at University of Liverpool in 1998. To quote, (mineralogy):

- *"Could do with livening up somehow."*
- At best was *"dry"* in terms of content.
- *"Is not the most interesting module I am doing."*
- *"Lectures were quite boring and hard to follow, often using new complex terminology - difficult to grasp."*
- and even, *"What on Earth is [001] etc. all about?!"*

Rationale for the Experiment

What could be done about this state of affairs? My gut feeling when taking over the module was that mineralogy is fundamentally interesting, so the problem must be a pedagogical one. The module had to be taught, but I set up a strategy to help me understand the processes taking place, so that I could then see what interventions I could make to improve teaching matters. I had already become aware that students have modal learning preferences (e.g. VARK inventory Fleming (1995) and - http://www.vark-learn.com/) and later realised that what I was doing was enacting the concept of constructive alignment (Biggs, 1999). In this short article, I describe a four-year pedagogical experiment in using multimodal learning and teaching methods, coupled with assessment aligned to the intended learning outcomes and subsequent reflection on the whole process, in an attempt to improve understanding and appreciation of mineralogy for stage 1 students.

The use of the VARK Inventory

The VARK inventory (Fleming,1995),asks 13 everyday questions, which provide information on different learning modalities: Visual, Aural, Read/write, and Kinaesthetic. Table 1a and 1b summarise outcomes from the use of the VARK inventory with 114 stage 1 Earth Science students in 1999. 72% of the students gave multimodal responses with a preference for Read/write and Kinaesthetic modes. Interestingly, the multimodal combination Visual/Aural,ideal for the enjoyable experience of watching a video, does not figure as a preferred learning mode. Read/write and Kinaesthetic preferences also dominate single

preference modes.These results support those of a much larger study conducted by Fleming (2002), the creator of VARK, involving 31,243 responses in the June-September 2002 period. Students clearly have different learning style (modal) preferences. So, how can these be accommodated within a university module?

Preference	Frequency of Response
MULTI-MODAL VARK PREFERED RESPONSE	82 Students (72% of sample)
Visual / Aural	0
Visual / Read	8
Visual / Kinaesthetic	8
Aural / Read	6
Aural / Kinaesthetic	7
Read / Kinaesthetic	15
Visual / Aural / Read	1
Visual / Aural / Kinaesthetic	8
Visual / Read / Kinaesthetic	11
Aural / Read / Kinaesthetic	7
Visual / Aural / Read / Kinaesthetic	11

Table 1a
Summary of multi-modal responses to the vark inventory (September 1999) (N=114)

SINGLE VARK PERFERENCE	32 Student (28% of sample)
Mild Preference	
Visual	2
Aural	0
Read	3
Kinaesthetic	7
Strong Preference	
Visual	2
Aural	0
Read	2
Kinaesthetic	5
Very Strong Preference	
Visual	0
Aural	0
Read	4
Kinaesthetic	7

Table 1b. Summary of single preferred responses to the VARK inventory (September 1999). (N=114)

Mineralogy module outline

The ESGY105 Mineralogy module at the University of Liverpool comprises 12 lectures and 6 practicals and is a prerequisite for subsequent petrology modules.Lectures have to cover mineral,physical, chemical and optical properties and classification, crystallography, and how minerals are used to classify rocks. Where appropriate, phase diagrams are introduced to facilitate understanding of physical and chemical processes (e.g. changing composition of plagioclase during cooling and crystallisation of a melt).

Following the initial student feedback summarised above, all 12 lectures were converted to PowerPoint to make use of movies of microscope images,3D animations of crystal lattices,etc. to 'liven them up' and help to improve the understanding of difficult concepts (e.g. interaction of minerals with polarised light, evolution of the plagioclase binary phase diagram).These lectures are all available on the University of Liverpool intranet before, during and after the lectures.This allows students with a Read/Write modal learning preference to take advantage of that fact. The lectures favour students with Visual/Aural learning preferences, though the use of animations may help students with Kinaesthetic learning preferences.

