The Higher Education Academy

Geography, Earth and Environmental Sciences (GEES)

GEES Learning and Teaching Guide

# Assessment in the Earth Sciences, Environmental Sciences and Environmental Studies

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# List of Case Studies



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# 1 Introduction

## *1.0 Rationale and structure*

This is one of a series of guides aiming to provide academics teaching in Earth Science, Environmental Science and Environmental Studies (ES3) subjects in higher education (HE) with some support and ideas for their practice. It has been written from a UK context, but much of what follows is relevant internationally.

The existence of these guides acknowledges that there are learning and teaching issues specific to these disciplines, and that academics in these disciplines can find the generic educational literature inaccessible. We have therefore attempted to produce something that acts as a bridge to some of the powerful ideas for practice - and the underpinning concepts about learning and teaching - that exist in the generic literature, whilst also integrating case studies of practice, and our own experience, from our own disciplines.

The ES3 subjects cover a wide territory, but we have used as a frame of reference the UK Benchmarking statement for these subjects (QAA, 2000b). As authors, we represent some of that diversity, with one being an earth scientist who has taught mainly on Geology programmes, and one being an environmental social scientist who has taught mainly on Environmental Studies programmes. It is hoped that this guide will complement an earlier guide on assessment produced for Geography (Bradford, 1998).

We recognise that most readers will not engage with our text in a linear fashion, even less so in the electronic version. There is though some rationale to the structure that may help you find material relevant to you.

- in Section 2 we provide a conceptual and practical outline of the teaching, learning and assessment system;
- in Section 3 we review some key aspects of the general debate around assessing learners in HE;
- in Section 4 we discuss the role of assessment in particular issues and themes that are central to our disciplines.

Embedded throughout the text are a number of ES3 case studies – these illustrate particular issues and themes in the main text, but can also stand alone as examples of assessment practice. Case studies are attributed to originators, departments and institutions as correct at the original time of reporting. In some cases people have moved on and departments have been renamed, so a list of current contact details for individuals is provided (where available) at the end of the guide. Many case studies are relevant to more than one assessment issue, so we have attempted to cross-refer where appropriate. We have favoured a concise reporting of initiatives, presented in boxes throughout the text. Where fuller accounts have been published, references have been provided.

We have also placed a number of activities throughout the text. These are designed to make the process of engagement more active, and to help frame your own thinking about certain issues. Where you encounter these we suggest that you note your own responses before moving on.

Overall, we are not trying to convey a message that there is a right or a wrong way to address issues around assessment and learning outcomes in the ES3 subjects. Instead, we hope to be part of a process whereby individual academics can develop a portfolio of valid assessment techniques which can be deployed as appropriate in a given context, and where academic departments or programme teams can think through these issues strategically.

In general, we have approached this guide not particularly as experts in all aspects of assessment practice, more as enthusiastic and reflective innovators who hope to stimulate reflection on assessment practice, be it at the individual, module, programme or department level - and through that to enhance the student learning experience. We are seeking to complement, from a subject-specific perspective, more comprehensive guides to generic assessment issues (e.g. Brown and Pendlebury, 1992; Brown and Knight, 1994; LTSN 2001), and we will focus on aspects of assessment in the ES3 subjects which we feel are particularly challenging or distinctive.

## *1.1 Assessment and learning outcomes in ES3*

As academics, we are continuously engaged in assessment-related activity. Indeed, Gibbs (1999, p.41) has stated that: "assessment is the most powerful lever teachers have to influence the way students respond to courses and to behave as learners". As such, the care that we put into the design of assessment is likely to influence the quality of our students' learning more than, say, decisions we make about the content of a lecture schedule.

## ACTIVITY 1

Before considering assessment issues in more detail, pause and reflect for a moment on your own practice. Select at random one item of assessment that you require your students to complete. Ask yourself the following questions:

- what is the purpose of the assessment?
- what exactly are you assessing in your students' learning?
- what method did you employ and why did you select it?
- how does it relate to other pieces of assessed work that the students involved will complete?
- what other methods might you have used to achieve the same outcome, be that a learning outcome, or a grade?

These are not the only questions we might have asked you to think about, but thinking through them should already have thrown up a lot of issues. For example, was your assessment designed to generate a grade, or to stimulate learning, or both? Was it assessing knowledge, skills, or both, and how do these relate to the intended learning outcomes of the module or programme of which the assessment forms a part? Did you select a particular method after careful consideration of the advantages and disadvantages of a range of alternatives? Or was the choice of method automatic, based on routine departmental practice or policy? Does the assessment form part of a strategy for a module, or programme? How much are we influenced by our academic disciplines?

We hope that this guide will help to stimulate some reflection on these issues, and we also aim to provide some explanation as to why we consider these sorts of questions to be important, together with some possible answers and approaches.

This is a good time to take stock of assessment issues, as over the past ten years the assessment agenda has shifted a long way in HE. While there have been many dimensions to this change, the overall trend has been:

- to increase the diversity of assessment methods;
- to assess skills, as well as knowledge and understanding;
- to see assessment as an integral part of a student's learning, not merely a means for certifying performance;
- to relate assessment clearly to the intended learning outcomes of a student's programme of study;
- to be more transparent and open with students about assessment processes.

In the UK, this has culminated in the Quality Assurance Agency (QAA) devising and issuing a Code of Practice on Assessment (QAA, 2000a) which should inform all practice in HE institutions.

The UK QAA subject benchmark statements for ES3 (QAA, 2000b) avoid being prescriptive about assessment methods (Eastwood and Blumhof, 2002), but do offer the following guidance:

- learning, teaching and assessment (LTA) methods should be seen as interrelated, and should therefore be designed together;
- LTA methods should develop and assess knowledge, skills and understanding;
- LTA methods should be made explicit to students;
- LTA methods should be justifiable in terms of the stated learning;
- LTA practice should be regularly evaluated in the light of developments in the subject and in the academic community at large.

Taken together, the above points give us a snapshot of current thinking regarding assessment, and help to define the issues and perspectives featured in this guide. However, we would not want to give the impression that changes in assessment practice are merely driven by quality *assurance* processes. The fact that the quality assurance framework has highlighted these issues reflects a growing body of research into the relationship between student learning and assessment in HE. This literature shows that assessment has the power to *enhance* student learning, but also that inappropriate assessment can limit and constrain learning. Elton and Johnston (2002) provide a concise review of research into assessment issues in HE.

As this guide is written for HE academics it will, at times, seem that we are adopting a very teacher-centred approach, given that we are suggesting strategies, tactics and interventions that HE teachers can make. In fact, all of what we discuss here is based around a student-centred perspective on learning.

