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1. Introduction

1.1 Purpose of this guide

This guide is intended to provide support and ideas to academic and technical staff engaged in the design and delivery of fieldwork in the environmental and natural sciences. It draws on literature and experiences from the disciplines of environmental science, geography, Earth science and the biosciences. Important differences exist between these discipline areas in the way that fieldwork is regarded and undertaken. Nevertheless, there is a substantial degree of commonality of fieldwork pedagogy and practicalities across the natural and environmental sciences and there are advantages in sharing ideas and identifying generic principles of effective fieldwork design. The guide has been prepared for higher education in the UK, with the focus predominantly, but not exclusively, at the undergraduate level. However, most of the issues discussed are also relevant for teachers in further education and sixth-form colleges in the UK, and upper level high school teachers in other countries.

This document aims to:

• outline the main elements in fieldwork design
• investigate the nature and diversity of fieldwork
• assess the practical and pedagogical issues facing fieldwork leaders
• discuss the issues surrounding fieldwork in higher education

It is tempting to take a short cut and describe this as a guide to ‘best practice’ in fieldwork. However, there is not a predetermined set of pedagogical principles and practical procedures, which, if adhered to, will result in an effective field course. The situation is rather more complex and exciting than that. There is tremendous creativity associated with field teaching which has generated a wealth of inspiring ideas. We have attempted to disseminate elements of effective design where they exist and especially, but not exclusively, when they are substantiated by evidence. In general, we have adopted the approach set out by Livingstone et al. (1998) in their guide to fieldwork in geography to “explore the nature, purpose and relevance of fieldwork as components of a degree”.

In doing this in a systematic and accessible way as possible, we hope to provide the following for the reader:

• an introduction to fieldwork for staff not familiar with it
• an opportunity for lecturers to share in the fieldwork ideas and experiences of others
• a discourse to encourage experienced practitioners to reflect on their practice in a more informed way
• an entry point into the educational research literature relevant to fieldwork
• help in supporting staff in managing changes (voluntary or enforced) to field course provision

In a recently published document Butler (2008) sets out guidance specific to teaching geoscience through fieldwork. His approach reflects the strong emphasis placed on field-based studies in this discipline and the need to develop field skills in geoscience graduates to prepare them for employment in the sector. Whilst also addressing these issues, this document relies more heavily on the educational
literature than does Butler (2008) and seeks to illustrate more explicitly the ways in which effective fieldwork design is underpinned by pedagogic research and theory.

1.2 Definition of fieldwork

The ‘field’ has been defined as “any arena or zone within a subject where supervised learning can take place via first-hand experience, outside the constraints of the four-walls classroom setting” (Lonergan and Andresen, 1988). This allows for a wide range of activities to be classed as fieldwork, ranging from a half-day visit to the local museum or shopping mall (see Guertin, 2005) to an overseas residential course lasting a fortnight or longer. For the purposes of this guide we focus on teaching in outdoor locations, but do not include any underground, submarine or aerial situations. Defining the field in this way also allows some work placements to be classified as fieldwork. For a work placement, the student works within an organisation as a ‘regular’ employee and it is this that dictates the activities that he or she undertakes (see Gedye and Chalkley, 2006). This document focuses on fieldwork where the aims and activities are set entirely or predominantly by academic staff, but this does not preclude the involvement of external organisations. The ‘field’ is seen as the location where learning takes place and ‘fieldwork’ is the set of activities that are undertaken by students to facilitate that learning. The ‘field course’ or ‘field trip’ is therefore the element of the curriculum into which these learning activities are packaged.

1.3 A model of fieldwork design

The conceptual framework adopted in this document identifies several key influences on fieldwork design (Figure 1.1). These are issues, trends and developments that affect not only fieldwork design, but also restrict or enhance an institution’s capacity to offer fieldwork. These extend to legislative, professional, technological, pedagogic and logistical issues many of which are external to the higher education institution that is delivering the field course. Influences on fieldwork design are described and discussed in Section 2.
Figure 1.1 Influences on Fieldwork Design

The guide breaks down fieldwork design into particular components or ‘elements’ (Figure 1.2). When brought together, these elements constitute the structure and characteristics of a field course or activity and embrace both practical and pedagogic aspects. The elements in fieldwork design are described and discussed in Section 3 of the guide. The model does not treat fieldwork delivery as a separate entity as it is inherently linked to fieldwork design.

Figure 1.2 Elements in Fieldwork Design
1.4 Contemporary issues in fieldwork in higher education

1.4.1 The pedagogic value of fieldwork

Most practitioners involved in fieldwork are of the firm belief that it is a ‘good thing’. Staff hold the conviction that students learn better in the field than in the classroom, that fieldwork offers the best means for students to grasp the fundamental concepts associated with our academic disciplines, and that it is essential to acquiring the generic and subject-specific skills that will equip them for future employment. The overriding view, at least in the UK, is that fieldwork is a vital component of learning in the natural and environmental sciences. This view is also taken by the organisations responsible for setting out academic standards.

According to the revised Quality Assurance Agency (QAA) benchmark statement for Earth sciences, environmental sciences and environmental studies (or ‘ES3’) (QAA, 2007a) “it is impossible for students to develop a satisfactory understanding of ES3 without a significant exposure to field-based learning and teaching, and the related assessment”. However at the moment, the extent to which these views are supported by empirical pedagogical evidence is limited by the relatively low number of publications in this apparently neglected area of research. Without this evidence, can we really be sure that students learn better in the field than in the classroom?

So, given the apparent rarity of evidential support for fieldwork, why do so many academic staff regard it in such a positive light? One explanation is that the majority of practitioners are correct in that fieldwork is particularly special and provides a unique experience for students. After all, it is the staff who deliver field courses year in and year out and witness at first hand the effect on students. Moreover, fieldwork consistently receives positive feedback from students, external examiners and employers. Is this not evidence enough? It may be true therefore that only in the field can the real complexity of natural and anthropogenic processes be fully appreciated and their relationships illustrated. Fieldwork may be the best environment by far to develop skills in a real world context. In time, we may find that continued pedagogic research into fieldwork reveals that the conclusions already reached by experienced academic staff were right all the time.

On the other hand, the majority of academic staff may be wrong and there is little that is special about fieldwork. Fieldwork may be perceived as effective purely because staff enjoy delivering it. Equally, staff may be influenced by their own experience of fieldwork at undergraduate or postgraduate level. Those individuals who progress to teaching field-based subjects in universities are likely to be people who responded well to fieldwork in their own studies. Field course leaders may carry a conviction that fieldwork is an effective way, if not the most effective way, to teach. Other reasons why practitioners favour fieldwork could be related to their own observations of the outcomes of their practice on student learning. Over time, staff may develop a favourable impression that fieldwork benefits students in ways that other forms of learning cannot. The danger inherent in judging field courses in this way is that it is inevitably subjective. Staff are likely to pay more attention to the students who respond well to fieldwork than to those who do not.
Almost certainly, the reality lies somewhere between these two positions. Key pedagogic research undertaken so far suggests that there is something uniquely valuable about the field learning experience (see section 2.1), but further studies are required if we are to build a more convincing body of evidence. At the same time, it is unlikely that fieldwork represents a pedagogic ‘magic bullet’ which will engender deep learning and facilitate rapid skills development in all students in all discipline areas. Moreover, simply taking students out into the field is not sufficient for them to learn – there is no ‘automatic osmosis’ of field information in the minds of the students (Lonergan & Andresen, 1988). There are bound to be certain circumstances under which field-based learning is particularly effective for an individual student or group of students. The role of pedagogic research is to identify these circumstances so that they can be incorporated into good practice. The challenge for academic staff is to become familiar with the existing knowledge of effective fieldwork design and to use it to full effect in their teaching. This guide is intended to help staff achieve this through presenting case studies and pedagogic research findings in a relevant and accessible manner.

1.4.2 Pressures on fieldwork in higher education
There are several factors that are making it increasingly difficult to provide fieldwork in higher education. Reviews by Smith (2004) and Boyle (2007) identify the following common issues in relation to undergraduate fieldwork in the environmental and natural sciences:

**Fieldwork is less likely to be a compulsory part of training**
Some disciplines have been moving away from the need to leave the classroom, for example through the development of technological alternatives to fieldwork, including remotely sensed data, GIS and virtual ‘field’ exercises. In the biosciences, the number of students opting for some laboratory-based courses such as Genetics or Medicine/Dentistry has increased.

**Staff expertise and motivation**
An increasing number of experienced, enthusiastic biosciences practitioners are reaching retirement age and are not being replaced with people with the same ethos regarding fieldwork. In other disciplines, field experience is also no longer seen as a prerequisite for appointing academic staff. In addition, time and effort spent organising fieldwork may not be recognised in an institution’s promotion or staff reward system.

**Cost**
It is generally accepted that fieldwork is relatively expensive compared with lecture-based teaching. There is often a need to pass on part or all of the cost of fieldwork to students whose level of debt has already increased in recent years.

**Time**
Fieldwork planning and delivery places a considerable time burden on staff which can detract from their ability to undertake research or other academic activities.

**Health and safety**
Legislation and regulation is increasing in relation to health and safety is increasing. A growing ‘blame culture’ in the UK makes some institutions worry about the potential legal implications of accidents on field classes, with the result that it is becoming more difficult for students to work alone in the field.
**Equal opportunities**
The introduction of the Special Educational Needs and Disability Act (SENDA) in 2001 places pressure on traditional expeditionary-type field trips as it requires all compulsory classes to be fully inclusive.

**Access to sites**
UK landowners are more aware of the legal implications of granting access, whilst in the USA some of the best field sites are now being bought out by a new breed of developers with an attitude of ‘get off my land’.

**Characteristics of the ‘modern student’**
Students now start university with different prior experiences than previously and they also have different priorities. Fewer students may have experienced fieldwork at secondary school level (see Tilling, 2004) and thus arrive at university with a positive field experience. Once at university, they may be reluctant to give up extra time from their paid jobs or family commitments to attend field trips.

Many of these issues are explored in more detail in section 2 of this guide.

**1.4.3 Approaches to effective fieldwork design**
Two of the most comprehensive articles on fieldwork teaching are the reviews by Gold *et al.* (1991) and Kent *et al.* (1997). Whilst written with geography in mind, much of what they contain is relevant across the natural and environmental sciences. Amongst their recommendations for good practice in fieldwork is the need to adopt a dispassionate and questioning attitude to all aspects of current fieldwork practice. Also, it is stressed that field courses should be under constant review and staff should be ready to modify them where necessary. Gold *et al.* (1991) warn against field trips that “habitually return to the same locations and follow the same patterns because that is the way that things are done”. In particular, the following aspects of field courses are identified as requiring close attention: the educational purpose, level of specialisation, modes of field teaching, influence of class size, learning activities, student progression, assessment methods, gender issues and the role of virtual reality.
Both Gold et al. (1991) and Kent et al. (1997) advocate an evidence-led approach informed by pedagogic research and stress the importance of evaluating the effect of changes to fieldwork on students. The articles also acknowledged that the learning activities associated with fieldwork could be extended beyond the period allocated to the field course itself. For instance, it was found to be beneficial to prepare students for fieldwork by running briefing sessions prior to the field course and to organise debriefing and reflection activities post-fieldwork. Thus fieldwork can be supported by and used alongside existing teaching methods where appropriate.

More recently, studies have revealed that fieldwork can have a considerable influence on student learning through its effect on the 'affective domain' (Boyle et al. 2007) (see Case Study 1). The affective domain deals with emotions, feelings and values; they lead to perceptions of learning tasks that can have a profound influence on a student’s motivation and performance. Another emerging influence on fieldwork design is the potential for field-based studies to be supported and enhanced (but not replaced) through the use of information technology. In particular, taking portable computers and mobile devices into the field creates opportunities for pedagogical innovation which cannot be achieved by traditional means. Field-based IT can revolutionise the recording of data and observations and be extended to help students understand troublesome concepts needed to explain some field phenomena.

A recurrent theme in the literature has been that in order to justify fieldwork, practitioners need to make the best use of it that they can. This principle applies irrespective of whether staff regard fieldwork as a central and intrinsic element of their students’ education, or as simply one of a set of teaching and learning tools to ‘deploy’ across a programme. In both contexts, fieldwork should be regarded as a form of learning which exploits the unique characteristics of the field environment to improve the student learning experience. This guide attempts to identify the ‘unique characteristics of the field environment’ and by implication the unique characteristics of the field experience. As already mentioned, this task would be made easier if more research evidence was available. However, in drawing together what currently exists, we hope to be able to provide an informative and useful document.
Case study 1

Fieldwork is good?
The student experience of field courses

**Originators:** Alan Boyle, University of Liverpool and co-workers from eight UK universities

This study was commissioned by the Higher Education Academy Subject Centre in Geography, Earth and Environmental Sciences to examine students’ views of fieldwork. The research had two main aims; firstly to examine the changes in student attitudes to learning that occurred as a result of attending field courses; secondly to assess the changes in how students value the fieldwork experience. One of the strengths of this study was its coverage – a total of 365 students were involved from Geography, Earth and Environmental Science departments across seven UK higher education institutions. Each student was asked to complete two questionnaires – one before and one after a residential field course - which focused on their attitudes, perceptions and feelings towards the experience.

Students demonstrated very positive affective responses to residential fieldwork and these feelings were strengthened during the field experience. The field experience tended to foster high levels of confidence, both in students’ ability to meet the challenges of fieldwork, and in beliefs that fieldwork is an academically valuable learning method. Unsurprisingly, given all this, the results also confirmed that students enjoyed fieldwork. In addition to enhancing subject knowledge and understanding, the field courses under study were found to be highly effective in achieving academic and social integration. Uniquely, this study also identified the important role that a residential field course can play in the student induction process, particularly in relation to meeting new people and forming new friendships, meeting staff and undertaking group work. The authors’ conclusion? - fieldwork is good.

**References:** Boyle et al. (2003), Boyle et al. (2007)
2. Influences on fieldwork design

2.1 Educational theory and research

2.1.1 The field as a learning environment

Is fieldwork effective?
Many practitioners may consider this question rhetorical. However, learning does not ‘happen’ just because we take students into the field – nor is the learning that does take place necessarily effective (Lonergan & Andresen, 1988). So what is necessary for effective learning in the field? According to the existing literature (Cottingham et al., 2002; Hall et al., 2004), it depends on a ‘complex interaction’ between:

- Appropriateness of the learning objectives;
- Design of the teaching and learning experience;
- Methods of assessment;
- Full inclusion of students based on recognition of their needs.

A useful model is that developed by Beetham (2004) to inform the design of e-learning activities (JISC, 2004). Applying this to fieldwork indicates that the design of fieldwork activities is influenced by the interaction of the three main factors of the learners, the field environment and the intended outcomes (Fig. 2.1).

![Figure 2.1 A design model for learning activities for fieldwork (adapted from Beetham, 2004)](image-url)
Despite the lack of clarity surrounding the effectiveness of fieldwork, common themes have recently started to emerge which appear to support the inclusion of fieldwork in the curriculum (Fuller et al. 2006):

- Fieldwork provides an ‘unparalleled opportunity’ to study the real world;
- Student perceptions of fieldwork tend to be overwhelmingly positive;
- Fieldwork provides the opportunity to reinforce classroom-based learning;
- It increases students’ knowledge, skills, and subject understanding.