Practicals were kept basically the same, except for radically updating the 60 page practical handbook, which contains all of the information (primary and secondary) needed for each practical. Students thus have all the practical information up front and can address the material outside formal 3 hour practicals as well, should they wish to do so.

The overall aim of the mineralogy module re-structuring was to deliver the material in a variety of modes: predominantly VAR (visual, aural, read/write) in lectures, RK (read/write, kinaesthetic) on the web and VRK (visual, read/write, kinaesthetic) in practicals.

Module Assessment, Alignment and Reflection

Knowledge and understanding are assessed using an objective Computer Aided Assessment (CAA) package (TRIADS) (Boyle et al., 2000) and a set of objective criteria. Practical skills are assessed by review of the practical handbook using a set of subjective criteria, (e.g.) how accurate/representative a drawing is made from a thin section viewed with a polarising microscope. Reflection on assessment outcomes has guided modification of the assessment instruments to remove ambiguity (especially in the practical handbook instructions) and to completely change question structures (e.g. change from multiple choice to multiple response question styles in the TRIADS-based assessment (Boyle, 2002)).

In theory, consideration of alignment of teaching methods with intended outcomes (Biggs,2003) and learner preferences, coupled with reflection on the performance of assessment tools should improve things.

The student perception of the module as a whole was indeed much improved when surveyed in 2002. To quote again:

- *"A good course. Could have been dull, but wasn't."*
- *"Found the teaching material was very good compared to some other modules."*
- *"Great presentation, keep access to lectures on the web."*
- "*Content presented clearly on the net, but not in lectures." [does this reflect a Read/write VARK preference?]*
- *"Very enjoyable. Hard as new to me, but fascinating."*
- *"What are Miller Indices all about?!"* [some things don't change!]

What about assessment? The objective (CAA) assessment always produced lower marks overall than the subjectively marked practical assessment, with a rather poor positive correlation between the two. One feature of all three years of the experiment, exemplified in the data for 2001 (Figure 1), is that there are a significant number of students who perform much better in the subjective practical assessment than in the objective CAA assessment. Many might view this as an assessment problem suggesting perhaps that the practical assessment is not ranking the students correctly. On the other hand, the two assessments assess different things in different ways,and given the aim of developing practical skills as well as knowledge and understanding, both must be considered necessary.

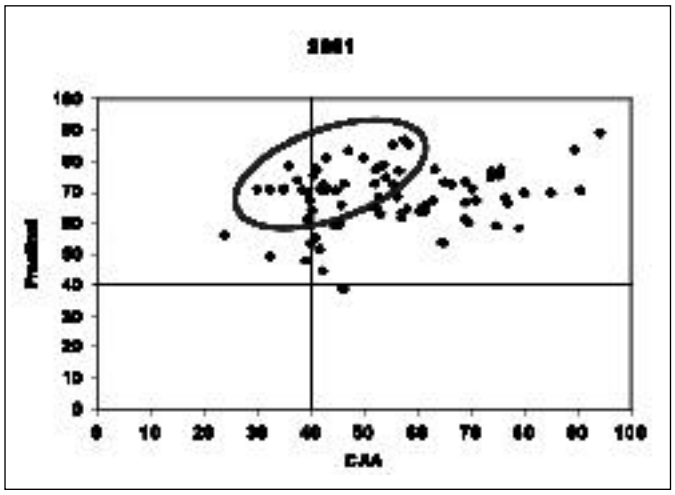

Figure 1. Graph of CAA versus practical assessment scores in session 2000-01. The ellipse highlights students who scored well in the practical work but poorly in the CAA.

Another way of looking at this is to compare the practical, CAA and whole module performance against student performance in the rest of their programme (Table 2).Mineralogy is just 7.5 credits,or 1/16 of the year of study. The mark from the remaining 15/16 can be used to represent an independent measure of student ability. Table 2 summarises Pearson Correlation coefficients between these three components (practical, CAA and overall module marks) and year average performance in the other 15/16 of the programme for the assessment years 2000-2003. Table 3 also summarises equivalent correlations for three other 7.5 credit modules taken by mostly the same cohort of students.