# 2 Alignment of learning outcomes, assessment and teaching

## *2.0 Introduction*

**ACTIVITY 2**

Take one intended learning outcome from a module that you are responsible for, or participate in the delivery of.

Think about how you assess whether your students have achieved this outcome.

Are you able to articulate levels of achievement for this outcome?

What teaching/learning activities have you put in place to enable your students to develop their learning towards this outcome?

As academics in the ES3 subjects, we are used to thinking about the world in terms of systems. When considering the relationships between learning, teaching and assessment we think it is helpful to do the same: all elements are related; there are inputs and outputs; there can be positive and negative feedback loops, and so on. While as teachers we can design certain elements of this system, we are not in control of all aspects of it (e.g. students' prior knowledge).

What we are leading to here is the principle that assessment shouldn't be considered in isolation from the other aspects of this 'system', especially the intended learning outcomes that we have elaborated for our students and the teaching/learning activities that we design to facilitate these outcomes. Indeed, the educationalist John Biggs theorises this relationship as: "a balanced system in which all components support each other, as they do in any ecosystem" (Biggs, 2003, p. 26).

Biggs (2003, p. 27) adds:

> "In aligned teaching, there is maximum consistency throughout the system. The curriculum is stated in the form of clear objectives, which state the level of understanding required rather than simply a list of topics to be covered. Teaching methods are chosen that are likely to realise those objectives; you get students to do the things that the objectives nominate. Finally, the assessment tasks address the objectives, so that you can test to see if the students have learned what the objectives state they should be learning. All components in the system address the same agenda and support each other."

He introduces the term 'constructive alignment' to provide the overall framework for these ideas.

So how do we put this theory into practice? In the next section we outline an approach for this, which is built around the two standard scales of operation in HE - the programme and the module. In doing so, we will admittedly focus on what can seem a technical process of aligning outcomes with assessment, as these two issues are the remit of this guide. However, this process of 'making visible' factors that have previously been hidden to students (and probably tutors) can only be a helpful adjustment to the student's learning context. We acknowledge though that the most important part of the alignment process comes in devising appropriate learning/teaching activities that will help students develop towards the intended, and beneficial unintended, outcomes. Some aspects of this are expanded within this volume, but it is a theme that is also taken up in the companion guides.

## 2.1 Aims, learning outcomes and levelness

In terms of programme, module and even individual class design, we firstly need to clarify the learning objectives. These will normally be informed by a set of *aims*, which can be cascaded into a clear list of intended *learning outcomes*. In a constructively aligned teaching/learning environment, the teacher will design teaching/learning events that will provide students with an opportunity to develop (learn) the knowledge, skills and understanding expressed in the outcomes. The teacher will also design appropriate assessment that will enable the student to demonstrate achievement of these outcomes, in a form subject to independent verification. None of this precludes the fact that most learning, teaching and assessment will also result in beneficial unintended outcomes.

Advice on the wording of aims and learning outcomes varies, and therefore we need to be cautious about accepting any one specific set of instructions. It is likely that your own institution has developed guidelines, and clearly you should work within these. Some other helpful guides are:

- Jennifer Moon's *The Module and Programme Development Handbook* (Moon, 2002);
- the University of Hertfordshire's 'Guidelines on Learning Outcomes', together with a very useful FAQ, can be found at http://www.herts.ac.uk/tli/guidelines/guidelines_contents_main.html;
- Kansas State University's 'How to Write Learning Outcomes' can be found at: http://www.ksu.edu/apr/Learning/HowTo.htm.

*Aims* are usually written at an aspirational level; they are the overall purposes towards which a course team is working. Aims will be informed by the national subject community, but also national priorities in HE (e.g. regarding widening participation), as well as by institutional and school/department aims. Typical aims at the honours degree programme level in the ES3 subjects might include:

- this programme aims to provide an interdisciplinary working environment for its students;
- this programme aims to produce graduates who are aware of the ethical dimensions of environmental issues;
- this programme aims to equip graduates for work in a wide range of environmental and sustainable development professions;
- this programme aims to equip students for independent collection and documentation of information in the field.

None of these aims are necessarily assessable but, if they are stated, then a course team must be able to show how they will be met. This is done by cascading to a set of intended *learning outcomes* that each graduate of the programme will be expected to have achieved.

*Learning outcomes* should be succinct statements of the learning that a student should have achieved and, importantly, should have demonstrated, upon completion of a particular learning sequence. We note in passing that the rise to prominence of an outcomes-based approach in HE has not been without controversy, nor has the critical debate over its relative worth ended (see Atkins et al., 1993, pp 45-48 for a full account of this debate).

Learning outcomes are normally expressed as verbs (e.g. analyse, synthesise, describe) that learners have to enact in relation to a particular knowledge base or situation (Biggs, 2003). The conventional rubric for learning outcomes begins with either: *upon successful completion of this programme/module, students will be able to…*, or *upon successful completion of this programme/module, students will have demonstrated…*. Some commentators favour one over the other, some apply the first of these to skills and the second to knowledge. Some institutions have strict guidelines on language, others are more flexible.

In writing learning outcomes, particular consideration needs to be given to *level* (Moon, 2002). Level can indicate both a stage in learning (e.g. an honours degree may be conceived as having three levels of study) or level of performance (e.g. the QAA's qualification descriptors). Many HE institutions are now producing their own level or qualification descriptors, and these are designed to guide and inform programme and module development within them.

For convenience in the following discussion, we will adopt the framework outlined in Table 1, which is prevalent in UK HE. It should be noted that these 'levels' are not necessarily synonymous with years of study.

### Table 1: Levels of study and awards in UK higher education

| Level | Award equivalence |
|---|---|
| 1 | Certificate |
| 2 | Diploma |
| 3 | Honours degree |
| 4 | Masters |
| 5 | Doctorate |

Two taxonomies that are widely referred to when discussing levelness are Bloom's Taxonomy and Biggs' SOLO (Structure of Observed Learning Outcome) Taxonomy. Bloom's has been reproduced extensively in the past ten or fifteen years, and has been attractive to both academics and administrators as it provides a ready, structured vocabulary of verbs for phrasing learning outcomes at the appropriate level. One way in which this taxonomy can be framed in terms of a three level Honours degree programme is outlined in Table 2.