Fieldwork has also been shown to aid the development of attributes such as interest, attitudes, motivation, and self-confidence (Hendrix & Suttner, 1978; Thompson, 1982; Kern & Carpenter, 1984, 1986; Boyle et al. 2007).

Case study 2

Was fieldwork conspicuous by its absence?
– the effect of Foot and Mouth disease in 2001

Originators: Ian Fuller¹, University of Northumbria; Steve Gaskin², University of Plymouth; Ian Scott³, City University, London, UK.

During 2001 in the UK, fieldwork was withdrawn from many degree programmes as an outbreak of Foot and Mouth disease in livestock led to restrictions on access to the countryside. In a number of university departments across the country field programmes were cancelled and in many cases replaced with alternative class-based exercises. This provided a chance to evaluate the extent to which fieldwork gives opportunities for learning which cannot be duplicated in the classroom. A research team approached five UK universities to ask students “How do you perceive fieldwork cancellation to have affected your learning?” and to ask staff “In the light of its cancellation, how do you regard fieldwork as a pedagogic device?” The universities selected had provided a variety of field courses in the geography and environmental science subject areas and had adopted a variety of replacement learning activities.

The study demonstrated that student perception of fieldwork was overwhelmingly positive. The most important benefits were regarded as the experience of geographical reality, developing subject knowledge, acquiring technical, transferable and holistic skills and working with peers. Lecturers perceived that fieldwork provided a number of direct benefits to student learning in the subject areas studied. Lecturers used fieldwork as a means to help students understand theory, to inject reality into their teaching and to
teach subject-specific skills. Thus a broad agreement emerged between lecturers and students on the importance and function of fieldwork in geography and environmental science. However, there was a difference in emphasis, with lecturers placing more stress on the relationship of fieldwork to theory, whilst students focus more on fieldwork as a means of experiencing reality and developing transferable skills. However, in the minds of both, a loss of field programmes from the curriculum removed learning opportunities that could not be replaced effectively.

References: Fuller et al. (2003), Scott et al. (2006)

Present Addresses: ¹Massey University, New Zealand; ²University of Exeter, UK; ³University of Worcester, UK

Court Barton Farm, Venny Tedburn, near Crediton in Devon, suspected of being the first organic farm to be hit by foot and mouth disease. (Image: Tim Cuff/Apex)
Learning domains

Table 2.1 summarises the hierarchies of skills associated with the three main learning categories, or ‘domains’. A useful introduction to learning domains, together with further explanation of the associated skills, can be found at http://www.businessballs.com/bloomstaxonomyoflearningdomains.htm. Student learning, and learning outcomes in particular, are typically defined in terms of the acquisition or development of cognitive or ‘thinking’ skills (i.e. learning in the ‘cognitive domain’), not least because the majority of established techniques for evaluating or assessing learning focus on what the student knows as opposed to what they do.

Table 2.1 The three principal learning domains (from ¹Bloom, 1956; ²Dave, 1975; ³Kratwohl et al., 1964)

<table>
<thead>
<tr>
<th>Cognitive¹ (Knowledge)</th>
<th>Psychomotor² (Physical skills)</th>
<th>Affective³ (Attitude &amp; emotion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluate</td>
<td>Naturalise</td>
<td>Characterise</td>
</tr>
<tr>
<td>Synthesis</td>
<td>Articulate</td>
<td>Organise</td>
</tr>
<tr>
<td>Analyse</td>
<td>Be precise</td>
<td>Value</td>
</tr>
<tr>
<td>Apply</td>
<td>Manipulate</td>
<td>Respond</td>
</tr>
<tr>
<td>Recall</td>
<td>Imitate</td>
<td>Receive</td>
</tr>
</tbody>
</table>

However, learning is not just a cognitive process, and becoming a natural or environmental scientist also requires the development of practical or psychomotor skills such as taking a compass bearing, collecting a soil sample, or determining the pH of stream water– skills which may also be assessed as part of the learning outcomes for a particular fieldtrip.

The third type of learning – the ‘affective domain’ – deals with students’ attitudes, emotions, and values. Learning in the affective domain is rarely considered as a learning outcome, and yet research seems to suggest that the outcomes from fieldwork are frequently affective as well as cognitive or psychomotor (e.g. Kern & Carpenter, 1984, 1986; Nundy, 1999; Boyle et al., 2007). Affective outcomes are valuable in themselves, e.g. the development of attitudes and behaviours appropriate to professional practice, and can also influence outcomes in the cognitive domain (Ashby et al., 1999; Isen, 2000).

2.1.2 Key research in field-based learning

Early investigations into the impact of fieldwork on learning focused on memory and the ability to recall information. Mackenzie & White (1982) looked at the impact of different types of fieldwork (active fieldwork, passive fieldwork and no fieldwork) on the ability of school children to retain and recall information learnt in the field environment. Their findings suggest that active participation in fieldwork helped the children to form ‘easily recalled episodes’ which then influenced their ability to remember what they had learned, i.e. it can help with the development of basic cognitive skills. These findings are supported by Killerman (1996), who reports a significantly enhanced level of plant identification skills in children whom had been taken into the field compared with those taught in the classroom. Kern & Carpenter (1984, 1986) took a different approach and looked at how students’ values and attitudes (i.e. their affective responses) appear to influence the development of their thinking or cognitive skills (see Case Study 3).
Case study 3

A “thumbs-up” for fieldwork? - A pioneering experiment to assess its value in Earth science teaching

Originators: Ernest L Kern, Southeast Missouri State University and John R. Carpenter, University of South Carolina, USA

Kern and Carpenter are credited with undertaking the landmark study to objectively measure the benefits of field activities in undergraduate teaching. Kern was responsible for ‘Earth Science Lab’ – an introductory laboratory course in the geosciences. He identified a “low motivational climate” on the course and thought it may be related to the exclusively classroom-contained delivery. As one student put it “Since this is Earth science, how come we aren’t out there?” An alternative field-orientated approach was designed so that approximately 70% of its activities were conducted outside the laboratory as direct, on-site, field experiences.

In their 1984 study, Kern and Carpenter found that students who learned in the field were more motivated, had more positive attitudes, and placed more value in their work than those that learned in the classroom. This was followed up with a second study in 1986 which found that the students learning through fieldwork performed better in tests which required them to apply more sophisticated (higher-order) cognitive skills, e.g. analysis and evaluation. From this they ‘strongly suggest’ (but admit they cannot prove) that improvements in students’ motivation and attitude can exert a positive influence on their ability to learn (in terms of developing cognitive skills). This study is generally regarded as convincing evidence of the value of fieldwork in Earth science education.

The findings of Nundy’s (1999) study of primary school children undertaking residential fieldwork support those of both Kern & Carpenter (i.e. that the emotional responses of the children to fieldwork influenced their learning outcomes in terms of cognitive skill), and Mackenzie and White (i.e. that fieldwork helps create ‘memorable episodes’ which form the basis for long-term learning). Nundy also suggests that both the emotional (affective) responses and the cognitive development seem to be important aspects of the learning process, rather than just outcomes. Interestingly, Nundy identified that the types of events that the children were most likely to remember were those involving an element of ‘fun’, i.e. events that were enjoyable and made them feel good. However, it is worth noting that a poorly planned and ineptly conducted fieldtrip may be just as memorable as a well planned and enjoyable trip, but is likely remembered more for its boredom rather than its memorable learning experiences! (Lonergan & Andresen, 1988).

More recently, Boyle et al. (2007) showed that students’ affective responses (feelings, attitudes, motivation etc.) improve as a result of participating in fieldwork, whilst Elkins and Elkins (2007) demonstrated increased conceptual gain in students learning entirely in the field against those learning in more passive environments. These studies all support the widely held notion that fieldwork helps students to improve their learning by developing their thinking or cognitive skills, and that aspects of the field experience relating to enjoyment and motivation, i.e. to learning in the affective domain, are an important part of that learning process.

2.1.3 Fieldwork and the affective domain

“the common person does not deal with knowledge alone because knowledge, feelings and emotions are, in reality, inseparable” (Iozzi, 1989).

The model of learning developed by American psychologists Eiss & Harbeck (1969) (Fig. 2.2) proposes that, rather than being simply a cognitive, affective or psychomotor process, learning involves a degree of interaction between the three different domains. Stoddart (1986) recognises the potential for fieldwork in encouraging these interactions, stating that “the acquisition of ‘real’ [geographical] knowledge takes place in the field as a result of an interaction of physical, mental and emotional experiences”.

According to this model, learning is initiated through some kind of sensory input (e.g. seeing, hearing, touching) which then interacts with the cognitive, affective and psychomotor domains. The output is ‘overt behaviour’ whereby the student ‘does something’ to indicate whether or not learning has taken place, e.g. nods their head to indicate understanding, takes a measurement, or writes a report. What the model makes clear, however, is that as well as being an integral component of learning, the affective domain is also the ‘gateway’ or the ‘key’ to the overall learning process. So when a student is presented with a learning task, they have to ‘want’ to learn in order for the cognitive and psychomotor domains to become engaged. The nature of the link between the cognitive and affective domains is poorly understood, particularly with regard to fieldwork, but it seems that paying greater attention to learning in the affective domain might result in increased levels of success in the cognitive domain (Iozzi, 1989).
Despite the recognition by Eiss & Harbeck almost 40 years ago that the affective domain seemed to play a greater part in the learning process than most educators were willing to admit, science education has continued to focus on cognitive development – not least because the outcomes are more easily observed and controlled than those based in emotion (Novak, 1979). However, there is now growing interest in the role played by the affective domain in student learning, particularly in the geosciences (see http://serc.carleton.edu/NAGTWorkshops/affective/index.html). Thompson (1982) identified the development of ‘interests and attitudes’ as one of the key purposes of geological fieldwork, while Kern & Carpenter (1984) and Boyle et al. (2007) have demonstrated the potential for fieldwork to generate positive affective responses in students. The affective domain also plays an important role in environmental education where programmes need to be effective in exploring environmental attitudes and values (Iozzi, 1989; Pooley & O’Connor, 2000).

It is still not understood exactly how fieldwork generates affective responses, but it is thought to result – at least in part – from the students’ ability to physically interact with their environment (Millar & Millar, 1996). This notion of ‘direct experience’ is consistent with the findings of Orion (1993), who suggests that it is the interaction between the student and their environment that enables students to actively construct knowledge, rather than passively absorb information from staff. Orion et al. (1997) also found that students who participated in active outdoor learning developed more positive perceptions about their learning environment than those that were learning more passively.

2.1.4 Deep versus surface learning

One of the ways in which the affective domain can impact upon cognitive outcomes is by influencing whether a student adopts a ‘deep’ or a ‘surface’ approach to learning (Table 2.2). Deep learning is typically characterised by the acquisition of higher order cognitive skills such as analysis, interpretation and evaluation, and is more likely to be achieved through programmes which actively consider the way that students are taught as well as the way that they learn (Hill & Woodland, 2002). Surface learning, on the other hand, is characterised by memorisation of facts, and superficial retention of material with little or no intention to understand.
Students can apparently switch between deep and surface approaches with relative ease, and the learning environment plays a crucial role in determining which approach the student adopts (Higgitt, 1996). Fieldwork encourages a deep approach by providing an environment in which students are able to ‘connect’ aspects of their learning to reality (see Case Study 4). This enables them to generate understanding through the integration of facts and concepts, rather than by simply recalling individual items of information (Ramsden, 1988). It should not be assumed, however, that just because fieldwork facilitates deep learning it will always result in cognitive gain for the student. In fact, some

Case study 4

Chemical equations in the field

**Originator:** John Maskall, University of Plymouth, UK

A field exercise is described which aims to enhance students’ understanding of the chemical reactions of acid mine drainage. Field study of this particular phenomenon is aided by its extreme chemistry (e.g. low pH) and the presence of an orange precipitate of ochre. These features circumvent the common difficulties presented by outdoor study of biogeochemical processes i.e. that they have no strong visual presence and that low analyte concentrations can be problematic to detect using portable instrumentation.

Prior to the field trip, the products, reactants and symbols comprising key chemical reactions are reproduced individually on a series of laminated A4 sheets. The illustrated example is the formation of iron (III) hydroxide (ochre) from the reaction of ferrous ions with water and atmospheric oxygen i.e.

\[ 4\text{Fe}^{2+} + \text{O}_2 + 10\text{H}_2\text{O} \rightarrow 4\text{Fe(OH)}_3 + 8\text{H}^+ \]

In this case, five student volunteers are asked to place the chemical species in the correct order and present the completed equation to the rest of the group. Questions are then posed to each individual student to draw out knowledge which is linked to the visual evidence at the field site. For instance “What chemical are you?”, “Are you a solid, liquid or a gas?” and “What happens when you react with Helen?”

Student feedback was almost entirely positive with the exercise being perceived as an
students may acquire no more knowledge in the field that they do in other environments (e.g. Hoffman & Fetter, 1975; Koran & Baker, 1979).

Fieldwork also impacts on the affective domain, and thus promotes deep learning, by raising levels of motivation and increasing students’ belief in their own abilities (‘self-efficacy’) (Boyle et al., 2007). In general, deep learning is associated with interest and relaxed self-confidence, and surface learning with anxiety and fear of failure (Entwistle, 1991; Entwistle & Smith, 2002).

effective means to illustrate and explain chemical processes that encourages active participation, retention of material and is enjoyable. However, the presenting students need to be genuine volunteers who are willing to be asked searching questions in front of their peers. Feedback also referred to the benefits of being able to relate theory to practice in the field environment.
### Table 2.2 Key characteristics of deep and surface approaches to learning (Higgitt, 1996, adapted from Ramsden, 1988).

<table>
<thead>
<tr>
<th>DEEP APPROACH: intention to understand</th>
<th>SURFACE APPROACH: intention to complete task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus on what is signified (i.e. argument in a text)</td>
<td>Focus on signs (i.e. text)</td>
</tr>
<tr>
<td>Relate and distinguish new ideas and previous knowledge</td>
<td>Focus on discrete elements</td>
</tr>
<tr>
<td>Relate concepts to everyday experience</td>
<td>Unreflectively associate concepts and facts</td>
</tr>
<tr>
<td>Relate and distinguish argument and fact</td>
<td>Fail to distinguish principles from evidence, new information from old</td>
</tr>
<tr>
<td>Organise structure and content</td>
<td>Memorise information and procedures for assessment; treat task as an external imposition</td>
</tr>
<tr>
<td>Internal emphasis: a window through which aspects of reality become visible, and more intelligible</td>
<td>External emphasis: demands of assessment, knowledge cut off from everyday experience</td>
</tr>
</tbody>
</table>

### 2.1.5 Experiential learning theory

Fieldwork is a classic example of experiential learning, or ‘learning by doing’. Perhaps the best known theory of experiential learning, and indeed learning in general, is that of Kolb (1984), which posits that learning proceeds via a four-stage cyclical model in which experience is transformed into knowledge through a process of concrete experience, reflection, generation of new ideas, and subsequent testing. Closely linked to the learning cycle is the idea that students have preferred ways, or ‘styles’ of learning, e.g. they may prefer to deal with abstract concepts, or be inclined towards practical activities. Although empirical evidence for the effectiveness of Kolb’s cycle in learning is somewhat limited, it can provide a ‘theoretical rationale’ for fieldwork and a useful basis for wider curriculum development (Healey and Jenkins, 2000).