Year	2000	2001	2002	2003
Practical	0.439 (93)	0.598 (82)	0.596 (78)	0.665 (91)
CAA	0.541 (93)	0.644 (82)	0.712 (78)	0.804 (91)
Module	0.622 (93)	0.780 (82)	0.770 (78)	0.843 (91)

Table 2. Pearson Correlation coefficients for ESGY105 Practical, CAA and whole module components with year average performance. Numbers in brackets are the number of students involved. [Note that the values in this table differ somewhat from those reported in Boyle (2002).This results from using final university stored data, including the effects of moderation and resits, to recalculate coefficients, rather than the raw pre-resit data used by Boyle (2002).This approach was taken because of the need to make proper comparisons with other modules, for which I only had access to the university-stored data.]

Year	2000	2001	2002	2003
Mod X	0.752 (95)	0.569 (78)	0.714 (72)	0.734 (79)
Mod Y	0.773 (92)	0.722 (79)	0.835 (71)	0.826 (95)
Mod Z	0.582 (100)	0.689 (86)	0.798 (79)	0.708 (84)

Table 3. Pearson Correlation coefficients for modules Mod X, Mod Y and Mod Z summarising whole module correlation coefficients with year average performance for level one modules that run after the mineralogy module discussed in this article and taken by mostly the same students. Mod Y used the same MCQ examination in all four years. Numbers in brackets are the number of students involved.

With respect to Table 2, there is clearly a general improvement in correlation coefficients for the practical and CAA components, and the overall ESGY105 module score over the 4 years.The CAA coefficients improve each year, and it always correlates better than the practical. However, the overall module mark, which combines the two, always correlates better still. For comparison, Table 3 summarises comparable Pearson Correlation coefficients for three other level one 7.5 credit modules, Mod X, Mod Y and Mod Z, taken by mostly the same students. These data can be used as a 'control' for student ability. Mod Y used the same 60-item multiple-choice examination in all four years. So, what can the data in these two tables tell us?

- The correlation coefficients for Mods X,Y and Z (Table 3) suggest that there is no general trend of better correlation between marks in individual modules and overall year average marks over the four-year period. This in turn suggests that any significant changes in performance in the ESGY105 module (practical, CAA and whole module) are not due to changes in student cohort ability between years.
- The year-on-year improved correlations in the CAA (Table 2) reflect changes made to improve it. Put simply, the CAA performed better.
- Improved practical mark correlations (Table 2) reflect updating of the handbook while marking it – specifically reflecting on student outcomes and removing ambiguities.
- The fact that the overall module score (Table 2) always has the best correlation suggests that the multi-modal assessment strategy used provides the best indicator of student ability.
- Assessments based solely on one assessment method (CAA or practical or traditional theory paper) should perhaps be viewed with caution, though Mod Y in Table 3 generally performed quite well with only an MCQ test for assessment.
- Care should be taken when relating objective methods of assessment (e.g. CAA) to necessarily more subjective assessment methods.They are measuring different things.
- There is a need to ensure that there is "Constructive Alignment" between Aims, Learning Outcomes and Assessment in all modules.
- Practitioners should reflect on learning outcomes and modify their teaching and assessment accordingly so as to make the alignment more constructive for student learning.

This general statistical approach outlined above is useful in other ways. At the end of each session, I now routinely correlate individual module scores against their overall year scores for every module taken by all students in my department.This is easily done as the data can all be downloaded into a table and then analysed. As Chairman of the department's Board of Studies,I use this information as one method to check on module outcomes. If module scores correlate poorly with students' overall scores then it might suggest that something may be amiss with the assessment strategy in that module, or that the module is perhaps assessing quite different outcomes from all of the other modules which the student is taking.