### Table 2: Bloom's taxonomy of education objectives mapped against the three levels of an Honours degree programme (Bloom, 1965).

| Level one | | Level two | | Level three | |
|---|---|---|---|---|---|
| Know | Understand/ Comprehend | Apply | Analyse | Synthesise | Evaluate |
| *E.g.:* | *E.g.:* | *E.g.:* | *E.g.:* | *E.g.:* | *E.g.:* |
| Define | Express | Apply | Experiment | Integrate | Judge |
| Describe | Discuss | Interpret | Distinguish | Develop | Revise |
| Identify | Clarify | Practise | Debate | Design | Value |
| List | Recognise | Operate | Categorise | Create | Rate |
| State | Report | Employ | Infer | Organise | Question |
| Measure | Summarise | Predict | Relate | Formulate | Defend |

Bloom's taxonomy has been criticised for concentrating on the cognitive (thinking) domain, with people recognising the need to include affective (feeling) attributes and skills, including for example reflection, self-motivation and independence. Moon (2002) also points out that it is not the verbs themselves that imply a level of learning, but their combination with a problem, some aspect of the knowledge base, or some other learning situation. For example, you might 'rate' the success of something in simple quantitative terms, based on data provided by others (maybe at level one), or you might rate the success of a range of concepts in explaining a given state of affairs (more like level three). As such, there is a danger when Bloom's taxonomy is applied rigidly, e.g. by insisting all level three examination questions should incorporate verbs from the 'synthesise' and 'evaluate' columns in the table above.

Biggs' SOLO taxonomy, developed in the late 1980s, distinguishes between five approaches to learning that might be evident in, for example, a learner's attempt at an assignment. As with Bloom's taxonomy, this can be considered as a staged model, with each stage associated with progressively higher-level cognitive skills (Table 3).

**Table 3: Biggs' SOLO Taxonomy (Biggs, 2003)**

| Stage | Characteristics of learning | Examples of Verbs |
|---|---|---|
| Prestructural | Misses point. Doesn't understand the question. | |
| Unistructural | Can identify one relevant element in response to a question. | Identify, name. |
| Multistructural | Can identify multiple relevant elements in a response to a question. A 'shopping list' of ingredients. | Describe, list, combine, enumerate. |
| Relational | Integrated response, addresses the question, ties things together. A recipe. | Compare, contrast, explain, analyse, relate. |
| Extended abstract | Goes beyond what has been given, applies to new or different domains, reconceptualises. | Theorise, generalise, hypothesise, reflect. |

This taxonomy might be used as an aid in the development of level descriptors, or graded assessment criteria (see below).

## 2.2 *Cascading aims and learning outcomes*

**ACTIVITY 3**

Take one of the four ES3 Programme Aims listed under 2.1 above (page 4), or devise one of your own. We will assume that these programme aims relate to the Honours degree level.

First write a programme learning outcome (LO) relating to this aim.

Secondly, if it is to be assumed that a learner is to demonstrate achievement of this outcome, write three module learning outcomes that might contribute to delivery of the programme outcome, one for each of the three levels of an Honours degree.

One response to the above activity might look something like this:

- Programme Aim: To produce graduates who are aware of the ethical dimensions of environmental issues.
- Programme LO: Upon completion of this programme students will have reflected on the ethical dimensions of a range of environmental issues.
- L3 module LO: … students will have evaluated the ethical dimensions of international environmental affairs

- L2 module LO:
  …students will have analysed the management of biodiversity in terms of both utilitarian and non-utilitarian views of non-human nature
- L1 module LO
  …students will have described and discussed a number of ethical perspectives on the non-human world, including deep ecology, the land ethic and animal rights.

In arriving at these outcomes, we have paid attention to *level*, in that progressively higher levels of cognitive and affective performance are required of learners, from description through to evaluation and reflection. Note also that the reference to the knowledge base has gone from the level of the specific (perhaps allowing for Biggs' unistructural or multistructural responses) to that of synthesis and relation, perhaps even leading toward the level of extended abstract.

The other key point to note is that the outcomes above have been written to *threshold* performance, i.e. the minimum performance required to gain a pass. This does not mean that all performance will be at this level; most of us experience a range in our students' expression of their learning. This variety in performance will be reflected in the grade or classification that we award to a particular piece of assessed work. This leads us nicely to the next consideration, assessment criteria.

## *2.3 Assessment criteria*

Consistent use of assessment criteria is a key aspect of making the assessment process reliable and internally reliable. The changing assessment culture has tried to shift these criteria from being tacit, implicit, hidden and subject to guesswork by students, to being rendered visible and explicit. This can go beyond the tutor publishing the criteria, to including students in the development of those criteria. An intermediate position, common for examinations in the sciences, and in team-taught and team-assessed modules, is where assessment criteria are incorporated within a written marking scheme.

A key principle of assessment within a constructively-aligned learning and teaching environment in HE is that it should be criterion-referenced, not norm-referenced (Biggs, 2003 – especially pp143-168 which gives a full discussion of this debate). *Norm referencing* attempts to assess characteristics of individuals relative to other individuals, or against general norms. *Criterion referencing* is designed to assess changes in assessment performance as a result of learning that has been undertaken.

Devising and writing out appropriate criteria, particularly graded criteria, can be time-consuming. To overcome this, some departments and even whole institutions have developed generic criteria or grading schedules. This can be helpful when first introducing criteria, and is useful for gaining consistency across modules. However, generic criteria can lead to inflexibility. For example, would exactly the same criteria be applicable for an in-class presentation, a field report and an essay? To accommodate this diversity, it is possible to develop a universal checklist of criteria, with a tutor stating in advance which are being applied to a particular assignment. However, this flexibility is less easy to achieve with graded criteria.

One common problem with all of these sorts of generic criteria and checklists as they are often currently expressed is their heavy reliance on *negative* terms. For example, a threshold pass might be expressed as: "Poor response, fails to directly engage with the question, little evidence of analysis, no wider reading, lacks structure, poor referencing." This approach usually results from starting at the highest level of achievement, and then working down, but what results is a statement that gives the impression that the intended learning outcomes have hardly been achieved; something that must be the case if a pass grade has been awarded.

Instead, the recommended approach is to start writing assessment criteria at the threshold, i.e. what is required to pass, and then build up to the higher grades of attainment.

## ACTIVITY 4

*Writing threshold assessment criteria*

Let us take as an example an individual essay assignment that was designed to test achievement of the level 2 module learning outcome expressed above:

> *students will have analysed the management of biodiversity in terms of both utilitarian and non-utilitarian views of non-human nature*

Alternatively, work on your own outcome:

Now draft threshold graded assessment criteria for this outcome:

One version of threshold graded assessment criteria for the above outcome at level 2 might be:

> *Cites relevant examples from the management of biodiversity, and demonstrates limited capacity to analyse these through applying 'utilitarian' and 'non-utilitarian' views of non-human nature. May depend heavily on lecture material with only limited evidence of wider reading. Comprehensible written communication, some attempt at citing source material.*

Even here, we are perhaps drifting away from our one intended learning outcome, into issues to do with referencing and communication. This reflects that in fact this assignment may be assessing more than one learning outcome – including some that may be skills-related. These other outcomes would of course need to be stated in the module guide and assignment brief if we are indeed intending to assess them summatively.