### 2.1.6 Novelty space

When students are confronted with the complexity of a ‘real’ field environment they can easily become overwhelmed. The combination of an unfamiliar environment, the requirement to achieve academic goals, and general uncertainty as to what awaits them, can create a metaphorical ‘barrier’ which inhibits their ability to engage with their learning tasks. This ‘novelty factor’ of fieldwork was first described by Falk et al. (1978) who found that barriers to learning could be reduced through preparatory exercises which familiarised students with key aspects of the fieldwork. This enabled students to engage with their learning tasks more quickly and hence use their time in the field more efficiently. Orion (1993) and Orion & Hofstein (1994) subsequently expanded the idea of ‘novelty factor’ to ‘novelty space’, a conceptual barrier to learning defined by three key factors (Fig 2.3):

- Cognitive factors – how familiar are the students with the basic concepts and skills that are relevant to the field trip? Do they know on what they are to be assessed?
- Psychological factors – do the students know what to expect from the experience overall? Have they previous experience of working or learning outside?
- Geographical factors – how familiar are the students with the field location and the physical environment?
Fieldwork is a social activity where learning can be a shared experience (Image: Stephen Cotterell, University of Plymouth)

By addressing each of these factors, effective preparation helps to reduce novelty space and increase student engagement, which in turn can lead to improved student performance (in terms of both attitude and achievement) (Orion, 1993; Orion & Hofstein, 1994) and increased motivation (Koran & Baker, 1979). Approaches to pre-fieldwork preparation are covered in Section 3.5.

2.1.7 Social learning

Fieldwork is a social activity, enabling interaction between students (and staff) and a sharing of experiences that is not present in other, more passive, learning environments. This is particularly true of residential fieldwork where students are required to become fully immersed in ‘living’, as opposed to simply ‘doing’, their discipline. Such interaction facilitates the construction of knowledge and meaning, and helps to develop problem solving ability and task performance (Vygotsky, 1978; Bandura, 1986). In addition, through shared experiences with both peers and ‘experts’, students can acquire the behaviours and beliefs characteristic of their discipline (Lave and Wenger, 1991; Wenger, 1998). To date, the social context of fieldwork and its impact on student learning has received relatively little attention from researchers. A notable exception is the study by Elkins and Elkins (2007) in which they suggest that ‘social novelty’ can significantly influence students’ motivation to learn, and may hence form a fourth dimension of novelty space. Another useful study is that of Langan et al. (2008), who provide interesting insights into the development and dynamics of ‘learning networks’ during residential fieldwork.

Fieldwork is a social activity where learning can be a shared experience (Image: Stephen Cotterell, University of Plymouth)
2.2 Professional and curriculum requirements

2.2.1 Curriculum requirements
According to the revised Benchmarking Panel for Earth sciences, environmental sciences and environmental studies (QAA, 2007a) "it is impossible for students to develop a satisfactory understanding of ES3 without a significant exposure to field-based learning and teaching, and the related assessment". The QAA does not go as far as recommending a minimum number of days of taught fieldwork for the relevant discipline areas.

The situation for biosciences is less clear cut due to the wide range of discipline areas within its remit, only some of which are strongly field-based. The benchmark statement refers to fieldwork in the context of practical skills development and states that "Bioscience degree programme students should be able to obtain, record, collate and analyse data using appropriate techniques in the field and/or laboratory, working individually or in groups, as is most appropriate for the discipline under study" (QAA, 2007b). In her review of fieldwork in biology in higher education, Smith (2004) argues that the QAA statements should make it absolutely clear that fieldwork must be an integral part of every biological science course.

2.2.2 Professional accreditation
As more focus in higher education is placed on the employability agenda, having a programme accredited by a professional body signals to potential students and employers that the teaching, learning and research is aligned to high quality professional development. Various professional bodies offer accreditation in the ES3 area including:

- The Chartered Institute of Environmental Health
- The Chartered Institute of Water and Environmental Management
- Institute of Ecology and Environmental Management
- Institute of Environmental Management and Assessment
- Institution of Environmental Sciences
- Institute of Materials, Mining and Metallurgy
- Institute of Professional Soil Scientists
- The Geological Society, London
- The Royal Meteorological Society

(QAA, 2007a)

At the time of writing, the Geological Society of London is the only professional body facing the environmental and natural sciences discipline group that has specific expectations of fieldwork provision for the degree programmes they accredit. The Geological Society has currently updated its accreditation requirements, and now expects an accredited BSc geology degree to include at least 60 field days over the course of a three year programme (http://www.geolsoc.org.uk/gsl/education/highered/page3253.html).

There is a joint accreditation scheme run by the Institution of Environmental Sciences (IES) and the Committee for the Heads of Environmental Sciences (CHES) that relates to honours degrees in the environmental sciences. While there are no formal designated levels of activity, IES/CHES asks that "Particular reference should be made to the development of practical, field and laboratory-based activities".
2.3 Fieldwork safety

2.3.1 Introduction
Fieldwork often occurs in potentially hazardous locations including rivers, woodlands, coastal/tidal areas, moorland, mountains, urban and industrial areas. Risks to the health and well being of staff and students may derive from a variety of hazards including rough or inhospitable terrain, extremes of climate, disease or environmental contamination. The degree of risk will be influenced by a range of other factors including the nature of the field activities and the extent to which students are supervised. For the purposes of this section of the guide we focus on teaching in outdoor locations, but do not include any underground, submarine or aerial situations. These settings have their own health and safety issues and lie outside the scope of this guide - for more information see the Health and Safety Executive website at: http://www.hse.gov.uk

The most important aspect of fieldwork is the health and safety of its participants. The establishment of a ‘safety culture’ is underlain by the principle that all participants have a duty of care to themselves and others. However, the mechanics of how fieldwork risks are managed can vary considerably between higher education institutions and between academic departments and schools. Recent initiatives from various organisations including the British Standards Institute have sought to engender a more co-ordinated approach to field safety and training.

2.3.2 Written guidance
Field safety guidance relevant to the environmental and natural sciences subject areas is available at national, institutional and departmental levels. Key sources of information produced at a national level are listed below:

- Association of University & College Lecturers (1996) Guidelines and Code of Practice for Fieldwork, Outdoor and Other Off-Campus Activities as Part of an Academic Course. Southsea: AUCL.
These guidelines provide recommendations for the establishment of procedural systems designed to ensure the safe execution of fieldwork. An evaluation of this guidance undertaken by Couper & Stott (2006) concluded that whilst such systems are essential, a ‘check-list’ approach to complying with them would not necessarily ensure safe, effective leadership of fieldwork. They point out that such guidelines are often limited in their consideration of what actually happens in the field, emphasising pre-field visit procedures and the establishment of precautionary incident procedures, and post-visit review. Couper & Stott (2006) suggest that competent leadership whilst in the field, and the on-going decision making involved in this is the most important safety factor of all and that this should be reflected in the approach to field safety training (see section 2.3.4).

2.3.3 British Standard 8848
A recent addition to the guidance literature has been the following document from the British Standards Institute:

British Standards (2007) Specification for the provision of adventurous activities, expeditions, visits and fieldwork outside the United Kingdom. BS 8848. BSi.

The standard has been developed for adventurous activities abroad with the aim of reducing the risk of injury or illness. BS8848 specifies requirements that have to be met by an organiser of adventurous trips conforming to good practice. It is aimed at a range of organisers of overseas activities including university and academic fieldwork, gap year experiences, adventure holidays, charity challenges and research expeditions. This document is comprehensive in scope, deals with fieldwork safety in considerable detail and has addressed to some extent the limitations of previous guidance.
The main guiding principles of BS8848 are as follows (modified from Butler 2008):

- A single entity is accountable for the entire field class. This includes elements generally provided by secondary suppliers, such as transport and accommodation.
- A complete Risk Analysis and Management System needs to be in place, in the terms and language defined by BS8848, that fully documents the hazards and support structures, strategies for incidents and contingency plans.
- Participants must give ‘informed consent’ – so must have full information about the risks to which they will be exposed – before they are committed to participating. They need to know the limitations of duties of care by venture providers.
- Participants must agree to particular standards of behaviour.
- Effective operational management requires full documentation of staff expertise to deliver the activity to the standard identified in the Risk Analysis and Management System – and this information needs to be available to participants for their informed consent to the activity.

A consultation process for BS8848 was completed in April 2008, at which time the draft of the amended standard went out to public review until September 2008. At the time of writing, the outcomes of the public review have not been released. However, BS8848 has received a mixed response from the higher education community. For instance, the Committee of Heads of University Geosciences Departments (CHUGD) and the Geological Society of London have not endorsed the draft document as they are unhappy that educational fieldwork is being trailed as a ‘venturous activity’. They argue that risks must be and are managed so that fieldwork is not ‘venturous’ and also that there is no intrinsic difference between field training carried out in the UK or overseas. However, the document continues to be used to inform discussions about fieldwork activity for higher education in the UK.

It is clear that higher education institutions should consider BS8848 carefully prior to deciding to what extent to incorporate its suggestions into university or departmental safety policy. Staff may regard certain proposals as more appropriate to academic fieldwork and others as more appropriate for the other activities that the document aims to encompass, namely gap year experiences, adventure holidays and charity challenges. Further details on BS8848 are summarised in a resource briefing prepared by Winsor and France (2008) for the GEES Subject Centre and are available at http://www.gees.ac.uk/pubs/other/BS8848BriefFeb2608.doc
2.3.4 Staff training
Couper & Stott (2006) argue that an improvement in field safety in higher education could be achieved if staff training was more informed by the expertise of the Outdoor community i.e. mountaineering and outdoor pursuits leaders. They identify that the Outdoor community has considerable expertise in leading groups of all ages and [dis]abilities in field environments, with participant safety and risk management (rather than simply risk assessment) to the fore. The emphasis is on a continuous process of risk management and leadership, from pre-visit risk assessment and establishment of necessary protocols, through effective group leadership incorporating continuous assessment of, and adaptation to risk, through to post field visit review. In reviewing of the outdoor leadership literature (e.g. Ogilvie, 1993; Langmuir, 1995; Graham, 1997; Long, 2003), Couper & Stott (2006) conclude that it considers not just safety procedures and the necessary technical skills, but also the ‘soft skills’ of group leadership.

A ‘framework for staff development’ outlined by Couper & Stott (2006) consists of:
(i) A statement of the desirable competencies, which field leaders should endeavour to develop;
(ii) A statement of the mechanisms by which such competencies may be recognised.

The proposed framework (Tables 2.3a-e and Table 2.4) integrates pedagogy and fieldwork safety as the educational purpose of fieldwork is considered central to the management of any visit and provides the justification for undertaking the activity. Tables 2.3a-e list the competencies suggested to be those that it is desirable for field leaders to endeavour to develop. The lists are not intended to be prescriptive, and could be used, for example, as an aid to self-reflection and the identification of development needs. Table 2.4 presents the four mechanisms recognised by the Health & Safety Executive for the demonstration of competence.
Field trip planning. Staff should:
• be clear about the pedagogical aims of, and reasons for, the field visit, ensuring they are appropriate to the student cohort
• ensure that the field visit is organised in accordance with the guidelines and requirements of the department or institution
• complete detailed preparations; plan the venue, negotiate access, obtain relevant weather and tide forecasts, arrange transport
• ensure the students involved are thoroughly briefed; students should understand the purpose of the activity, what to expect of the visit, and what is expected of them

Risk assessment prior to fieldwork. Staff should:
• understand the difference between generic risk assessment, event-specific risk assessment, and on-going risk assessment and management
• aim to promote a culture of risk awareness, risk assessment and risk management among students, involving students in risk assessment whenever possible
• be aware of hazards specific to the environment in which the visit is to take place
• be aware (as far as available evidence allows) of the most hazardous aspects of fieldwork

Table 2.3a Pre-fieldwork planning

Fieldwork should be a safe, enjoyable, educational experience for students. Staff should endeavour to:
• manage the group effectively by setting realistic targets, reviewing and revising them if necessary, performing ongoing risk assessments, and maintaining effective communication with students as appropriate to the form of fieldwork being undertaken
• develop a reflective, flexible approach to leadership
• develop effective group management and supervision skills
• have in place clear guidelines for remote working of students where appropriate

Table 2.3b On-site aspects of field leadership

The department and institution providing fieldwork opportunities should have established procedures for dealing with incidents. Staff involved in fieldwork should:
• be thoroughly conversant with these procedures in order to implement them in stressful circumstances if necessary
• ensure that students working remotely are conversant with relevant procedures
• hold a current first aid qualification

Table 2.3c Incident management

Post-event review should be an integral part of fieldwork, and should:
• include review of the pedagogical effectiveness of the activity
• include review of the management of the group and event in relation to both pedagogy and the safety of participants
• lead to enhancement of practice

Table 2.3d Post-fieldwork review

Throughout all elements of fieldwork, staff involved:
• should endeavour to develop an awareness of their own competence/limitations
• would benefit from familiarity with the legal responsibilities of field staff towards individual students and the group as a whole, including in ‘down-time’ on residential fieldwork
• should be mindful of the responsibilities of field staff towards each other, land/property owners and managers, the general public, the environment, and the HE community
• should be aware of current best practice in managing adult groups, particularly in ‘down-time’ on residential fieldwork

Table 2.3e General Issues

Table 2.3 Framework for Staff Development - desirable competencies for field leadership (Couper & Stott, 2006)
At present there is no national, fieldwork-related qualification tailored to a higher education context.

Equivalent qualifications, ideally nationally recognised (or equivalent overseas qualifications), may provide evidence of competence in some (perhaps all) of the areas listed above.

In-house training offered by institutions may provide evidence of competence in some (perhaps all) of the areas listed above.

Staff should be encouraged to maintain a reflective log of their fieldwork/field leadership experience, as evidence of competence developed through accumulated experience.

| i. Holding a national qualification       | At present there is no national, fieldwork-related qualification tailored to a higher education context. |
| ii. Holding an equivalent qualification  | Equivalent qualifications, ideally nationally recognised (or equivalent overseas qualifications), may provide evidence of competence in some (perhaps all) of the areas listed above. |
| iii. Undertaking suitable in-house training | In-house training offered by institutions may provide evidence of competence in some (perhaps all) of the areas listed above. |
| iv. Demonstrating competence developed through experience | Staff should be encouraged to maintain a reflective log of their fieldwork/field leadership experience, as evidence of competence developed through accumulated experience. |

Table 2.4 Framework for Staff Development - mechanisms by which such competencies may be demonstrated (Couper & Stott, 2006)

### 2.3.5 Student training

The issue of the extent to which students can be expected to take responsibility for their own safety during fieldwork is addressed comprehensively by Nash (2000) and Butler (2008). This is especially relevant to the geosciences where independent fieldwork tends to be more prevalent than in other disciplines, particularly in the case of a final year project. In such cases, institutions may consider providing training to students in hazard awareness, assessment and management. Winlow et al. (2007) give an insight into the issues raised by the provision of independent field-based placements in developing countries and the approaches used to manage these (see Case Study 5).