Conclusions and Recommendations

Mineralogy needn't be boring! Awareness of student preferences, coupled with alignment of content, delivery, intended learning outcomes and assessment result in a student experience that can be enjoyable and one which facilitates their learning A key recommendation from this study is that continual reflection on learning outcomes coupled with systematic action improves the alignment. Failing modules can be improved by researching the processes that take place during the module.

Statistical checking of individual module scores against student overall scores should be conducted more routinely as a first stage in auditing module outcomes. A small amount of pedagogical research in this respect can go a long way to enhance the student learning experience.

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Alan Boyle
Department of Earth & Ocean Sciences
University of Liverpool
apboyle@liverpool.ac.uk

Examining the Effects of Teaching/Learning Methods on Student Understanding of Value-Laden Issues

Thérèse Kennedy and Shelagh Waddington, Department of Geography, National University of Ireland, Maynooth

Abstract

This short paper is firmly anchored within a pedagogic research framework. It explores the implementation of alternative teaching methodologies with large groups within a Geography module with a view to promoting more critical student awareness of development issues. Furthermore, it investigates students' opinions and responses to these methodologies in terms of achieving learning outcomes. The study specifically examines the results of a survey concerning (a) the preferred personal learning styles of geography students and (b) the changes in students' perceptions and misconceptions about Sub-Saharan Africa and Africans after the relevant module.

Introduction

This investigation draws on the theory of multiple intelligences (Gardner, 1999) in that it acknowledges and addresses some of the various learning styles of individuals in a bid to achieve greater 'consciousness' or self awareness of personal values and attitudes so that students may move on to explore more complex issues involving others' perspectives (Freire, 1996). It is motivated by the work of human geographers such as Potter, Robson and Massey amongst others, who highlight the problems associated with defining 'development' in the first instance and the relevance of geography to education in a globalising era. In addition, it adopts some of the methods of teaching used by Harrison, which have been adapted for use in teaching large groups, specifically in examining images of development whilst teaching development geography (Harrison, 1995).

In an Irish context, little research has been carried out in HE especially into large group interactive teaching and learning and the authors are seeking to replicate some of the previous work done with small groups in order to explore some of the values and attitudes to development held by young Irish citizens. This is because the Irish have traditionally been considered willing and enthusiastic donors of financial aid to less-developed countries (particularly in sub-Saharan Africa.) The cultural and historical factors,such as shared colonial experiences,that underpin this positive attitude towards lesser-developed countries by Irish citizens, are suggested by the authors to have an influence on students' perceptions of these countries in general. However, despite the empathy towards such countries which Irish people display (reflected in the large amounts of aid donated per capita), it is argued that a critical and deeper awareness of issues and processes underlying development theory is still little understood by Irish students. While the culture and history are unique to Ireland, the wider consideration of these issues and the relevant methodologies used in this project are applicable in a large number of contexts where values and attitudes are explored and in other GEES areas.

The Study

170-second year undergraduate students at NUI Maynooth (mostly taking a two subject BA degree) took the module entitled, '*Environment and Development in Sub-Saharan Africa*'. Undergraduates were given a pre-module questionnaire in which they were asked to rank their learning preferences.Further questions invited them to suggest reasons for uneven development between rich and poor countries and how this gap might best be reduced. (In previous surveys participants had already defined development and indicated past levels of involvement in development programmes.) In addition, they were asked to indicate their experience, if any, of 'active learning' in secondary school or elsewhere.

Results of the pre-module questionnaire and previous surveys indicated that respondents had little or no familiarity with alternative teaching styles in this context, but yet displayed a good theoretical knowledge of development issues.

The module was delivered by a total of five lecturers using a wide variety of teaching/ learning strategies. These included:

(1) Standard lectures, i.e. where the lecturer speaks and students listen.Topics included:(a) Development from the perspective of an Irish non-Government Organisation, (NGO) and (b) Structural adjustment policy.

(2) Lectures based on case studies, images and personal accounts from individuals working in the field. Topics included: (a) Urban housing and urban livelihood strategies and (b) Rural livelihoods.