To summarise, Brown (2001, p16) offers the following key principles for devising assessment criteria:

- decide on the essential criteria
- make the criteria or checklist simple to use
- allow for brief global impressions
- give the criteria to students before they do the assignment
- if possible, involve them in the design of the criteria and checklist
- encourage students to use the criteria

and she lists the characteristics of good criteria such that they:

- match the assessment task and learning outcomes
- enable consistency of marking
- can pinpoint areas of disagreement between assessors
- help students to achieve the learning outcomes
- be used to provide helpful feedback to students.

# 3 Choosing an assessment approach

## 3.0 Introduction

So far we have outlined certain aspects of a teaching, learning and assessment approach. We have designed aims, developed intended learning outcomes, and articulated criteria for assessing achievement of those outcomes. The next logical step would be to design a teaching approach that will help students develop their learning toward those outcomes. However, a full discussion of teaching and learning methods and strategies goes beyond the remit of this guide. So what we will focus on now are the decisions that are to be made about assessment. These decisions are at the *strategic level* (the general approach we wish to take) and the *tactical level* (what methods we might use in any given situation). To aid us in this discussion we need to take a couple of steps back, to consider the purpose of assessment.

## 3.1 Purpose of assessment

Brown (2001) grouped the purposes of assessment into three main areas:

- the improvement of student learning;
- certification – "the license to proceed to the next stage or to graduation" (p.6);
- classification.

She points out that these purposes may at times be in conflict, and that no one piece of assessment would necessarily fit all purposes.

Gibbs (1999, p47) suggests the six main functions of assessment to be:

- capturing student time and attention (e.g. through motivation)
- generating appropriate learning activity in students
- providing feedback which students pay attention to
- helping students to internalise a discipline's standards and notions of quality
- marking to enable pass/fail decisions to be made
- quality assurance through providing evidence to outsiders, enabling judgements about appropriateness of standards to be made.

The first four of these fill out the ways in which strategic assessment can help improve students' learning, and in part recognise that much of what motivates students to work outside of class time is indeed completing required assessment.

Brown and Pendlebury (1992) and Brown and Knight (1994) offer longer lists of purposes (seventeen and thirteen respectively), which on the whole cover the three areas of certification, classification and improving learning. The former also add that the results of assessment feature heavily in selection for employment, and the latter prosaically suggest that part of the reason we assess is that we have always done so.

The primary foci of this guide are the issues, techniques and tactics associated with using assessment for the improvement of learning.

## 3.2 Assessment principles

The basic guiding principle of assessment must be that any inferences drawn from it about a student's knowledge, skills, understanding and overall abilities must be reliable, valid and not open to misinterpretation. Knight (2001) also commends that assessment should be affordable and useable. What do these terms mean?

### 3.2.1 Reliability

Reliable assessment should be objective, accurate, repeatable and analytically sound (Knight 2001). It should not be compromised by intra-marker or inter-marker bias. The tool used should be appropriate and sensitive to the item being measured so that the result is accurate. Measurement procedures must be clear and consistent so that they are repeatable between different observers/markers, or from year to year, for example. Finally, allocation of marks, addition of marks and their transfer to other systems should be accurate and error free.

### 3.2.2 Validity

Validity of assessment is primarily concerned with whether what is intended to be assessed is assessed. This can also be turned around as: "what is not intended to be assessed should not be assessed" (e.g. through hidden or tacit criteria). In a constructively-aligned framework, this might be expressed in terms of whether assessment is aligned with intended learning outcomes or not.

Validity may be relatively more straightforward to achieve for simple outcomes where a reliable assessment can be easily formulated (e.g. a knowledge-based learning outcome concerning mineral compositions: What is the chemical formula of quartz? Answer: $SiO_2$) but much harder for more complex learning outcomes concerning abilities such as 'critical thinking', 'creativity' or 'originality'. Is the assessment method used a valid tool for assessing these more complex outcomes? Knight (2001) suggests that we often "unwillingly and perhaps unwittingly" fail to assess all learning outcomes validly because we are driven towards increased reliability of assessment and this leads to simplicity (Breland 1999, Linn 2000), and a resulting inability to assess complex outcomes validly.

### 3.2.3 Affordability

The principal limitation on affordability is staff time, especially if the principles underlying 'reliability' above are considered. Assessment of low-level outcomes may be routinely assessed by efficient means such as computer-mediated multiple-choice questions, which may take initial time in setting up, but can then run in a more or less independent fashion. However, more complex tasks are less routine. Breland (1999) demonstrates that reliable assessment of students' skill at writing single-page pieces on general unprepared topics requires three trained assessors to look at three different pieces of writing from each student. This is clearly very expensive in terms of both training the assessors and then using their time. Moves towards requiring double marking of most assessments has clear resource issues for departments, and in the light of Breland's comments may not actually improve reliability in the generally assumed way.

In an attempt to make the assessment process more affordable, there has been an increase in the use of assessment of in-class presentations, with the added bonus of rapid feedback. Group assignments can also bring resource savings in terms of the time taken to assess the product. While we commend these types of assessment as completely appropriate for bringing about certain developments in students' learning, we would caution against the validity of any approach that was adopted simply on cost terms, without due consideration to the relationship to student learning. Other attempts to make assessment more affordable whilst retaining validity have focused on being more efficient in the provision of feedback (see 3.4 below.)

A more strategic approach to assessment includes more careful consideration of its staging, so that the assessment activities of the tutor are not bunched into a few weeks of the academic year. Even if a department or programme doesn't adopt such an approach, this is one area where an individual academic should be able to take more control over their assessment loading.

### 3.2.4 Usability

Usability concerns the usefulness of assessment. Internal usability concerns the usefulness to students, teachers and managers within an institution. Does the assessment outcome provide usable evidence for progression from one year or level to the next? External usability concerns the usefulness of assessment outcomes to employers, postgraduate schools etc. Will the graduate be capable of completing future tasks that lie in wait. National benchmarking coupled with the increasing development of accreditation within ES3 has concentrated on subject content, subject-specific skills and transferable skills. It is likely in the future that these external stakeholders will want a bigger say in assessment, for example a demonstration that assessment is directly aligned with intended learning outcomes. This may be achieved by inclusion of academic transcripts in student progress files, or by students

themselves logging information during Personal Development Planning. As such, this is primarily an institution-level concern and so will not be developed further in this guide, which is designed more for the individual module-level practitioner or departmental programme-level teams.