### 2.4 Site access and conservation

#### 2.4.1 Access

Recent legislation associated with increased countryside access has implications for planning and delivering fieldwork. Access rights to land for educational purposes in many open countryside areas in England and Wales are determined in the Countryside and Rights of Way (CRoW) Act 2000. This provides a right of access to mapped areas of mountain, moor, heath, down and registered common land. Starting in November 2001 the Countryside Agency (in England) and the Countryside Council for Wales undertook the process of producing maps showing the areas of land that qualify as either open country or registered common land. This process finished with the commencement of the right of access in the West and East of England on the 31st October 2005.
Case study 5

Supporting independent fieldwork in developing countries

Originators: Heather Winlow, David Simm and Simon Haslett, Bath Spa University, UK

The Geography Department at Bath Spa University runs a Foundation Degree in Development Geography which is designed to increase student employability within the field of development. A key aspect of this programme is a three month visit to a developing country where students undertake a work-related placement and their own small-scale research project. Providing opportunities for independent overseas fieldwork is relatively rare in the HE sector partly because it is seen as a high risk endeavour. Challenges encountered by students in their host country will include: adapting to an unfamiliar physical, cultural and social environment; designing and implementing meaningful field research; and having limited communications with family, friends and supervisory staff in the UK. There are also issues of personal liability, health and safety and ethics.

Staff at Bath Spa set up placements abroad in cooperation with a partner Projects Abroad who provide vital overseas support, a point of contact 24 hours a day and some supervision (although the main academic supervisor is based in the UK). Comprehensive pre-placement training is embedded in the degree programme and covers generic fieldwork and research skills as well as familiarisation with the destination country and the area of study. Useful information on communications in distant localities is compiled in the form of a checklist which is updated by students whilst on placement. This proforma provides structured guidelines to prompt students to make initial and continued contact with academic tutors at the home institution, ideally through the use of email or a Virtual Learning Environment. Staff also visit placement locations, every few years, to ensure academic compatibility and effective in-country support systems.

Reference: Winlow et al. (2007)
Under the CRoW Act, access rights may at times be restricted although existing public rights of way are unaffected. The Act sets out some general restrictions on certain activities within open countryside. Such activities such as lighting fires, driving a vehicle and camping are not permitted. In addition, specific restrictions also cover the removal or destruction of plants, shrubs and trees and use of vessels in non-tidal waters. However, as in the past, a landowner may give permission for any of these activities on their land, and may also withdraw that permission without notice. The full text of The Countryside and Rights of Way Act 2000 can be found on the web-site of The Office of Public Sector Information. http://www.opsi.gov.uk/acts/acts2000/00037--t.htm#sch2

The CRoW Act does not cover the coastlines of England and Wales. However, in September 2007, the UK Government announced it planned to legislate to give Natural England new powers to improve access around the whole English coastline. These powers are included in the draft Marine Bill, which was published for scrutiny on in April 2008. Natural England has published its own proposals for coastal access which can be found at the following website: http://www.naturalengland.org.uk/leisure/access/coastal/

In Scotland the situation is different from that in England and Wales. The Land Reform (Scotland) Act 2003 establishes a statutory right of responsible access to almost all land and water and came into effect on 9th February 2005. The Act provides for widespread public access rights for the purposes of recreation and education. However, locations need to remain undamaged which implies that sample collection or hammering of rocks is unacceptable. A full description of the access rights and responsibilities are explained in the Scottish Outdoor Access Code which can be found on the following website: http://www.outdooraccess-scotland.com/

The best source of information on access to the countryside is available from the following organisations who regularly update their material:

- Ramblers Association
  http://www.ramblers.org.uk/
- British Mountaineering Council
  http://www.thebmc.co.uk/

2.4.2 Conservation

By definition, protected areas within the UK feature many natural phenomena of scientific interest, aesthetic beauty and conservation importance. It is unsurprising therefore that such locations can become popular destinations for field visits from higher education institutions. Under these circumstances, the intrinsic value of these areas, over and above their utility as an educational resource, should be borne in mind. It is critical that fieldwork practice is in accordance with the protection afforded to these sites so that they are preserved for the benefit of future generations (of the general
public as well as science students!). In the UK, there are a number of designations applied to areas of land and water which determine the level of protection. Some of these are listed below:

- National Nature Reserves
- Local Nature Reserves
- Sites of Special Scientific Interest
- National Parks
- Areas of Outstanding Natural Beauty
- Special Areas of Conservation
- Heritage Coasts
- Regionally Important Geological/Geomorphological Sites

More information on these designations can be obtained from Natural England at the following website:
http://www.naturalengland.org.uk/default.htm

It is the responsibility of the fieldwork organisers to identify the designation of the field location and the implications that this has for the planned fieldwork activities. For instance, the purpose of SSSIs is defined as follows:

“to safeguard, for present and future generations, the diversity and geographic range of habitats, species, and geological and physiographical features, including the full range of natural and semi natural ecosystems and of important geological and physiographical phenomena throughout England.”

(DEFRA, 2003)

Field activities that conflict with this definition of an SSSI include removal of material from the location (including specimens of rocks, minerals, soil, fauna and flora) or damaging or harming the environment in other ways. More subtle perturbations may be wrought through conducting field experiments involving introduction of exotic species or modification of soil nutrient levels. Further information on the designation of protected areas is available from the following organisations:

- Joint Nature Conservation Committee
  http://www.jncc.gov.uk/
- Scottish National Heritage
  http://www.snh.org.uk/
- Countryside Council for Wales
  http://www.ccw.gov.uk/
- Environment and Heritage Service of Northern Ireland
  http://www.ehsni.gov.uk/

Have you checked that your location is not an SSSI?
2.5 Equal opportunities

2.5.1 Introduction
In these days of widening participation we are seeing a much more diverse range of students undertaking fieldwork. This means that issues concerning ‘equal opportunities’ which might in the past have received a cursory nod now have to considered far more carefully, particularly in relation to designing and running fieldwork. The term ‘equal opportunities’ may typically call to mind issues such as gender, race and physical ability, but in terms of fieldwork this can extend to include domestic arrangements, sexuality, finance, and degree of physical fitness. These factors can have significant impact on the personal situation of a student which in the context of some fieldtrips may lead to feelings of isolation and exclusion.

There are numerous discussions in the literature relating to gender issues, particularly the female experience of fieldwork and the field as a ‘masculine domain’ (see references below) dominated by intense physical activity and sometimes excessive drinking. While many of these studies imply that women have more varied experiences of fieldwork than males, Boyle et al. (2007) identify no significant differences with respect to gender – a factor which they suggest might be an artefact of the current ‘ladette’ culture and increased acceptance of social drinking amongst females. We also need to be mindful of the way in which fieldwork is visually portrayed. In a survey of 45 HEI prospectuses containing images of fieldwork Hall et al. (2004) found that a recurrent theme was to show predominantly young, white, able-bodied males ‘conquering’ a difficult terrain. In this time of widening participation just how representative, or inclusive, are such images?

Publications addressing some of these issues which might be of further interest include:

- **Fitness/physical ability** – Maguire (1998), Nairn (1999), Hall et al. (2004)
- **Age** – Maguire (1998), Nairn (1999)

2.5.2 Fieldwork and disabled students
Hall et al. (2004) present an extended discussion on issues of inclusion and equal opportunities in relation to fieldwork. In the US it is required by federal law that all courses (including fieldwork) must be accessible to all students (Cooke et al., 1997). In the UK, the QAA benchmark statements cite fieldwork as a ‘requirement’ for learning in earth and environmental sciences (QAA, 2007a). However, it is unclear how a student could successfully complete a geology or environmental science degree without undertaking a component of fieldwork. Further, it is an unfortunate fact that disabled students, and in particular those with impaired mobility, may tend to avoid courses with compulsory fieldwork because of real and perceived barriers to physical accessibility (Cooke et al., 1997; Hall et al., 2004). Healey et al. (2002) explore some of the ways in which these barriers to inclusion can be dismantled (see Section 3.9).

Participation by disabled students in higher education has been steadily increasing; From 2000/01 to 2004/05, figures show an increase from 4.1% to 5.8% of the total student population (HESA, 2006).
Quality assurance and legislative changes have raised awareness of the need to adopt inclusive practices in higher education, which provide equal opportunities for disabled students in courses. Many of the issues faced by disabled students in HE are magnified for those taking fieldwork and related activities. For field course organisers, it is important to be aware that there are many different types of disability. For instance, of the 22,500 undergraduates who in 1998/99 self-assessed themselves as having a disability, less than 5% were wheelchair users or had mobility difficulties (Healey et al., 2002). The most common category was unseen disabilities such as epilepsy, diabetes or asthma (39%) followed by dyslexia (26%). The net outcome of the legislative changes is that HEIs need to treat disabilities in a more structured manner, particularly in relation to the parity of the learning experience that disabled students receive (Healey et al., 2002).

2.5.3 Legislation and guidance
The main legislative instrument affecting provision for disabled students in higher education is the Special Educational Needs and Disability Act (SENDA) (2001) which came into force in stages between 2002 and 2005. SENDA (2001) amended Part 4 of the Disability Discrimination Act (DDA) to place specific duties on all educational institutions in the provision of education. The key elements of SENDA (2001) are as follows:

- The Act defines as disabled anyone who has “a physical or mental impairment which has a substantial and long-term adverse effect on his or her ability to carry out normal day-to-day activities”.
- The Act introduces the right for disabled students not to be discriminated against in education in relation to a range of student services.
- These services cover all aspects of teaching, learning and assessment, including fieldtrips.
- It is unlawful for institutions to treat a disabled person ‘less favourably’ than they treat, or would treat, non-disabled people for a reason that relates to the person’s disability.
- Part of not discriminating is making ‘adjustments’. If a disabled person is at a ‘substantial disadvantage’, the institution is required to take such steps as are reasonable* to prevent that disadvantage.
- The adjustments are intended to be anticipatory and apply to disabled students in general and not simply individuals.
- Reasonable adjustments are not, however, meant to affect academic standards.
- Deciding what is reasonable may take into account of cost, practicality, health and safety issues and the interests of other students on the course.

*Clark (2007) reported that at that time the word ‘reasonable’ was poorly defined and would remain so until the courts had established case law.
Further information on SENDA (2001) can be found in the following sources:


As a result of the EU Directive on Equal Treatment, the DDA was amended from September 2006. These changes provide for a broader definition of disability (to include the specific conditions of HIV, cancer and MS) and further strengthen the rights of disabled people in education. A full explanation of the implications of the DDA for higher education institutions can be found in the following documents:

- Disability Rights Commission (2007) Understanding the Disability Discrimination Act. A guide for colleges, universities and adult community learning providers in Great Britain. This document is available for download from the website of the Equality and Human Rights Commission at the following address:

The latter document gives specific advice on field trips as follows:

> "With careful planning and monitoring, most work placements, field trips and study periods abroad can be accessible to most disabled students”.

The other main influence on educational provision for disabled students in the UK is the Quality Assurance Agency’s Code of Practice on Students with Disabilities which came into force in September 2000. Precept 11 relates specifically to field trips and states:

> "Institutions should ensure that, wherever possible, disabled students have access to academic and vocational placements including field trips and study abroad”

QAA (1999)

The QAA will expect to see, in the self-evaluation document, a statement about how a higher education institution has addressed the intentions of the precepts, including any resulting changes to its practices and will discuss any areas of difficulty the institution has experienced (Czapiewski, 2002). The full version of the QAA Code of Practice for students with disabilities (October 1999) can be found on the QAA website at:


### 2.6 Resourcing fieldwork

#### 2.6.1 The issue of fieldwork costs

Fieldwork is widely accepted to be a relatively expensive form of teaching. Whilst this view is probably justified in many cases, there appears to be no published research of the comparative costs of fieldwork...
against other teaching approaches. As Smith (2004) points out, the costs involved in certain laboratory practical sessions involving specialist equipment and expensive reagents are also high. Moreover, the advent of ‘space charging’ in some UK universities may serve to highlight the full economic costs of teaching inside. The recommendation of Jenkins (1994) is still valid: that institutions should rigorously and systematically cost their fieldwork and related activities such as assessment which derive from it.

The cost issue was raised by Kent et al. (1997) who at the time of publication of their review, reported serious problems of the cost of fieldwork to both departments and students. This was attributed to the massive growth in student numbers that occurred in the 1990s. Universities responded by asking students to pay an increased proportion of fieldwork costs (McEwan, 1996) and in some cases to offer several courses with different levels of student contributions. This approach resulted in a two-tier system of student opportunity; those who had little money could at least obtain some form of field experience whilst students with more financial resources could go to more exotic locations. Kent et al. (1997) regarded this form of ‘choice’ as manifestly unfair whilst at the same time acknowledging that it provided some answers in terms of fieldwork planning under financial constraints.

In a recent article, Boyle et al. (2007) examine the concern that fieldwork is being, or will be, reduced within universities in the UK and elsewhere. Of the five reasons that are put forward as contributing to this, two are associated with cost. Firstly, it is reiterated that fieldwork is expensive because of the growth in student numbers in combination with declining unit funding. Secondly, the authors assess the impact on fieldwork of ‘top-up’ fees that were introduced in parts of UK higher education in the academic session 2006-07. It is pointed out that many UK universities have decided that students should pay nothing towards compulsory fieldwork, but are not necessarily willing to cover existing full costs. This places financial pressure on many existing field classes, despite more money being available from ‘top-up’ fees.

The longer term effects of ‘top-up’ fees is unclear. However, it is likely that the future of fieldwork will rely partly on the response of students (and in some cases their parents) to the projected levels of debt accumulated whilst studying for an undergraduate degree. In comparison, the additional costs associated with a field course may be regarded as relatively minor. On the other hand, for a hard pressed student relying on part-time employment, the true cost of a residential field course may be a combination of the university’s charge and a substantial potential loss in earnings due to the time commitment.

2.6.2 Managing fieldwork costs
Most of the effort in controlling fieldwork costs should be expended at a programme or departmental level through development and implementation of a fieldwork strategy. This should seek to optimise the field provision, ensuring that it is used to best effect, is fully aligned with the programme aims and integrated into the curriculum. Once a department is committed to running a particular course, there are some practical ways of keeping costs to a minimum.

The main costs of fieldwork derive from transport, accommodation, equipment and staffing. Staffing of field classes is generally more intensive than other forms of teaching, particularly lecturing. Maintenance of an appropriate staff:student ratio is usually essential for fieldwork safety and precludes cost cutting measures based on understaffing. Staffing strategies employed for teaching large classes include employing postgraduate students alongside academic staff, involving enthusiastic professionals
with knowledge of the field location and organising field sessions which involve students undertaking more self-guided and independent work (see Jenkins, 1994; Comber & Headley, 1998; Francis, 2000).

Transport and accommodation costs are cut if fieldwork can be undertaken locally. However, this approach has its disadvantages: for instance it may be harder to develop a student group’s cohesion on a non-residential local field trip (Jenkins, 1994). Transport and accommodation costs are relatively low in some developing countries (once you’ve got there). Planning as far ahead as possible gives field course leaders time to minimise the costs of transport and accommodation through ‘shopping around’, particularly if they are negotiating on behalf of a large student cohort.