(3) Trial lectures using interactive and standard teaching methodologies. In the interactive sessions, participants were required to discuss topics and give feedback in small groups.Topics included: (a) What makes successful/sustainable development? and (b) How images affect our understanding of development.

The trial lectures (3) required dividing the class into two groups (85 students in each) and using two lecturers to deliver the simultaneous sessions.Each lecturer used only one method of delivery (interactive or standard) for topic (a) and then reversed the teaching style for the same group in a subsequent lecture on topic (b). In this way, all students were therefore taught both topics, but in two different teaching styles. At the end of the module, participants were again questioned about their preferred learning style in relation to these two particular lectures and were asked to provide commentary against their responses. It is the preferences of the students for these two particular lectures and delivery methods, which are examined in the post-module questionnaire discussion below, rather than the pre-test general learning preferences. In addition, participants were asked to outline any misconceptions they could now identify which they may have had about 'development' and 'Africa' in general, prior to undertaking the module.

Results

Student Responses to Teaching Methods

Results from the pre-module learning styles questionnaire show that respondents favour involvement in the learning process and rank discussion and interaction highly as a learning tool (as opposed to the standard lecture where they are required to just listen, which they ranked low). Results show that 'hearing words' is the least preferred learning option of students.They prefer to 'do the real thing'or at least 'simulate' or 'see it being done'. Not surprisingly, reading - which is also highly ranked - is a popular learning option, given that a substantial amount of university courses require extensive reading as part of the learning process. An interesting finding shows that students generally express a dislike for giving talks and presentations but nonetheless acknowledge that they learn a lot from this technique. It is likely that lack of experience with this learning method accounts for the dislike and general uneasiness amongst students. This highlights some interesting questions as to how we can make learning more accessible to their needs and learning preferences and so facilitate more critical awareness and analysis of complex issues.

With regard to the trial lectures, results were more evenly balanced. Forty four percent of those surveyed prefer standard lectures, citing reasons such as *"it is what I am used to"*; *"it is more structured"* and *"I learn more"*. Fifty five percent favoured the interactive discussions and feedback sessions, considering them *"easier"*, *"more enjoyable to learn by doing"* and *"more interesting"*. In general, the students expressed great enthusiasm for the interactive learning method, declaring that learning from others helped them to understand better the topic. However, many were concerned about tangible/measurable benefits in terms of knowledge acquisition. Although the majority preferred this mode of learning, many students were concerned about not being able to take notes for later reference at examination times.This has been referred to as *"hard-nosed"* knowledge (Lambert and Balderstone, 2000).

Satisfactory examination results are one of the primary educational outcomes of Irish universities as they provide a measure of a student's level of achievement and an indication for future employers as to the student's perceived worth. One way of reassuring students in this matter is to provide them with adequate handouts,including notes and references, and this has been taken on board for future trials in the next academic year. However, in the authors' institution, the terminal examination is the dominant method of assessment and requires a large amount of knowledge output on behalf of the student. Continuous assessment represents only 20% of the final mark, which raises salient questions as to how interactive and other alternative pedagogical methodologies can be truly useful if there is only one primary mode of assessment.Students are naturally attuned to how to maximise marks in a system that is primarily knowledge-based and will not willingly accept multi-modal methods of teaching/learning if appropriate alternative assessment methods are not also utilised.

In effect this also raises questions about the value that is allotted to knowledge acquisition where one style of learning/teaching is deemed preferable to others. Ways of assessment, which do not require factual recall, but test higher order skills,such as application of learning to new situations, have already been tested in the in-class assessment, with some success. However, students still appear to lack confidence in their own abilities in this area, possibly a reflection of previous success in assessment based on repeating other people's ideas. In the coming year further work will be undertaken on this aspect of the module, both in the in-class assessment and in terms of an alternative, decision-making or data response question being used as part of the terminal examination. The learning outcomes and objectives will also be rewritten to place greater stress on the importance of personal awareness and consideration of issues.