### 3.2.5 Fitness for purpose

It is clear from the above that assessment needs to be reliable, valid, affordable and useable. It must be fit for purpose and be seen to be so, but not so overbearing that it prevents the student or lecturer from doing anything else! Assessment methods should be clearly related to the stated aims and learning outcomes, and be compatible with the learning environments used. It is unlikely that a single method can adequately assess the outcomes at a module level, and it would be appropriate at programme level for students to experience a wide range of assessment methods in order to ensure a comprehensive assessment of student performance at the programme level that is reliable and valid. *This implies the need for a system of assessment rather than a set of isolated module-level assessments.*

**ACTIVITY 5**

What steps does your own institution/department/board of studies take to ensure that assessment is fit for purpose at programme and module level?

Responses here might include annual reporting mechanisms, involvement of employers in approval or revalidation events and so on.

Before discussing fitness for purpose further, it is appropriate to run through and summarise some the range of assessment methods available.

## *3.3 Formative and summative assessment*

All assessment provides some measure of student performance or ability. For summative assessment, this measure is typically a number or grade, leading ultimately to an indicator of competence such as a degree certificate. Summative assessment is often referred to as high-stakes assessment – it is essential that the assessment gets it right, so it must be reliable and valid.

Formative assessment, on the other hand, does not usually provide a mark or grade – although this can be provided if it is seen as helpful in enabling students to learn about standards. Instead it provides guidance to a student concerning what they need to do to improve their work through feedback on what they have done. Formative assessment is often referred to as low-stakes assessment, because the need for reliability is reduced. However, formative assessment is not just something to do when there is no summative alternative. Black and William (1998) have reviewed 681 research publications on formative assessment and found conclusively that *formative assessment does improve learning.*

A purely theoretical approach to assessment might distinguish between the roles of formative and summative assessment, the former being to improve learning and help develop a body of evidence, the second to provide reliable measures of students' abilities. However, with increasing student numbers in HE, we also need to allow for the fact that most assessments that students undertake have both a formative and a summative role. In reality, the boundaries between these two assessment forms are somewhat blurred. It is becoming more common practice for students to receive feedback on performance in summative assessments, even terminal exam papers. It is also common for indicative grades, awarded for essentially formative tasks or assignments, to contribute small percentages to final summative marks for a module/programme.

Overall we would encourage the strategic use of pure formative assessment, but recognise that, especially in a climate of rising staff-student ratios, we should look to maximising the formative potential of all assessment, including examinations, through the provision of effective feedback to learners (see 3.4 below). This should be coupled with the strategic staging of assessment events. The potential role of formative assessment in developing field skills is outlined in Case Study 17.

## 3.4 Providing feedback

Providing good and timely feedback is a fundamental requirement of assessment that has a formative purpose – this can be a time-consuming process for the tutor, but is an essential part of learning for the student (see Case Study 13). Following from the discussion above, feedback has a clear relevance and use for the student when it is directly related to assessment criteria, and also the intended learning outcomes.

Some general principles for good feedback include:

- relate it to assessment criteria and learning outcomes
- outline strengths of the work as well as any weaknesses – don't just raise negative points
- where negative points are made, supplement these with advice on how performance can be improved
- don't use a red pen – many students are blind to red ink following its over-use at secondary or high school
- try to avoid using ambiguous symbols like '?', '!' or ',' – make sure your meaning will be understood by your students
- try to incorporate all of this within the 'sandwich technique' – start with positive comments about the successes of the piece of work, then comment on any weaknesses with advice on improvement, and finish with a positively toned comment on the overall achievement in the assessment.

A further suggestion is that feedback is most effective when personalised, though such an approach is becoming difficult in the shift to anonymising assessment. Whitelegg (2002), drawing upon focus groups with tutors and students, discusses this debate and puts forward one way of overcoming the impasse: mark anonymously but provide feedback non-anonymously.

There are several techniques for providing feedback, some of which are outlined below.

### 3.4.1 On-script comments

On-script comments are usually reactive, and can tend towards simply pointing out errors, or the use of ticks and crosses. Some people have suggested that receiving back a script covered in tutor's comments, especially if it is in red ink, can have a negative psychological impact on students. Alternatively, a student may feel that work has not been read properly if there is not some indication that a tutor has looked at each page. To get around the first problem, one technique is for the tutor to put small numbers at points on the text that they wish to comment on, and to run a separate feedback sheet correlating with this.

### 3.4.2 Verbal feedback

For certain forms of assessment verbal feedback can be appropriate; for example in individual supervision sessions where a student may be given verbal advice on progress so far and advice for future development. Verbal feedback's major weakness is that there is typically no permanent record for either the tutor, student or moderators; and if used for giving class-wide feedback not all students may be present when it is given. The availability of tools such as "Horizon Wimba", which integrates with VLEs such as Blackboard and WebCT, can facilitate on-line presentation of verbal feedback. Verbal feedback could be recorded and delivered through a VLE as well as in person.

Such feedback can be helpful in more formative situations, for example in individual supervision sessions where a student may be given verbal advice on progress so far and advice for future development. Ironically, one form of assessment where verbal feedback remains almost the only viable option is with terminal examinations, and this is often only provided at the request of the student. Historically, the dominant mode of assessment in the sciences – the examination – has usually resulted in no feedback to the students, beyond the grade. There are now some signs of innovation in providing formative feedback on examination performance where learners are at an interim stage (e.g. end of semester one, end of level one or level two), for instance through the tutor providing a report back to the class on the general strengths and weaknesses of responses to each question.

### 3.4.3 Assessment sheets

The use of assessment sheets is now widespread in HE, although their style and format can vary considerably. At one level they can be an almost blank page with a heading such as 'tutor comments' and a box for the grade. Alternatively they can be an extensive list of assessment criteria, with room for comment against each. A variant of the latter is to grade each criterion (see section 2.3), for example from first to fail, but this can create some confusion for students if it is not clear that some criteria are weighted more heavily than others.

Assessment sheets can be a very effective way of providing rapid and prompt feedback that a student understands and that clearly relates to assessment criteria. However, some tutors can find this process a little mechanistic and limiting, and so it would be usual to incorporate space for more qualitative and holistic comments. Overall though, the use of pre-printed feedback sheets probably provides the most cost and time effective way of providing prompt feedback that is visibly correlated with learning outcomes and assessment criteria.