Other approaches involve holding a joint field course with another higher education institution (Smith, 2004). This can also address the issue of low numbers of students enrolling for a fieldwork course which may threaten its viability. It has the advantage of staff being able to share resources, experiences and organisational roles, as well as making the cost of the trip less expensive for students. This strategy can be highly effective, although it requires pedagogic, logistical and financial co-ordination across two (or more) institutions. Extending the collaborative approach to overseas field courses can be achieved through forming partnerships with higher education institutions abroad. Walters (2003) gives an example of co-ordination across several European universities under the ERASMUS Intensive Programme (see Case study 6).
Case study 6

Providing European field courses at low cost

Originator: Graham Walters, London Metropolitan University, UK

Staff at London Metropolitan University (LMU) established links with two European universities through the ERASMUS Intensive Programme. Bilateral exchange programmes were set up with the Fachochschule, Eberswalde, Germany and subsequently with the University of Lleida, Spain. This arrangement provided financial support for a final year field course in Environmental Management, the location of which rotated annually between the UK, Germany and Spain. Each year the field course was hosted by staff at the home institution and accommodated students from all three universities. Two years in three therefore, a final year student had the opportunity to experience environments quite unlike those studied in the field in their own country. Moreover, in all years, students benefited from the perspectives of other European nationals on environmental issues and approaches to study. Repeat visits abroad gave opportunity for travelling staff to develop their own expertise in the overseas environments.

The European financial contribution made a considerable difference to the costs incurred by the student. LMU received £5900 as the ERASMUS contribution when the university hosted the programme in 2001, for 30 students and 6 staff. Details of the funding allocated varied from year to year as did the details of expenditure, which also varied between the different institutions. However, in the years when the field course was located abroad, the costs for London-based students (for ten days) were little more than the return air fare, reduced further by a departmental contribution. The group subsequently expanded to 5 institutions, each in a separate EU country and has a 5 year rotation cycle for field course venues, with a 3 year cycle of SOCRATES IP funding following each successful application.

3 Elements in fieldwork design

3.1 Aims of fieldwork

3.1.1 Fieldwork aims, objectives and learning outcomes

There is no such thing as a ‘definitive’ list of fieldwork aims, objectives and learning outcomes. One of the main difficulties in specifying fieldwork aims and objectives relates to the widely varying backgrounds of today’s student cohorts. Students are now entering higher education with different prior experiences than they may have had previously, and hence will have different priorities (Smith, 2004). It is also becoming increasingly common for students to follow an earth, environmental or biological science programme with little or no previous experience of either their chosen academic discipline, or of fieldwork.

Fuller et al. (2000) present a useful overview of the educational objectives that are addressed by fieldwork, based on the work of Gold et al. (1991). Whilst relating primarily to geography, these objectives are equally applicable to other natural and environmental sciences:

- Development of observational skills;
- Facilitation of experiential learning;
- Encouragement of student responsibility for their own learning;
- Development of analytical skills;
- Provision of a taste of ‘real’ research;
- Kindling of a respect for the environment;
- Development of personal skills;
- Promotion of social interaction between staff and students on residential courses.

Additional learning objectives identified by Wilson et al. (2008) for field biology include identification skills and experimental design.

According to Lonergan & Andresen (1988) a ‘pedagogically valid’ programme is one that has clear and precise objectives that are achievable within time and physical constraints, and with suitable contingencies in place for unforeseen obstacles (e.g. weather, problems with transport). Recognising that this represents a major challenge, the following are considered to be the key tasks when developing a programme of field activities:

- **Identification of goals** – goals should be appropriate to the type of exercise, e.g. acquisition of certain types of knowledge or skills.
- **Method of instruction** – this should be appropriate to the goals, the field setting, and the time available.
- **Implementation strategies** – e.g. reconnaissance trips to new field localities.

In terms of learning outcomes, McEwen (1996) states that “a standardised diet of learning outcomes is neither necessary nor desirable. It is, however, essential to match delivery and assessment patterns to the skills and knowledge base expected from students at the end of the fieldwork programme”
3.1.2 Fieldwork and employability

The role of fieldwork in enhancing students’ employability is widely recognised by academic staff and by professional bodies through accreditation schemes (see Section 2.2.2). Fieldwork offers a rich environment in which students can acquire and practise transferable skills that contribute towards their ability to gain employment. Kent et al. (1997) give a list of ‘transferable enterprise skills’ developed in fieldwork as follows:

- Provoking students to ask questions and identify problems
- Stimulation of independent thinking
- Development of the motivation and skills to learn autonomously
- The enhancement of communication and presentation skills
- Development of group work skills
- Development of leadership skills
- The improvement of organisational skills
- Appreciation of the importance of safety in fieldwork
- Realisation of the parallels between skills involved in carrying out fieldwork and those in employment in the ‘real world’

In some cases, the careers relevance of fieldwork can be enhanced through minor re-orientation of traditional research and skills practical sessions and increased contact with industry professionals (see Robinson & Digges La Touche, 2007).

In recent years, the context of employability has broadened and is presently understood to entail the development of:

- experience, skills, attributes and knowledge of value to employers
- self-promotional and career-management skills
- a willingness to learn and reflect on learning

Enhanced employability is a key element of Personal Development Planning (PDP) for which all students in higher education are now required to receive guidance and support (Gedye and Chalkley, 2006). PDP is defined as:

“a structured and supported process undertaken by an individual to reflect upon their own learning, performance and/or achievement and to plan for their personal, educational and career development”

QAA (2000)

Gedye and Chalkley (2006) give further clarification as to the nature of PDP and state that it is:

- concerned with learning in an holistic sense (both academic and non-academic)
- something that an individual does with guidance and support: the support needed is likely to decrease as a person’s capacity to manage their development grows
- a process that involves self-reflection, the creation of personal records, planning and monitoring progress towards the achievement of personal objectives
- intended to improve the capacity of individuals to communicate their learning to others who are interested in it.
It is clear that within this wider framework, fieldwork can make a significant contribution to enhancing a student’s employability. This is because of the potential of fieldwork to facilitate learning in a non-academic sense, the opportunity to design field activities requiring project management and self-management skills and the chance to incorporate reflection exercises and communication-linked assessments at the post fieldwork stage.

3.1.3 Social aspects of fieldwork

The role of fieldwork in facilitating social integration between staff and students can make it an important mechanism in student induction and retention (see Boyle et al., 2003). The social aspect of learning is one which is commonly overlooked, but is something that is almost intrinsic to fieldwork (Hall et al., 2004). However, whilst many students cite social interaction with students or staff as one of the most valuable attributes of fieldwork (Fuller et al., 2006), it should not be assumed that social bonding will automatically occur (Nairn et al., 2000). Indeed, social interaction may need to be encouraged through ‘ice-breaker’ or carefully designed group work exercises.

Some institutions deliberately run field courses during induction week or early in the first term to generate social cohesion within a student cohort. Nuttall et al. (2007) studied the effects of introducing a residential field trip into the induction programme for first year students on a range of undergraduate degree courses. The evaluation to date has proved inconclusive; quantitative data showed no evidence of enhanced rates of student retention, but qualitative feedback from staff and students was overwhelmingly positive. The field course facilitated better interaction between staff and students and more rapid social integration amongst students. However, some staff perceived that the latter actively encouraged a culture of poor attendance in some modules as students groups coalesced on the basis of social friendships at the expense of study friendships. The conclusions and recommendations suggest that for an induction field course it is important to strike the appropriate balance between academic and social aims.

The concept of social, travelling and learning spaces in relation to fieldwork is interesting and is something that can impact significantly upon the students’ field experience. Issues of space are perhaps most significant in relation to residential fieldtrips, where students are expected to become ‘fully immersed’ in their activities and their surroundings. Whilst on a day trip students will predominantly share their learning space, with perhaps some sharing of social space in relation to eating and travelling, on residential fieldtrips this requirement to share social or ‘living’ space extends also to sleeping, bathroom facilities, and socialising. This in turn can lead to all manner of unspoken assumptions relating to gender, race/culture, and sexuality, which may ultimately serve to exclude particular social groups (see Nairn, 2003, for an interesting discussion of sleeping arrangements during residential fieldwork). Students may also be required to share aspects of this space with members of academic staff, thus shifting the implicit boundaries that may exist between staff and students. For the majority of students this is a positive process which adds to the overall field experience, but for some it can be disconcerting and unsettling, and potentially lead to feelings of isolation and exclusion.

Structured activities can promote social interaction!
(Image: Anthony Morris, University of Plymouth)
3.2 Placing fieldwork in the curriculum

It is generally agreed that for fieldwork to be effective it must serve a clear purpose in the curriculum (Pawson & Teather, 2002). Fieldwork is important to good curriculum design, e.g. it must complement, enhance or extend an existing part of the curriculum, or fulfil some major objective of the curriculum as a whole (Livingstone et al., 1998). Thus the successful integration of fieldwork with lectures or classroom teaching is particularly important, as failure to do so may result in less transfer of learning and meaning (Ferry, 1995). Such integration may be more difficult to achieve if a field course is delivered as a stand-alone module and the trend towards modularisation in higher education has not aided this. It is perhaps easier when fieldwork represents only a component of a module and can be more closely linked to classroom or laboratory-based sessions. However, this may mean restricting the time that students spend in the field and may ultimately prove counterproductive. Butler (2008) points out that optional field courses, particularly those run at the end of a programme, are far harder to integrate than those designated as compulsory which run earlier in a degree.

Where fieldwork sits in the curriculum depends on what it aims to achieve, and the key aims of fieldwork are likely to change as students progress through the stages of a degree programme. In those disciplines where a field-based project in the final year is regarded as critical, fieldwork in the earlier stages tends to be designed specifically to support this end point. There is a link between fieldwork style and place in the curriculum, and in particular the issue of ‘progression’ in terms of the type of fieldwork that is undertaken at each stage of the undergraduate programme. Kent et al. (1997) point out the importance of progression, stating that “fieldwork skills and the skills needed by students to make effective use of the student-centred learning strategy are learned over a period, not absorbed instantaneously the moment the students step out of the minibus or coach”. Fuller et al. (2002) studied the impact on student learning of two contrasting teaching approaches during Stage 1 fieldwork. They conclude that the ‘traditional’ descriptive-explanatory mode of teaching (essentially staff-centred) may be more effective in the early stages of a degree programme than the more student-centred, analytical-predictive approach – the latter becoming more appropriate as students progress through their programmes and towards their final project.

Fieldwork can be used to bring about key elements of knowledge, skills and personal progression in students through the learning experiences they undertake. For instance, at the University of Plymouth, fieldwork on the BSc Environmental Science degree is designed so that students experience an increase in the following as they move through the degree programme.

- autonomy and responsibility
- research competence and specialisation
- global perspective
- complexity of subject matter
- contact with external organisations
- personal and professional confidence
3.3 Types and styles of fieldwork

3.3.1 Classifying fieldwork styles
Read ten different papers on fieldwork design and you will probably find ten different ways of categorising fieldwork activities. Each will have their own merits, but some will undoubtedly be more useful than others. Kent et al. (1997) provide a particularly useful overview of the main types and styles of fieldwork:

Observational
Observational fieldwork includes the ‘look-see’ type fieldtrip, and can be a useful way to introduce students to an unfamiliar area. This type of field trip is often referred to as a ‘Cook’s Tour’ after the Thomas Cook (1808-1892), widely regarded as the pioneer of modern tourism. However, the limited time available for activities tends to restrict the opportunities for learning (particularly deep learning), and often students are required to do little more than observe key features pointed out by a member of staff (which may be missed if they are not made explicit).

Participatory
Participatory fieldwork offers far more opportunity for students to engage in field activity. Types of participatory fieldwork include:

- Staff-led projects
- Staff-guided projects
- Role-playing exercises
- Student-led group work
- Independent projects

Although it can more effective than observational fieldwork at promoting deep learning (e.g. Hill & Woodland, 2002) participatory fieldwork is generally more time-consuming both for students and academic staff. Preparation time can be extensive, and there may be difficulties with supervising scattered groups.

Learner-practitioner and participant observation
This type of fieldwork is generally more common in social sciences and human geography, but may be appropriate for some earth, environmental or biological science activities, e.g. where the student would take on the role of a consultant. This category might also include work placements if the institution offers some kind of work based learning.
Livingstone et al. (1998) present another useful classification based on the more practical characteristics of fieldwork (Table 3.1)

<table>
<thead>
<tr>
<th>Status on the course</th>
<th>Optional</th>
<th>Freestanding</th>
<th>Compulsory</th>
<th>Integrated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pattern of delivery</td>
<td>Residential</td>
<td>Local</td>
<td>Non-residential</td>
<td>Non-local</td>
</tr>
<tr>
<td>Skills training</td>
<td>Implicit</td>
<td>Extensive</td>
<td>Passive</td>
<td>Course specific</td>
</tr>
<tr>
<td>Delivery</td>
<td>Staff-selected</td>
<td>Staff-led</td>
<td>Reception</td>
<td>Prescribed</td>
</tr>
<tr>
<td>Assessment</td>
<td>Traditional</td>
<td>Individual</td>
<td>Tutor-assessed</td>
<td>Directed</td>
</tr>
<tr>
<td>Management</td>
<td>Controlled</td>
<td>Rigid</td>
<td>Whole class</td>
<td>Creative</td>
</tr>
<tr>
<td>Resources</td>
<td>Institution-financed</td>
<td>Unconstrained</td>
<td>External links</td>
<td>Student-financed</td>
</tr>
</tbody>
</table>
It is clear that, over the past few decades, there has been a move away from the ‘Cook’s Tour’ models of fieldwork towards a more student-centred and problem-solving approach (Stainfield et al., 2000). Bradbeer (1996) suggests that, if the aim of fieldwork is to promote deep as opposed to surface learning, then problem-based learning may have much to offer. However, despite widening support for problem-based learning in general, there are relatively few examples in the literature of where problem-based learning has been applied to fieldwork (Pawson et al., 2006; Giles et al., 2008 – but see Perkins et al., 2001 and Spronken-Smith, 2005). Also, whilst this type of project-based fieldwork may appear to be more conducive to ‘deep’ learning than observational fieldwork, there is limited empirical evidence at present to support that idea that ‘student-centred’ methods are more effective than other methods of learning.

### 3.3.2 Fieldwork duration

The duration of fieldwork varies from a single day (or part thereof), short residential (3-4 days) to long residential (1-2 weeks or more). These different modes of fieldwork have their own advantages and disadvantages and selection is dependent on a range of factors.

- Aims and activities of the field course
- Proximity of appropriate field sites to the higher education institution
- Desire to promote social interaction between students and between staff and students
- Perceived benefits of prolonged ‘immersion’ in the field environment
- Costs to the student and to the institution
- Staff availability
- Personal and work commitments of students

### 3.3.3 Virtual fieldwork

Virtual fieldwork refers to the simulation of field-based activities by use of information technology and is carried out in a classroom environment. The nature and purpose of virtual fieldwork is a major issue and lies mainly outside the scope of this guide. However, given the pressures on fieldwork logistics, it has been suggested that technological developments could increase the efficiency of, supplement or replace real fieldwork (Fletcher et al., 2007). The current consensus amongst practitioners seems to be that virtual fieldwork should complement, rather than replace ‘real’ fieldwork (Rumsby & Middleton, 2003). Examples can be found in the literature which describe the use of virtual fieldwork in lieu of in-situ field activities (e.g. Suthren, 1998). Simulation can provide problem-based fieldwork scenarios which are impracticable or impossible to deliver in the field itself (e.g. Moles et al., 2005; Maskall et al., 2005).