Students' Perceptions of Africa and of the Development Gap

Despite evidence from the pre-module and earlier surveys that the students had some understanding of the development gap and related concepts, the post-module survey revealed that students themselves identified that they had possessed a large number of misconceptions concerning these issues and that their personal understandings of the issues had subsequently been changed. Respondents reported that on the surface, they had a theoretical understanding of the concepts, but at a deeper level they had many stereotypical and inaccurate impressions or perceptions of Africa. The gap in theory and practice is disturbing because although students are technically correct in their responses and could well address questions successfully at examinations, the lack of deeper awareness of the realities of development is affected by their personal values and attitudes and serves to reinforce rather than dissipate stereotypical thinking. Many reported that prior to the module they had considered Africans to be *"lazy"*, *"responsible for their own problems"* and *"sitting around waiting for the aid truck to roll in."*

(25%).A considerable number of respondents remarked that they had believed Africa to be a backward, desolate, bleak and hopeless place (47%).

It can be argued that the media have influenced some of this thinking amongst students as many consider debt to be the overriding factor in underdevelopment, as portrayed in campaigns by celebrity pop/rock figures such as Bono and Bob Geldof. Young people today, more than ever before, acquire a lot of knowledge from the media and electronic sources and so are very much influenced by comment or interpretations made by people to whom they relate. This would suggest that students need to establish a personal reference point concerning issues which may not appear to have much significance in their lives at first glance, before they really consider these in depth. In effect, they need to be able to engage and identify with the subject matter in order to appraise it more critically. In HE, interaction and engagement with materials, subject matter and other students during the learning process, can assist them in critically examining some of their own and peer values and attitudes, whilst embarking on studies that link them with other places and people.

Implications for Teaching and Learning

The value of fieldwork in learning about development is immeasurable. However, this is not always possible when it involves large numbers of students and/or high costs or distances. In the absence of a fieldtrip to Africa, such as in this case, it is imperative to somehow bring Africa to our students. This, we believe, may be achieved through the implementation of more diverse learning strategies combined with more appropriate modes of assessment that address the learning outcomes of the course (i.e.) a deeper and more critical understanding of the links and processes that bind people and places everywhere in a rapidly globalising world.

On a more general level, the experience of this research provides further insight into students' perceptions and perspectives of the learning process in terms of enjoyment and usefulness and underlines how understanding and awareness can be challenged through engagement with materials and application of multi-modal teaching methodologies. It raises questions about whether students' needs are being adequately met through matching teaching/learning practices with appropriate assessment methodologies in order to optimise the learners'potential. In particular, it contributes to knowledge about how students can become involved in thinking about their own learning - what is referred to as 'metacognition' or 'conscious awareness' (Leat, 1998) and become responsible and critical learners. The study is,thus, not only relevant to the teaching of development geography in large group settings but has a broad multi-disciplinary application in areas with a value-based content.

The authors would recommend other GEES practitioners to undertake similar pedagogic research into their own students' learning styles and preferences on particular modules. In doing this, and through the use of multi-modal methods of teaching, it is possible for some student misconceptions to be overcome, through more interactive, discursive and demanding sessions.

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Therese Kennedy and Shelagh Waddington
Department of Geography
National University of Ireland, Maynooth
Teresa.M.Kennedy@may.ie
Shelagh.Waddington@may.ie

Pedagogic Research: A Guide to Key Reading

There are a large number of references covering the topic of pedagogic research. Below are listed a few references that may be of generic and subject-based interest.

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LTSN Geography, Earth and Environmental Science Subject Network: Pedagogic Research and Fieldwork Programme www.gees.ac.uk/pedresfw/pedresfw.htm

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The LTSN Subject Centre for Geography, Earth and Environmental Sciences
University of Plymouth
Buckland House
Portland Mews
Plymouth
Devon PL4 8AA

Tel: +44 (0) 1752 233530
Fax: +44 (0) 1752 233534

Email: info@gees.ac.uk
Website: http://www.gees.ac.uk