#### 3.4.4 Class-wide feedback

For most assignments, tutors can find themselves commenting on similar strengths and weaknesses for many students. In these circumstances it can be efficient to write an overall piece of tutor feedback for the whole class. Verbal feedback in a scheduled class can also be useful, but runs the danger of not reaching absent students – often the ones most needing the feedback. On the other hand, there is no guarantee that students will read written feedback. Another version of this method can be used if largely the same assessment format is used from one year to the next in a given module – here the class-wide feedback for the previous year might usefully be included in the module guide or the assignment brief of the current cohort.

## *3.5 Learning from feedback*

Feedback is useless unless students read or hear it, reflect and act on it. Some methods of improving the processing of feedback by the students include the following:

#### 3.5.1 Withhold the grade

The first thing that the student looks for when receiving feedback is the grade or mark, and it is at this stage that feedback can go unread. Some tutors have operated a system of withholding the mark until the student offers some response to the feedback (this can relate to issues of self-assessment – see below), or until there has been face-to-face discussion of the feedback. The concern with this technique is that it can be very expensive in terms of staff time.

#### 3.5.2 Analyse feedback in tutorial sessions

In Environmental Studies at the University of Sunderland, a level-one core study-skills module incorporates a session on evaluating feedback. At the end of the first semester, students are asked to bring along all feedback that they have received in relation to assessed work (both formative and summative) during the start of their university careers. In the session they are handed a worksheet that asks them to group together the main positive comments, negative comments and suggestions for improvement they've received from all tutors across all modules. They then draw up a personal action plan for the coming semester, identifying priorities for their own development, and possible skills shortages that need addressing, based on the feedback they've received. Although this technique is only formalised at this one point of the course, the aim is that it establishes a culture of reflection on feedback that the students will carry with them through their studies.

It is likely that this sort of activity could readily be incorporated into Progress Files or Personal Development Planning as they become more fully used in HE.

## *3.6 When do we assess?*

Over the last thirty years there has been a general shift towards various forms of continuous assessment in HE programmes – for both formative and summative modes. Countering this, as student numbers have risen on many programmes in the UK in the 1990s, there has been some return to examinations. Most programmes have a balance between continuous and terminal assessment, but that weighting varies from department to department and from module to module.

The key advantages of continuous assessment in terms of student learning are that:

- it stimulates learning at strategic points, and therefore encourages continuous learning;
- as mentioned above, continuous summative assessment can have an important formative role, providing feedback is made available to learners in a focused and timely fashion;
- it spreads the load for the learner (and for the assessor);
- it more closely follows what happens in the real world: professionals work continuously and report appropriately at regular intervals.

Brown (1999) argues that such incremental assessment allows students to identify ongoing problems in their own learning and take action to put them right, whereas terminal assessment can be a 'sudden death' approach with no such facility. Staged assessment can be remedial, and hence can improve learning.

It has been suggested that one effect of the introduction of more continuous assessment has been to increase the total assessment load. If this is the case it may be to the detriment of both the student and the assessor. Another factor that militates against student learning is the bunching of assignments across several modules. It really is helpful if a programme-wide schedule of assignments can be developed, although within modular degree frameworks this can be difficult.

On the other hand, tutors recognise that, sadly, the best way of guaranteeing students' engagement with a particular learning task is to assess it. Gibbs (1999) reported this when he commented that, where the ratio of class/contact time to directed or self-directed study time is about 1:3 (a common ratio for many ES3 modules), students become more strategic about their use of time: focussing on what counts - i.e. to what is assessed. Clearly what is needed is a healthy balance.

Terminal assessment is the classical method with implied high reliability. The assessment takes place at the end of a period of learning (semester or year) and purports to provide a measure of the students' knowledge, understanding and skills. In ES3, terminal assessments tend to be written papers, but practicals, orals and Multiple Choice Questionniares (MCQs) are also commonly used. Their scope for providing formative feedback to help students is limited (see section 3.4), often due to university regulations, but also because the outcomes of such assessment are frequently some time after the assessment was taken. One commonly used mechanism comprises short progress interviews given by Programme Directors, though this rarely comes down to feedback on individual papers, let alone individual questions. There is an increasing trend (largely driven by Data Protection requirements) for institutions to be more open, with student access to all marked assessments and comments thereon.

## *3.7 Who assesses?*

One of the ways that the assessment agenda has moved on is in the recognition that the responsibility for assessing work should not necessarily lie just with the tutor. Instead of seeing assessment as something that is done to students, we can see it as something that tutors do with students (Brew, 1999). Most of this guide is about tutor-led assessment, and this reflects the dominant mode of practice. However, in this section we examine two other forms of assessment: student self-assessment and student peer-assessment. We will also raise some of the issues associated with moderation, which in itself amounts to an assessment of the assessors.

### 3.7.1 Self assessment

Self-awareness is seen as one of the many abilities and attitudes that students should develop in higher education, and the use of self-assessment is one way such abilities might be developed (Atkins et al., 1993). When first hearing about self-assessment, many academics assume it refers specifically to students awarding themselves grades. While in some circumstances this may be the case, a more rounded perspective on self-assessment sees it as any opportunity that a student has to reflect and comment on their own performance and to progress against a given or negotiated set of assessment criteria. There are a range of benefits to self-assessment: it should help students take a deeper approach to learning; it is a more effective simulation of the forms of assessment that students are likely to be exposed to in the world of work; it helps them engage with assessment criteria; and on the whole it helps students gain a better understanding of the mysteries of the assessment process. Perhaps most importantly is: "the goal of promoting the reflective student, one who has a degree of self-directing independence, and who is, therefore, well placed to be a lifelong learner." (Brown and Knight, 1994, p. 54).

Some good practice in self assessment includes:

- involving students in the development of assessment criteria;
- embedding it as a constant practice, rather than using it as a one off – students need practice to develop the skills (Boud, 1995). This means that self-assessment is much more effective when looked at from the departmental or programme level, rather than left up to individual innovators;
- moderation processes need to be sufficient to guarantee reliability, but not so overwhelming that they undermine the process (Race, 2001) – there is little point in offering a student the opportunity to suggest and justify a mark if the 'tutor-mark' always overrides it.

Some methods for introducing self-assessment include (Andresen et al., 1993):

- self-assessment questions, e.g. MCQs, through which students can assess the development of their knowledge. These have long been a feature of open learning materials, and are now being widely administered on-line as various Virtual Learning Environment packages are being taken up. This form of self-assessment would generally have a formative rather than a summative role;
- the use of attachment sheets with assignments where students are asked to respond to a series of prompting questions relating to, for example, the strengths of the piece of work, the areas needing improvement, the skills and knowledge that they have developed, how the work could be improved, and perhaps even a suggested mark with justification (e.g. Maguire and Edmondson, 2001, Case Study 1 below);
- the use of learning logs, diaries or journals, where students are asked to reflect on learning through a particular project, or even an entire course. This can be both formative and summative.