The aims and objectives of virtual fieldwork are likely to be very different from those of ‘traditional’ fieldwork. Jenkins & Williams (1997) propose the following education contexts and aims for a virtual field course (Table 3.2).
Table 3.2 Proposed educational contexts and possible aims of a virtual field course (Jenkins and Williams, 1997).

<table>
<thead>
<tr>
<th>Educational context</th>
<th>Educational aim</th>
</tr>
</thead>
</table>
| Enhancement         | • To prepare students for residential fieldwork.  
|                     | • To allow for follow up work. |
| Replacement         | • To enable physically challenged students to visit environments that are otherwise inaccessible to them. |
| Extension           | • To enable students to visit an environment that is inaccessible due to extreme of dangerous conditions, or to prohibitive costs |
| Interaction         | • To enable students to alter or intervene in physical processes, predict the consequences, and view the resulting consequences in real or accelerated time.  
|                     | • To slow down or speed up natural processes.  
|                     | • To view seasonal variations.  
|                     | • To compare/contrast different environments or processes.  
|                     | • To access simultaneously multiple datasets/environments. |
| Efficiency          | • To make efficient use of staff and student time.  
|                     | • To allow instant access to learning environments.  
|                     | • To allow sharing of data/knowledge.  
|                     | • To enable multiple revisiting of field sites. |

Hurst (1988) describes the use of virtual resources in teaching introductory geology classes using a series of computerised case studies, and cites the following advantages of virtual fieldwork:

• Ability to work at a range of scales from microscopic to planetary;
• Ability to display non-outcrop data (e.g. seismic lines, geochemistry);
• Exercises can be repeated and are easy to access;
• Can facilitate 3-D visualisation
• Resources are flexible and can be targeted to individual students;
• No restriction of access for students with disabilities;
• Logistical issues, e.g. weather, travel, accommodation, are removed.

The greatest disadvantage of virtual fieldwork is its inability to create the type of multi-sensory experience typical of real fieldwork (Qui & Hubble, 2002) which appears to be so vital in generating the kinds of affective responses which drive the learning process. Spicer & Stratford (2001) found that students were unanimous in their view that virtual field trips should not be a replacement for the real experience (see Case Study 7). Hurst (1998) suggests that students might learn more when assigned to create a virtual field trip, rather than simply interact with a virtual environment.

3.4 Choosing locations

3.4.1 Introduction
Location, location, location. There are plenty of parallels to be drawn between buying a house and designing a field course! In practical terms, we want a location that will fulfil the aims of the field course, that we can afford and that is suitable for the people who are going to be use it. But, of
Case study 7

Virtual Field Trips – as good as the real thing?

**Originators**: John Spicer¹ & John Stratford, University of Sheffield, UK

Tidepools is a hypermedia package which allows students to explore for themselves how a hypothetical tidepool animal might respond to low oxygen encountered during the low tide period. Users then go on to predict what four real tidepool animals actually do. Although the main purpose of the software was to explore physiological principles, it was set so firmly in an ecological context that students started to refer to Tidepools as a virtual field trip (VFT). The program used an interactive, but essentially linear, video-led approach using footage taken from real field sites. Many students and staff who were introduced to the package asked if this technology was supposed to take the place of a real field trip. These reactions prompted Spicer and Stratford to undertake a study to examine student perceptions on the use of VFTs.

Two major conclusions emerged. The first was that students were extremely positive about the potential of VFTs to provide valuable learning experiences. Secondly, nearly all students insisted that it could not, and should not, replace real field trips, a perception which was strengthened after a real field trip. Most felt that VFTs could be most effective in preparing for or revising after a real field trip. There was no significant difference in examination performance between students who had coursework presented to them in the form of a set of dedicated lectures and those who only had access to the VFT. It was argued that while VFTs may be well received by students, and can be extremely useful in some contexts, they cannot be seen as a replacement for real field trips.

**Reference**: Spicer & Stratford (2001)

**Present Address**: ¹University of Plymouth, UK
course, there is more to it than that: the choice is also influenced by personal attachments, by the charisma a location exudes, and how this can result in life-changing experiences for students and staff alike. Indeed, we may want to consider, how the ‘life-changing’ or ‘life-enhancing’ potential of such locations may be aligned with (rather than conflicting with) the academic aims of the field course.

One pitfall with focusing on destinations too much is that they can become the driver for the fieldwork. A course may be routinely referred to as the ‘Borneo fieldtrip’ or the ‘Dartmoor field day’ with the result that the academic aims retreat to the background. Such an emphasis may prove distracting particularly for students, and may serve to promote a feeling that they are ‘going on a trip’ rather than embarking on a course of study that is based off-campus. Whilst important, the destination is ultimately the means to an end and that end is the achievement of the academic aims.

In some cases, universities will hold a formal record of field sites that they use, or have used for particular disciplines. However, in most cases, this record will be kept in the heads of the academic staff and passed to new staff as they are appointed. The tendency will be to stick with existing locations until forced to change by curriculum, logistical or financial reasons. However, a healthy approach would be to maintain an ongoing review of field destinations and to question their suitability for purpose. Ask yourself this question – “Is this field location the best place for the students to learn about this topic or to develop this skill?”

### 3.4.2 Fieldwork in the UK

The UK represents a rich and varied resource for fieldwork in the natural and environmental sciences and its relatively compact size means that meaningful field trips fall within the logistical grasp of many universities. However, this has resulted in some particularly valuable sites being heavily used for undergraduate fieldwork. Although it is commonly assumed that students prefer to travel to an overseas location, fieldwork carried out in nearby or familiar locations can have particular benefits (Pawson & Teather, 2002; McGuiness & Simm, 2005). Such an approach may encourage students to appreciate the relevance of an area to everyday experience or may serve to familiarise students with the UK response to an issue and the specific institutions and stakeholders associated with it. For instance, Dove (1993) outlines the opportunities presented by derelict land for study of ecological processes.

### 3.4.3 Overseas fieldwork

One of the most compelling reasons for organising fieldwork abroad is that it gives the opportunity for students to experience environments and situations not available in the UK. For instance, environmental science and geography programmes seeking to investigate the impact of rapid economic growth on the environment and society may look to developing countries such as China and India. Geoscience fieldtrips must head overseas if students are to experience first-hand active tectonic, volcanic or glacial process (Butler, 2008). In the biosciences, some overseas locations hold a rich diversity of species and habitats and offer the chance to circumvent the seasonal restrictions imposed...
Case study 8

Field Schools in the Asia-Pacific Region

Originators: Philip Hirsch, University of Sydney and Kate Lloyd, Macquarie University, Australia

A Field School was used to study environment, development and rural livelihood in Southeast Asia with the aim to engage and challenge students through cross-cultural, intercultural and multicultural interactions. Field-based learning was carried out over five weeks as a collaboration between Sydney University students and students in Vietnam, Laos and Thailand. The key difference between the conventional field trip and the Field School approach is that the latter involves lectures, readings and written assignments, group work at regional universities, together with intensive interaction with students’ peers (using a ‘buddy’ system) at these universities. Students are encouraged to learn as much as possible with, through and about their local peers, and to reflect on the diversity and experiences in each of the sites visited.

The Field School focuses on use, management, degradation and conservation of natural resources and the environment in the context of rapid rural change occurring in Southeast Asia. This approach produces numerous benefits across a range of skill areas. These comprise subject-specific skills (and knowledge) as well as more general skills in dealing with cultural difference and a capacity to deal with complexity and ambiguity through a better understanding of multiple perspectives. Although often challenging, these experiences give students a chance to build their perspectives of environmental and development issues, and of cultural difference, through hands-on work instead of from the seat of a lecture theatre.

by the traditional October to April teaching period. The opportunities presented by overseas travel for students to interact with people of different cultures are integrated into field courses to greater or lesser degrees. Hirsch and Lloyd (2005) designed Field Schools to study environment, development and rural livelihood in Southeast Asia involving collaboration with higher education institutions in the host countries (see Case Study 8).

Short-haul European fieldtrips, e.g. to locations such as Malta or Spain, have been run for many years by UK institutions. Such trips can take advantage of relatively cheap travel and accommodation costs, and also a more favourable climate (sometimes!). However, there has been an evolving trend towards more long-haul fieldtrips, with locations such as North America, Asia and Africa becoming relatively common. As such fieldwork has become increasingly globalised - a process which seems to mirror the wider globalisation of economy and society (McGuinness & Simm, 2005). This was aided, at least in part, by a substantial reduction in air fares which made long-haul travel far more economically viable. However, recent increases in the cost of aviation fuel are likely to result in higher air fares in the future. Table 3.3 summarises some of the main benefits and limitations of long-haul fieldwork (but is in no way exhaustive).

<table>
<thead>
<tr>
<th>Benefits and “value added”</th>
<th>Drawbacks and limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>• being there’ makes learning more vivid and memorable</td>
<td>• cost</td>
</tr>
<tr>
<td>• increase in student motivation and interest</td>
<td>• logistics, including language barriers and jet-lag</td>
</tr>
<tr>
<td>• ‘once in a lifetime’ experience</td>
<td>• health and safety considerations</td>
</tr>
<tr>
<td>• promotes group and identity and student/staff relations</td>
<td>• ‘culture shock’</td>
</tr>
<tr>
<td>• different cultural and physical landscapes</td>
<td>• ‘academic return’, i.e. long-haul fieldwork will not necessarily result in effective learning</td>
</tr>
</tbody>
</table>

Table 3.3 Some benefits and limitations of long-haul fieldwork (from Ternan et al., 1999a)

The question of divisiveness is often raised with respect long-haul fieldwork, i.e. is it only available to those students that can afford to go? (McGuinness & Simm, 2005). Maguire (1998) found that, when faced with a choice of possible locations, students were more likely to be influenced by a personal desire to visit a particular place than by cost – but this does not mean that all students will be prepared, or able, to pay the financial price of long-haul fieldtrips. Other factors which may influence choice of location include domestic responsibilities and perceptions of physical fitness, particularly if the fieldwork is located in an area of physically demanding terrain.

It seems to be a growing expectation of students that fieldwork will provide them with the opportunity to engage in some kind of long-haul travel (McGuinness & Simm, 2005). In a time of increasing competition for students it can be tempting for departments to use far-flung and exotic field destinations as marketing tools to recruit students to a particular programme (Smith, 2004). Whilst it can be expensive, students generally seem to consider long-haul fieldwork to be good value for money – although there may be some debate over the extent to which this reflects the ‘total experience’ rather than just the
fieldwork element (Kent et al., 1997). For example, the quality of the out-of-field experience (e.g. nightlife) may be considered just as important as the field location – hence careful consideration needs to be paid to the ‘social benefits’ as well as the learning opportunities associated with a field course.

There may also be issues surrounding the political, ethical, and environmental implications of long-haul fieldwork. For example, taking students into areas of social deprivation can raise some awkward questions relating to race, poverty, and power (Madge, 1997; Abbott, 2006), whilst the cultural and social dynamics of some locations can exclude certain participants, e.g. on the basis of gender, sexuality, or physical ability (Nairn, 2003). Nash (2000) emphasises the need to behave in a manner that respects the cultural as well as the physical environments encountered on fieldwork. Increasing attention is being paid to the environmental impacts of long-haul air travel, particularly with respect to carbon emissions. There is clearly a balance to be struck between the educational benefits of undergraduate students undertaking fieldwork in overseas locations and the effect that their travel arrangements have on the global environment.

3.5 Preparing students for fieldwork

3.5.1 Why prepare?
The importance of fieldwork preparation has long been recognised (e.g. Koran & Baker, 1979; Gold et al., 1991) and the extent to which students are prepared for their field experience can impact significantly on the benefit that they gain from it (Lonergan & Andresen, 1988). Briefing can be significant in reducing ‘novelty space’ (See section 2.1.6) and helping students to prepare for their field experience (Orion & Hofstein, 1994). Preparation can also serve to establish students’ prior experiences of the field at secondary school level as these can have a strong influence on how a student adapts to fieldwork at university, particularly in the early stages of a degree (Dalton, 2001).
Effective briefing should focus on the aims and objectives of the fieldtrip as well as practicalities, and will help to impose both a structure for learning and set the boundaries within which learning takes place. Where students are undertaking fieldwork in an unfamiliar environment they may benefit from additional briefing over the duration of, as well as in preparation for, their activities (Lonergan & Andresen, 1988). However, there may be circumstances in which staff feel that it is important that students are faced with an unfamiliar situation or problem, particularly in the later stages of a degree or at postgraduate level. In this case, it would be beneficial to deliberately omit preparatory activities.

In addition to briefing, pre-fieldwork activities such as literature reviews can help to introduce students to published information about their field area, as well as aiding the development of research skills (e.g. McKendrick, 2002). Wilson et al. (2008) emphasise pre-fieldwork preparation for raising students’ ‘bio-literacy’ and in particular to teach identification skills. Novelty space can be further reduced by making explicit the expectations and intentions of both the staff and the students. Students’ expectations in particular will be influenced by their prior experiences (Lai, 1999), so providing them with the opportunity to set out their expectations beforehand will enable any that are unrealistic or unreasonable (i.e. working a 4 hour day and staying in a 5 star hotel!!) to be addressed prior to the commencement of fieldwork.

3.5.2 Using IT in fieldwork preparation
As discussed in section 3.3.3, virtual fieldwork can play a valuable role in helping students to prepare for their forthcoming field experience (Stainfield et al., 2000; Butler, 2002). McMorrow (2005) evaluates the use of a virtual resource in preparing students for fieldwork, and presents a useful set of recommendations for designing similar activities. Whilst apparently successful in reducing novelty space, the value of this resource in promoting deep (or any) learning is unclear. In addition to virtual fieldtrips, Warburton et al. (1997) discuss the use of computer-based tutorials as part of the preparation process to fulfil the following purposes:

- **Academic background**: introducing the background to the problem or issue, basic concepts, and why the study is relevant;
- **Academic briefing**: outlining aims and objectives, how the field activities will proceed, how they will be assessed etc.;
- **Site-specific information**: to familiarise students with the aspects of the physical environment and local context;
- **Technical preparation**: to familiarise students with field techniques;
- **Logistics notices**: to provide safety information, meeting times etc.

The most extensive use of IT for fieldwork preparation has to be that of Elkins and Elkins (2006) who utilised audio/visual technologies to brief students on upcoming locations on the GeoJourney fieldtrip in the United States (see Case Study 9).
Case study 9

GeoJourney – the ultimate field trip?

Originators: Joe Elkins¹ and Nichole Elkins, Bowling Green State University, Ohio, USA

First offered in 2004, GeoJourney is a nine week field trip, taking in 14,500 miles of travel and visiting many of the United States’ wilderness areas. Students and faculty staff camp across the United States using national and state parks, museums, industrial sites, and various other field locations as platforms for instruction in introductory geology topics and subjects analogous with those in traditional classroom-based courses. The geology courses are taught using an interdisciplinary and experiential approach in conjunction with two other introductory courses, one in Native American Studies/anthropology and the other in environmental studies/ ecology. The programs each offer a full semester of college credit in general education courses, compressed into nine weeks rather than the typical sixteen weeks, at a cost less than for a student living on their base campus during a semester.