The introduction of self-assessment or self-evaluation undoubtedly affects the tutor-student power relationship, and at the very least renders the existing power relationships visible (Brew, 1999). Both tutors and students find the process challenging, and there can be problems with resistance (Brown and Knight, 1994), which again emphasises the need for embedding the process throughout the students' educational experience. The introduction of Personal Development Planning (PDP) in the UK HE sector will go a long way to establishing a culture of reflection and self-evaluation in students (see the Higher Education Academy website for general information about PDP: http://www.heacademy.ac.uk/867.htm

**Case Study 1**

**Student evaluation and assessment of group projects**

***Originator(s):*** Sarah Maguire and Sally Edmondson, Department of Environmental and Biological Studies, Liverpool Hope University College.

***Key Words:*** Group Work, Self Assessment, Fieldwork

This case study illustrates the use of group work as a vehicle for effective learning during fieldwork, together with the potential for self assessment as a means of developing reflective practice in students.

A compulsory level-one field course consists of several days of tutor-led activities followed by a group research project on a topic chosen from a list provided. They work for one day in the field, and conduct data analysis and produce a group report on return to campus.

Students are required to complete an individual self-assessment form in which they evaluate their own experience of the group project, evaluate the group report against the provided criteria and suggest a grade, together with an overall evaluation of the process.

An analysis of one cohort revealed that of 58 students, 48 awarded marks higher than the tutor, reduced to 30 students if a 5% variance either side of the tutor's mark is allowed. This suggests that at this stage of their degree, student self-assessment would be unreliable as summative assessment, though with further training and experience it might prove possible. The self-evaluation exercise does though have strength in formative assessment, particularly in stimulating reflection.

This group project and self-assessment activity at level one is the beginning of a strategic approach to the development of skills and independence that runs through the programme.

**Reference:** Maguire, S. & Edmondson, S., 2001. Student evaluation and assessment of group projects, *Journal of Geography in Higher Education*, 25, 2, pp 209-217.

### 3.7.2 Peer assessment

Peer assessment involves students contributing to the assessment or evaluation of their fellow students. It is seen as a means promoting students learning from each other, and also learning more about what is expected in the assessment process. Peer assessment is seen by some as useful training for effective self-assessment, as it gives students practice in applying and grading to criteria (Brown and Knight, 1994). There are two main types of peer assessment, one focusing on process, and one that assesses product.

Peer assessment focused on process is normally applied to students who have worked closely together in groups on some form of project work. It has been introduced as one way of addressing the concern that marks for group work can mask weak performance and fail to reward high performance. Two main methods of conducting this form of assessment have emerged, sharing a pool of marks between members, or weighting a group mark differently between individuals (Healey, 1997).

Under the pool approach, students may be asked to share marks amongst themselves according to how they feel each person has performed against various criteria. Thus a group of five students may be awarded a group mark of 60% by their tutor, the tutor then gives the group 300 marks to share amongst themselves – this may come out as 60+60+60+60+60, or 50+50+60+70+70, or 0+75+75+75+75 or any variation of this. The third variation shown here illustrates one of the problems with this particular approach – a tutor has awarded a low upper second class grade to the group product, yet four of the students end up with clear first class grades. For this reason, some tutors place limits on the extent to which the results of peer assessment can deviate from their own grade (e.g. plus or minus 5 or 10%).

A methodology for weighting a tutor-defined group mark differently for individuals is outlined by Healey (ibid.). Students allocate marks to themselves and to the other members of their group freely, but an individual weighting factor is calculated, based on the ratio between the individual score and the average group score. In a group of three, with individual group contribution marks of 60, 50 and 55, the individual average is 55. The student that scored an individual mark of 60 has a weighting of 60/55 +1.09. With a tutor-defined group mark of 57, this student's final grade would be 57 x 1.09 = 62.

**Case Study 2**

**Peer-based assessments for group work**

***Originator:*** Nigel Mair, University of Central Lancashire

***Key words:*** Peer assessment, group work.

The MSc programme in Waste Management at the University of Central Lancashire has developed a new approach to group activity assessment. Peer-based evaluation is being introduced for the first time as a component of the overall assessment of the main group activity.

Each student within a group will be able to allocate marks to all group members based on what they feel is a fair reflection of the contribution each has made to the piece of work. The total marks allocated for the group must equal a predetermined figure. The average of the mark for each student will be used to weight the mark they are awarded for the activity. Such an approach will mean that a high mark, equating to a perceived higher contribution for one student, must be matched by a lower mark, equating to a perceived lower contribution being awarded to other members of the group.

For example:

- 4 students working in a group
- Group work is assessed as a single submission and given a mark of 63%
- Group contribution must equal 400

    - Students are asked to indicate the contribution made by each of the team, including themselves. This should be done in secret by each student, and the four indicative contribution marks should total 400.

**continued...**

**...Case Study 2 continued**

Scenario 1:

- All students make an equal contribution…..100
- All receive 63%

Scenario 2:

- Student A: 90+100+90+100 = 380
  - % contribution = 95% (380/400)
  - individual contribution = 59.85% (0.95 x 63%)
- Student B: 110+100+100+110 = 420
  - % contribution = 105% (420/400)
  - individual contribution = 66.15% (1.05 x 63%)
- Student C: 80+70+80+80 = 310
  - % contribution = 77.5% (310/400)
  - individual contribution = 48.83% (0.775 x 63%)
- *Student D:* 120+130+130+110 = 490
  - % contribution = 122.5% (490/400)
  - individual contribution = 77.18% (1.225 x 63%)

It is hoped that this approach will encourage the students to consider the different positive and negative contributions leading to the production of a piece of group work. The marker will also gain an important insight into these unseen dynamics. Such an approach should also help to dispel student claims of unfairness with more traditional group assessment approaches.

**Reference:** Archived as Abstract 210 in the GEES Subject Centre good practice database: http://goodpractice.gees.ac.uk/cgi-bin/searchspec.pl?terms=210

In comparing these two methods, Healey (ibid.) found the individually-weighted group mark to be a more effective means of distinguishing the contribution of individuals. Brown and Pendlebury (1992) give further examples of these sorts of methods, and another illustration of calculating marks in peer assessment is presented in Case Study 2, from the MSc in Waste Management at the University of Central Lancashire.