In order to ensure that travel time was not wasted, staff developed an audio-visual system (now updated to iPods) which was used to present preparatory material pertinent to each upcoming field trip. This material included PowerPoint presentations, animations and videos. It was estimated that over the entire field trip students were spending 241 hours in vehicles which exceeded the total number of contact hours a full-time student spent in classrooms during a sixteen week semester. Students participating in GeoJourney were found to have significant improvements in geoscience concept knowledge compared with their classroom counterparts. This was attributed to a combination of factors including effective use of preparatory materials and the strong affective components of students being ‘immersed’ in the field experience for such an extensive trip.

Present Address: ¹University of Northern Colorado, USA
The GeoJourney route: 14,500 miles over 9 weeks
(Base map from Wikimedia Commons. http://commons.wikimedia.org/wiki/Main_Page)
3.6 Fieldwork activities

3.6.1 Introduction
Effective fieldwork relies heavily on the use of appropriate, challenging and engaging learning activities. Some of the more common field activities undertaken in the environmental and natural sciences are shown in Table 3.4. In general, the nature of the activities undertaken on a particular fieldtrip will be determined primarily by the fieldwork aims and objectives, the available resources, and the type or style of fieldwork undertaken (see Section 2.1.1).

<table>
<thead>
<tr>
<th>Earth sciences</th>
<th>Environmental sciences</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Observation and recording of field phenomena and data</td>
<td>• Field survey techniques</td>
</tr>
<tr>
<td>• Field description of rocks</td>
<td>• Monitoring environmental quality using portable instrumentation</td>
</tr>
<tr>
<td>• Lithostratigraphic logging</td>
<td>• Observing the complexity of environmental systems</td>
</tr>
<tr>
<td>• Equipment-based studies (e.g. geophysical surveys)</td>
<td>• Investigating human activities that impact on the environment</td>
</tr>
<tr>
<td>• Geological mapping</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Biosciences</th>
<th>Geographical sciences</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Plant and animal identification</td>
<td>• Gathering data to investigate spatial patterns and processes in the environment</td>
</tr>
<tr>
<td>• Conducting field-based experiments</td>
<td>• Conducting surveys of human perception and behaviour</td>
</tr>
<tr>
<td>• Ecological habitat and community analysis</td>
<td>• Sampling biophysical characteristics of the landscape</td>
</tr>
<tr>
<td>• Collection of field samples and specimens for further analysis</td>
<td>• Relating sample data to wider patterns in the landscape</td>
</tr>
</tbody>
</table>

Table 3.4 Typical field activities in the environmental and natural sciences.

It may be useful to bear in mind some or all of the following points when considering possible activities (Kent *et al.*, 1997):

- Deep rather than surface learning can be encouraged through multi-sensory experience and active participation.
- Field experience can be controlled through the stating of explicit objectives.
- The success of the fieldwork will be influenced by the quality of the supporting material (e.g. handouts, workbooks etc.) which should be designed such that students are challenged, but not ‘spoon fed’.
- The effectiveness of field activities can be limited by poor preparation.
- Process-based rather than descriptive questions will encourage deeper understanding in students.
- The only way to acquire skills is through direct participation.
- Interaction with experts, e.g. on active research sites, can be an effective way of challenging and motivating students.
3.6.2 Large classes
Large classes have become increasingly common, and this can present some interesting challenges when it comes to fieldwork (see, for example, Gold & Haigh, 1992; Ternan et al., 1999b). Fieldwork prior to the 1990s was often a relatively ‘intimate’ experience that provided an opportunity for small-group teaching (Kent et al., 1997). The problem in subsequent years has been how to try to maintain teaching quality with increased class sizes. Teaching larger classes in the field will invariably lead to some kind of ‘trade-off’ in terms of both the student and staff experience (see Jenkins, 1994). For instance, simply talking to, or being heard by, a large group can be a problem, as can the need to physically move large numbers of students around the field or simply on and off of buses. Resourcing (i.e. the need to have multiple sets of equipment) and time are also issues that will may more careful consideration than with a smaller group. Strategies to address the issue of large class size are reviewed by Butler (2008) and include increased use of group work, specialised vocational training, and repeat teaching of the same field excursion. Wilson et al. (2008) propose a strategy of handing over responsibility for the site visit to students – smaller student groups select their own sites and make unaccompanied visits, working to a well-planned practical schedule. This frees staff to concentrate on preparation and debriefing and promotes autonomy of learning, but generates issues related to risks, transport and student motivation.

3.6.3 Using IT during fieldwork
Use of IT in the field has already brought significant advances. Consider the development of reliable, affordable, portable instrumentation for water quality monitoring that occurred in the 1980s and 1990s. Such equipment is now used routinely in undergraduate courses in environmental science. The pedagogical benefit is the integration of sampling and analysis; primary data can be generated in the field to give immediate feedback on a range of water quality parameters. Such information can be used in a variety of ways: to inform the design of further investigations; to address a particular problem or hypothesis or to form the basis of an assessment.

The technology has moved on. It is now possible to take powerful portable computers and mobile devices into the field which, backed up with sophisticated software, provide significant opportunities for pedagogical development. Some applications of mobile technologies in the field are based around their use in recording observations and data (Lynch, 2006; Stott, 2007). It is currently possible, but as yet not widely practised, to train students in geological mapping techniques by exclusive use of digital equipment such as GPS, digital cameras and tablet PCs which act as ‘digital’ notebooks (Clegg, 2006). This approach gives the geoscientist the enhanced ability to collect geospatially georeferenced...
field data in ways that are impossible or very difficult to achieve using traditional techniques. Other potential pedagogic benefits of using IT relate to enhanced capacity and speed of data analysis and greater scope for contextualisation of primary data. Integration of primary data with secondary data can deepen the knowledge acquired, aid understanding in the fieldwork context and be a form of descriptive instruction (Fletcher et al., 2007). Such secondary data can be stored on portable computers or accessed remotely from the field location as and when required. Fielding (2008) employs remote access to long-term ecological monitoring data to enhance fieldwork on the Hebridean Island of Mull (see Case Study 10). Priestnall (2006) used tablet computers in conjunction with Global Positioning System (GPS) and GIS software to create ‘location aware’ visualisations of landscapes in the field. This allowed students to ‘see’ representations of specific features such as underlying geology ‘draped’ over a digital elevation model which could then be compared with the actual landscape.

However, there are significant constraints to the expansion of technology in field courses, principally due to practical barriers such as: lack of time to develop materials, lack of familiarisation with developing technology and insufficient financial resources to purchase equipment and data (Fletcher et al., 2007). There have also been some questions concerning the suitability and ruggedness of certain mobile devices and their capacity to operate effectively under field conditions (Maskall et al., 2007). Finally a more general point: as with all applications of e-learning, there is a tension between innovations that are technology led (i.e. “I want this gadget, how can I use it in my teaching?”) and pedagogically led (i.e. “I want to improve a specific aspect of student learning, how can technology help me to achieve this?”). It is clear that we should adopt an approach dominated by pedagogical intentions. A good source of guidance on this subject is the publication on Effective Practice with e-Learning published by JISC (2004).

3.7 Post-fieldwork activities

3.7.1 Debriefing

A crucial, yet often overlooked, aspect of fieldwork, is debriefing. This is commonly a consequence of the complexity of fieldwork, which can leave insufficient time for students to reflect on what is being learned, and to relate their field experience to theoretical concepts (Boud et al., 1985; Lonergan & Andresen, 1988). Lai (1999) makes explicit the importance of follow-up work and debriefing activities, pointing out that without these there can be a “rapid reversion to the status-quo of the classroom”. Kent et al. (1997) make the following points in relation to debriefing:

• It can encourage integration of the field experience with the theoretical background, and prepare the student for the next stage in the educational process.
• Activities such as group exercises or short presentations which ‘work up’ particular aspects of a day’s activities as a way of debriefing can also form part of the assessment process.
• Consulting the literature during both the briefing and the debriefing process will help to consolidate learning and enable students to place their knowledge and observations in a wider context.
• A final debriefing session should be held soon after the fieldwork finishes to enable discussion and processing of data, and to relate the objectives of the fieldwork to the students’ experiences. The fieldwork experience as a whole should also be explicitly integrated into the objectives for the degree programme.
Case study 10

Tireragan – a real and virtual field experiment

Originator: Alan Fielding, Manchester Metropolitan University, UK

In 2003, staff at the Division of Biology at Manchester Metropolitan University started a long-term ecological study on the Tireragan Estate on the Hebridean island of Mull. The estate is an important and perhaps unique area in terms of conservation and features remnants of the original native deciduous woodlands. The aim was to identify the effects of grazing and woodland management on the biodiversity of mature broadleaf woodland using manipulative experimental treatments.

Studies are undertaken during an annual residential field course attended by MSc students on the Conservation Biology and Animal Behaviour programmes. Results from the field experiments are uploaded to a dedicated website currently hosted by the Higher Education Academy Biosciences Subject Centre (http://www.bioscience.heacademy.ac.uk/hosted/tireragan). Data includes high resolution georeferenced images of the estate and of specific plots of vegetation, experimental results reflecting several years of woodland monitoring plus additional data from surveys of invertebrates and birds.

The benefits of this approach are (i) students on a one year postgraduate course are given access to the results of a long-term field study and have the opportunity to interpret their own results in this context (ii) data and images can be used in preparatory exercises prior to the field course e.g. development of identification skills using keys and digital images of specimens and (iii) the delivery of experimental details and raw data to disabled students could be used to meet many important learning outcomes associate with fieldwork that would otherwise be unachievable.

In some cases it might be advisable to undertake smaller cycles of brief-activity-debrief within a single field activity or at different stages in a single excursion – although this may not always be practicable, especially during long-distance trips with multiple activities. It is suggested (Lonergan & Andresen, 1988), however, that on lengthy fieldtrips attempts are made to debrief nightly for the following reasons:

- it will enable students to recall their experiences more effectively;
- experiences can be shared amongst the group;
- it will allow reflection on how much has been learned during the day.

### 3.7.2 Reflection

Reflection is another important, yet frequently underused, part of the post-fieldwork process. Lonergan & Andresen (1988) point out that students might not have the time or opportunity whilst in the field to link theory with practice at the time it is occurring – hence the field activity needs to be mentally revisited and reflected upon in order for sense to be made of the complex field experience. One of the most effective ways of encouraging students to reflect on their experiences is to build it into the assessment.

### 3.7.3 Using IT in post-fieldwork activities

The most prevalent use of IT to support fieldwork does not occur prior to or during the field trip, but afterwards (Fletcher et al., 2007). Post-fieldwork activities such as data analysis and preparation of presentations utilise software packages and are often associated with widely used assessment approaches. However, as with preparation, participation in virtual fieldwork can be a valuable post-fieldwork activity (e.g. Warburton & Higgitt, 1997; Spicer & Stratford, 2001; McMorrow, 2005), enabling students to revisit locations and reflect upon their experience. This can be important in rekindling student enthusiasm especially if some time has elapsed since returning from a field trip.

### 3.8 Assessing fieldwork

#### 3.8.1 Introduction

It is clear that students are becoming increasingly driven by summative assessment, i.e. they are motivated only by tasks for which they stand to receive some kind of academic ‘reward’ (Hill & Woodland, 2002). However, fieldwork (particularly in the residential mode) offers unparalleled opportunities for provision of continuous and rapid feedback and formative assessment on practical skills, knowledge development and understanding of the scientific process. In using this opportunity, staff can demonstrate to students that professional and personal development can be achieved without the need for summative assessment.
A useful overview of assessment, together with a selection of case studies relating to fieldwork, is presented by Hughes & Boyle (2005). This section will aim to enhance, rather than simply repeat, the information presented by Hughes & Boyle. The assessment of fieldwork raises some key pedagogic issues. Moon (2004) goes as far as to question whether it is actually possible to assess work undertaken within an experiential learning context at all. Lonergan & Andresen (1988) agree that the assessment of fieldwork activities is contentious, as learning in the field may differ significantly from other types of learning in terms of methods and goals. In fact, they propose that, in order to be valid, assessment may need to take place actually in the field, rather than outside it.

Common types of fieldwork assessment include field notebooks, maps, written reports and oral presentations. However, there is currently little research into the nature and effectiveness of differing types of assessment of fieldwork activities. The experiential nature of fieldwork offers the chance to undertake some more innovative types of assessment such as the construction of websites (France & Ribchester, 2004 (Case Study 11); Latham and McCormack, 2007), producing a podcast (Downward et al., 2008) or using computer-based approaches for formative assessment (Baggott and Rayne, 2007). Regardless of the method ultimately selected, if assessment is going to be effective it should be considered as part of the whole-curriculum design and from the initial stages of planning, rather than merely an add-on (Kent et al., 1997; Moon, 2004). Assessment, particularly formative assessment, can also be an important part of the debriefing process.

3.8.2 Field notebooks
The field notebook is the principal means by which students record their field observations and data. Butler (2008) defines notebook skills as including “the practice of keeping a notebook as a document of scientific research, where hypotheses, methods, data observations, interpretations, hypotheses modification and planning the rest of the task are distinctly and systematically laid out”. Notebooks are commonly used as part of the formative or summative assessment of a fieldtrip where grades are allocated according to the quality of the data and observations, layout, and the clarity of notes and sketches (Clark, 1996; Stokes et al., 2006). Despite the apparent popularity of field notebooks as an assessment tool – particularly in the Earth sciences – there appears to be little or no existing research into their
Case study 11

Producing websites for assessment of fieldwork

Originators: Derek France & Chris Ribchester, University of Chester, UK

All BSc Single Subject Geography students at the University of Chester enrol on a core Level 1 module entitled ‘Introductory Field Skills in Geography’. The focus of the module is a residential field course, based at the Field Studies Council’s Slapton Ley Centre in South Devon. The module aims to provide tuition in, and direct experience of, a range of key physical and human geography fieldwork techniques; to introduce students to the key elements of field-based research; to explore different methods of presenting processed field data; and to encourage students to work effectively in a small team context.

One of the module’s assessment exercises requires students to ‘write up’ a field-based research project as a functioning website. This component ‘adds value’ to the core module aims by facilitating the development of C&IT skills as well as providing intellectual challenges associated with the selection, integration, presentation and structuring of information. Student feedback generally confirms these tutor perceptions, acknowledging the development of specific computing skills and increased confidence in using C&IT. Focussed discussions with participating students have highlighted the way that this assignment may serve to heighten awareness of report structure, increase recognition of the value of planning, provide practice at presenting ideas more concisely and bestow greater confidence to acquire new skills. It is acknowledged that this type of assessment creates specific logistical and resource challenges and is likely to be labour intensive, particularly at first. However, staff indicate that it is rewarding to see student surprise at being asked to produce a website, replaced at the end of the module, by surprise at how much has been achieved.

validity as a means of determining learning outcomes. This is not to say that field notebooks do not achieve this - individual practitioners may be convinced by their own experiences and informal evaluation that field notebooks are an effective assessment method. However, the current literature extends merely to providing a set of guidelines on keeping a ‘good’ notebook (e.g. McClay, 1987; Lewis & Mills, 1995).

Stokes et al. (2006) suggest that whilst field notebooks might offer an appropriate means of assessing basic field-based intellectual and practical skills at stages 1 and 2, their value at stage 3 is more limited. In particular they do not test the students’ ability to use their data in follow-up activities. Stokes et al. (2006) have developed an alternative means of assessing fieldwork which requires students to draw upon the information recorded in their field notebooks in order to complete an on-site ‘geotest’. This approach appears to be successful in maintaining the students’ attention and participation, and tests their abilities to organise, retrieve, and apply field data.

3.8.3 Oral presentations
The use of field-based oral presentations can serve as a powerful method of testing students’ understanding of content and its relation to the field environment. Such an approach can skew a field session to being student-led rather than staff-led and can expose the ‘audience’ to a wider set of perspectives. A potential pitfall of this assessment technique is the limited time that students have to familiarise themselves with the subject area, location or associated data. In an evaluation of the use of student-led presentations in situ, Marvell (2008) concludes that these widened the experience of students and developed a range of transferable skills, encouraging a greater sense of place and facilitating reflective learning. However, he also reports that the vast majority of the preparation for the presentation needed to be done prior to the field course, the intensive schedule of which reduced the time for supplementary research.

3.8.4 Reflective diaries
The use of reflective diaries or journals in assessment is also gaining popularity. These differ from the traditional field notebook by encouraging critical reflection of the learning process rather than concentrating on content or data (McGuinness & Simm, 2005). Reflective diaries allow students to capture, in their own words, their changing experiences and competencies, and can empower students to measure and evaluate their own progress in their own terms (see Harrison et al., 2003, for a useful overview of reflective learning in geography, earth and environmental sciences). However, they can produce mixed feelings amongst students, some of whom may have no previous experience of reflective writing (e.g. Stanesco, 1991; Thorpe, 2000; Wright & Waddington, 2006). There is also the issue of exactly how to assess reflective work, as essentially this requires the member of staff to put a figure to a student’s personal experience!

Despite the effectiveness of reflective activities in terms of student learning (e.g. Thorpe, 2000) it is interesting to note that the only reference to ‘reflection’ in the revised benchmark statements for the ES3 subject area (QAA, 2007a) refers to ‘excellent performance’ in ‘self management and professional development’ where it specifies the “ability to reflect on the process of learning and to evaluate
personal strengths and weaknesses”. This is in apparent contrast to the benchmark statements for geography (QAA, 2007c), which pay far more attention to the role of reflection in the learning process.

3.8.5 Peer review

Peer review may be another useful way of identifying an individual’s strengths and weaknesses in the field, particularly in relation to group activities where it can help to assess organisational, group and leadership skills (Kneale, 1996). However, as the assessment of group activity can cause controversy amongst the students, it may be advisable to incorporate a component of individual assessment. Kempa & Orion (1996) present an interesting discussion on students’ perceptions of group work which implies that students may perceive their own personal learning from group activities to be low (i.e. they see themselves as contributors to, rather than beneficiaries from, group work).

3.9 Overcoming barriers to inclusivity

In their discussion of disabled students and fieldwork, Healey et al. (2002) identify a range of barriers to participation and divide these into three categories:

- attitudinal barriers – e.g. personal attitudes of staff, other students and the general public
- organisational barriers – e.g. course requirements, time constraints, institutional regulations
- physical barriers – e.g. print size, audibility, building and site access

It is a mix of these barriers which will be the norm, rather than the exception and it is at this level that each Department or School needs to work to make fieldwork more inclusive. The key to overcoming many organisational barriers is through course planning and in particular careful consideration of the intended learning outcomes of fieldwork activities. A field course requires planning so that it is appropriate for as many people as possible, and is integrated into the programme in a manner which renders its intended outcomes very clear, in advance.

Healey et al. (2002) give the following examples of modifications that can assist disabled students to succeed in meeting the learning outcomes of field trips:

- Providing written details about the main features to be seen in the field and the activities and projects to be undertaken to benefit a deaf student also clarifies the learning to be experienced by all the students on the field trip.
- Making a video of a classic geological site that is not accessible to a student in a wheelchair may also be used in other classes and as part of the pre-fieldwork introduction for students visiting the site in subsequent years.
- Investigating an alternative local, non-residential field course venue for a student needing daily dialysis treatment may lead to the alternative location also being offered to other students, particularly benefitting those with family responsibilities and those who cannot afford the cost of a residential field course.

In many cases, such changes would benefit many students in addition to disabled ones. At Stanford University, USA, it was found that all students received a better learning experience when accessible, introductory geology fieldtrips were created (Cooke et al. 1997). Also see Davis et al. (1990) for advice on accommodating the learning-disabled geology student. The use of C&IT in supporting remote access to field sites has been trialled in the ‘Enabling Remote Access’ project at the Open University (see Case Study 12). A pilot project linked a mobility impaired student with those on a residential geology field trip using simple, but innovative wireless technology.
Case study 12

Enabling Remote Activity – fieldwork by distance learning?

Originators: Department of Earth and Environmental Sciences and Knowledge Media Institute, The Open University

The Enabling Remote Activity (ERA) project supports remote participation in field trips. Using mobile and wireless technologies, students are able to gather data and interact with colleagues in remote locations. Field trials in 2006 opened a third-level geological field course to a mobility-impaired student who otherwise would not have been able to attend. The student was situated with a course tutor in a car close to the field site and connected through mobile communication technologies to an assistant or ‘sherpa’ who acted as their legs and eyes in the field. The connections used real-time transmission of audio, video and still images, sent over a temporarily established local wireless network, such that the student was able to direct the mobile field assistant to gather samples and data from remote locations.

In 2007, the ERA project was extended to investigate how student groups at an accessible home-base and in the field could participate fully as members of a fieldwork team. A local mobile wireless network was set up at the field site, a sand quarry in Bedfordshire, which was linked over the internet to the ‘home-base’ at the OU campus in Milton Keynes. The field activities, in which students investigated the past depositional environment at the quarry, were devised in such a way as to require inputs and resources from both the field-based and the home-based students. Students participating in this trial responded positively to the novel approach to fieldwork and the opportunities presented by collaboration between the two locations. However, issues emerged related to the limitations of the technology, in particular connectivity, security and the impact of environmental conditions.

Reference: http://kmi.open.ac.uk/projects/era/
Some adjustments can be identified as contributing to an inclusive curriculum whilst others define a more exclusive curriculum (Figure 3.1). The extent to which existing curricula are either designed around inclusivity or whether this is seen more as a ‘bolt-on’ is discussed by Hall et al. (2002). Further information on fieldwork and disabled students is available from the Geography Discipline Network (GDN) which has produced a series of guides on ‘Providing Learning Support for Disabled Students Undertaking Fieldwork and Related Activities’. (see http://www2.glos.ac.uk/gdn/disabil/index.htm.) Another valuable source of advice is the US-based organisation Science Education for Students with Disabilities which makes available a set of resources on its website (http://www.sesd.info/) which include strategies for inclusive field-based education.

Figure 3.1 Spectrum of approaches to adjustments to fieldwork (Healey et al., 2002)

3.10 Evaluating fieldwork

3.10.1 Introduction
Evaluation is a key element of design for all teaching activities and is particularly important for fieldwork given the relatively high cost of provision. The purpose and context of evaluation will determine its form. At one end of the spectrum, evaluation techniques are used in routine annual monitoring of modules. At the other end, a specific development project (particularly those that are externally funded) may require practitioners to evaluate the educational value of a new innovation or field course. In the former case, the very least we need to know is the extent to which the field course or activity is achieving the desired learning outcomes. We may also wish to assess the effect that fieldwork is having on students' confidence and more simply whether they enjoyed it. In the latter case, it may be necessary to try to identify the specific benefits or drawbacks of the new approach and perhaps also to balance these against the costs of the innovation.

3.10.2 Principles of evaluation
Evaluation is the process by which people make value judgements about things (Oliver, 2000). Issues surrounding the subject of evaluation are complex and a detailed exploration of these is beyond the scope of this guide. However, a common theme is the ‘paradigm debate’ between the effectiveness of quantitative versus qualitative evaluation methods. On the one hand, quantitative methods claim to be objective and to support generalisable conclusions. On the other, qualitative methods lay claim to flexibility, sensitivity and meaningful conclusions about specific problems. Oliver (2000) argues that neither side has been able to put forward conclusive arguments and that the key to effective evaluation
lies in using the appropriate method for the question that is being asked. A hybrid approach can be adopted which combines qualitative and quantitative methodologies, thus enhancing the credibility of evaluation findings (Oliver and Conole, 1998; Breen et al., 1998). A similar principle often applied within evaluation is that of ‘triangulation’ which uses multiple perspectives to provide robust evaluation results. Other questions have been raised about the strength of evaluation when it is carried out by practitioners rather than experts and whether effective materials can be developed to support practitioners in the evaluation process. An example of such support material is the “Evaluation Cookbook” which although designed for innovations involving information technology, contains much information relevant to the evaluation of fieldwork. It is available on the website of the Learning Technology Dissemination Initiative at the following address:
http://www.icbl.hw.ac.uk/ltdi/cookbook/

3.10.3 Evaluation practice
Methods that can be used for evaluation include the following:

- Questionnaires
- Focus groups
- Interviews
- Pre and post testing
- Supplemental observation
- Student logs

A common approach to routine monitoring of modules is to collect feedback from students via a generic perception questionnaire, review the marks as an indicator of standards and gather comments from staff either informally or using a module evaluation form. In addition, practitioners may generate their own questionnaire specific to a field course to ascertain in more detail the students' response to particular activities, destinations or arrangements. These methods conform with the principle of ‘triangulation’ and may well prove to be effective especially if the intention is to identify key actions to modify next years’ provision. However, we need to interpret this information with caution as much of it is subjective in nature. For instance, high module marks may reflect a series of unchallenging field activities. Students may have enjoyed a field course mainly because it was fun and the weather was good. Positive feedback from staff may be based on an unwillingness to disturb the course with a far-reaching review of its design.

More specific evaluation can be achieved through use of purpose-designed techniques such as that described by Orion et al. (1997). In this case, researchers developed an instrument for assessing the quality of the learning environment of outdoor science activities at secondary school level. The method incorporates seven scales measuring environmental interaction, integration, student cohesiveness, teacher supportiveness, open-endedness, preparation and organisation and material environment. In this and many other cases, what is being measured is the student or staff perception of the field course or activity which is inherently subjective in nature. This can also be a problem when trying to assess cognitive gains from fieldwork - i.e. one ends up determining what students think they have learnt from a field course rather than what they have actually learnt. A more objective approach is that of pre and post testing using factual questions to assess a student's level of knowledge and understanding of a particular subject area. For instance, the Geoscience Concept Inventory developed by Libarkin and Anderson (2005) has been used to assess the effectiveness of entry level geoscience courses in the USA and the cognitive gains associated with an entirely field-based geoscience course (Elkins and Elkins, 2007).
4. Summary of guidance for design of effective fieldwork

Fieldwork strategy
Fieldwork should exploit the unique characteristics of the field environment in such a way as to provide a student learning experience that cannot occur as effectively in any other context. This principle applies irrespective of whether staff regard fieldwork as a central and intrinsic element of their students’ education or as simply one of a set of teaching and learning tools to ‘deploy’ across a programme.

Aims of fieldwork
The aims of fieldwork should be aligned to programme learning outcomes which in turn should be influenced by the QAA benchmark statements, expectations of employers and/or the requirements of professional accrediting bodies. Aims should be clearly identified and related to knowledge, skills and/or personal and professional development.

Designing fieldwork activities
Be aware of the range of fieldwork types, styles and assessments employed by practitioners across the natural and environmental sciences. Guard against fieldwork activities being exclusively determined by the features of the location – consider also the intended outcomes and the characteristics of the student cohort.

Integrating fieldwork in the curriculum
Fieldwork should contribute to, and be fully integrated with, overall curriculum design. Be aware that the learning activities associated with fieldwork can be extended beyond the period allocated to the field course itself. Fieldwork can thus be supported by and used alongside existing teaching methods where appropriate.

Preparing students for fieldwork
Effective briefing helps students engage with their learning tasks more quickly and effectively. Preparation can aim to enhance background knowledge, describe field locations, provide logistical and practical information and familiarise students with instrumentation or techniques.

Using IT to support fieldwork
Information technology can be used to enhance the students’ learning experience before, during or after fieldwork. When incorporating IT, adopt an approach which is pedagogically led (“I want to improve a specific aspect of student learning, how can technology help me to achieve this?”) rather than technology led (“I want this gadget, how can I use it in my teaching?”).
Social aspects of fieldwork
Social aspects of fieldwork are important and deserve active management. Fieldwork (particularly residential) offers considerable opportunity for social interaction within a student cohort and between students and staff. This can have a profound influence on students’ attitude to their studies, motivation to work and sense of 'belonging' on a degree programme.

Assessing fieldwork
Take advantage of the unparalleled opportunities that fieldwork offers for provision of feedback and formative assessment for practical skills, knowledge development and understanding of the scientific process. The methods of summative assessment should be considered as part of the whole curriculum design and from the initial stages of planning, rather than merely an add-on.

Evaluating field courses
Adopt a dispassionate and rigorous approach to assessing the effectiveness of fieldwork. Take advice on the choice and design of evaluation methods. Be sure to canvas opinion of all students and staff involved in a systematic way as possible.

Equal opportunities
Does your fieldwork provision and associated promotional material reflect the diversity of students now undertaking natural and environmental science degree courses? A review of fieldwork in this context should include issues of gender, race/culture and physical ability and can extend to include age, domestic arrangements, sexuality, finance and degree of physical fitness.

Field safety
Familiarise yourself with the relevant written guidance on field safety, but do not assume that a ‘check-list’ approach to compliance will necessarily ensure safe fieldwork. Field safety should be seen as a continuous process of risk management and leadership from pre-visit risk assessment, through effective group leadership incorporating continuous assessment of, and adaption to risk, through to post field visit review.

Site access and conservation
Pay attention to issues of site access in the context of the CRoW Act 2000 (in England and Wales) and the Land Reform (Scotland) Act 2003. In particular, understand how this legislation influences where you are allowed to go and what you can do when you get there. If you suspect the field destination has a protected status, establish its designation in advance and act to comply with the appropriate regulations.
Fieldwork and disabled students
Be aware of the requirements of the Special Educational Needs and Disability Act (SENDA) (2001) and the Disability Discrimination Act (2005) especially in relation to the wide range of disabilities it addresses. Field courses can pose significant barriers to inclusivity which should be addressed at the planning stage. Redesigning a field course to increase its inclusivity often results in an improved learning experience for all students.

Disseminating your experiences
Take notice of the small, but increasing body of pedagogic literature which has investigated and, in some cases, discovered the benefits of fieldwork for the student learning experience. If you have your own ideas as to why fieldwork is special, take time to examine them objectively and if you’re still convinced, publish them!


5. References

All of the websites referenced here and in the text have been accessed and checked on 13/10/08.


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