Peer involvement in the assessment of product does not have to be related to group work. For example, individual in-class presentations, or posters (or indeed most assessment formats) could be assessed by all students watching them, according to the same criteria and marking sheet as used by the tutor. Hughes (2001) has outlined how peer assessment, using a standard marking sheet, can be used for practical write-ups, with no loss of quality in assessment, significant saving of staff time, and improvements in the standards achieved by students. With this form of peer assessment a main issue again is the extent to which the peer assessment is actually used in arriving at a grade, Many tutors put limits on this, for example by saying that 10% or 20% of the final mark for a piece of work is made up of an average of the peer marks. However, others have found that tutors' grades usually tally quite closely with those resulting from peers, so long as everybody understands and applies the same criteria. It has also been pointed out that peer assessment usually involves far more assessors than the usual single or double marking by tutors, and it might therefore be seen as even more reliable (Brown and Pendlebury, 1992).

All this talk of methodologies is fine, but we should not be deflected from the fact that to apply them, and to maximise the benefits for student learning, both students and tutors need training. Case Study 3 from Jennifer Blumhof illustrates one possible approach. Case Studies 11 and 12 go on to illustrate the use of peer assessment in field work.

To sum up, key factors in successful peer assessment include the following:

- students need to be inducted or trained for the purpose – don't just expect them to be able to do it without any preparation;
- assessment criteria must be clear and understandable;
- the role of the tutor in marking and moderation must be made clear at the outset so as to avoid raising expectations;

- as with self-assessment, students can initially be reluctant to use the method, and may employ 'passive resistance' by awarding equal marks. However, once the methods become familiar and established, rather than just being seen as the whim of one 'innovative' tutor, they will be accepted.

**Case Study 3**

**'Marking Your Tutor' – an introduction to peer assessment**

***Originator(s):*** Jennifer Blumhof, Environmental Science, University of Hertfordshire

***Key Words:*** Peer Assessment; Assessment Strategy

This formative exercise has been developed to induct students into the peer assessment process. Peer assessment is an integral part of the learning, teaching and assessment strategy of all levels of the undergraduate degree programme, yet students find it somewhat problematic and challenging.

For the 'Marking your Tutor' workshop, students were informed that their tutor was going to give a short (5-10 min.) presentation, and that they had to mark it, agree a mark amongst themselves and give feedback, thinking of their tutor as a peer. They were first asked to develop a set of assessment criteria in pairs, reflecting both content and presentation. The whole class pooled these, and then agreement was reached regarding which eight criteria would be applied (four each for content and presentation.) The tutor gives the presentation (on the positive and negative effects of peer assessment, and on how to give appropriate and sensitive feedback), and then leaves the room while the students agree a mark. After 10 minutes the tutor returns and receives the mark and feedback, and then makes some concluding remarks about the process.

Students find the workshop a non-threatening and fun way of exploring the issues around peer assessment, although the approach does demand a brave tutor. The approach also illustrates one method of aligning the learning/teaching approach with the intended outcomes and assessment.

**Reference:** Presented at the Good Ideas in Environmental Sciences Learning & Teaching 'Swap Shop', University of Kingston, Surrey, on 23 February 2001, and Abstract 181 in the GEES Subject Centre database (http://www.gees.ac.uk).

## *3.8 Assessment methods*

**ACTIVITY 6**

List all of the assessment methods that you personally make use of in your teaching.

Compare this to the range of methods that you know to be employed on the main programmes of study that you are concerned with.

Is there a standard mix of methods, or of weightings, between continuous and terminal assessment that your department makes use of, or is there considerable scope for individual variation?

In all of the discussion so far, we have assumed that as tutors we keep an open mind about which format is most suitable for a particular assessment event. We evaluate alternatives, and select the option that offers some balance between the best method for developing our students' learning towards intended outcomes, the most reliable method, and the method we (or our department) can afford. Ultimately we have an extensive toolkit available to us.

In deciding on an assessment method it is useful to consider the following points raised by Beauchamp *et al.* (1996):

- Why am I using this type of assessment?
- Why am I assessing the students at this time? What am I assessing?
- What do I want to learn about the students through this assessment? What is my goal?
- What do I want the students to learn from this assessment?
- Is my assessment based on my intended learning outcomes?
- Are my students well-prepared for the assessment?
- Are different ability levels considered?
- What is my follow-up activity after the assessment?
- Is there anything about the assessment that would be difficult or confusing for the students?

In UK HE there is a wide potential of assessment methods that may be used to match the range of different learning environments, which include: lecture; practical; tutorial; seminar; independent study; field work; computer-aided learning; role play. Brown (2001) lists the following assessment methods:

- cases and open problems;
- computer-based assessments;
- direct observation;
- essays;
- learning logs/diaries;
- mini-practicals;
- modified essay questions (MEQs);
- multiple choice questions (MCQs);
- orals;
- objective structured clinical examinations (OSCEs);
- portfolios;
- poster sessions;
- presentations;
- problems;
- projects, group projects and dissertations;
- questionnaires and report forms;
- reflective practice assignments;
- reports on practicals;
- self-assessed questions based on open learning (distance learning and computer-based approaches);
- short answer questions;
- simulated interviews;
- single essay examinations;
- work-based assessments.

**ACTIVY 6 reprise**

Compare this list to the one that you drew up at the beginning of this section.

While an ES3 programme, or any individual academic, might not make use of all of these methods, it could, and we say should, use a significant number. As with any dynamic system, stability in part derives from diversity.

## 3.9 Moderation

We have mentioned the importance of effective systems of moderation in the development of self and peer-assessment regimes. However, moderation is a key element of all assessment practice. In UK HE, most moderation is performed by departmental academic peers, with the additional layer of one or more external examiners. The accepted culture is of an internal, but visible, system that guarantees appropriateness, fairness and consistency, and - most importantly - validity and reliability, in the application of academic standards. Within this though, Brown (2001) does make the point that *self-consistency* is the most important aspect of reliable academic standards, and that the moderator's job therefore is to check the consistency of the assessor.

Most moderation focuses on assessed work, but there is also a case to be made for involving peers more fully in assessment design. This does normally take place during programme or module approval, but rarely at a detailed level. There is also a widespread culture of peer review of examination questions, but how often is that extended to other forms of assessment?

Some key methods of moderation are:

- review of assessment procedure, in particular checking of examination papers;
- blind double-marking – often applied to final year dissertations or major projects;
- sampling – often applied to examination scripts and other elements of coursework – normally looking at all fails, firsts, borderlines and a sample across the performance range;
- for student presentations, having at least two assessors present who then discuss the performance and agree a mark.

## 3.10 Towards a reflective and strategic approach

The foregoing suggests that a systematic approach to assessment is required at the programme or departmental level (see Case Study 4). Module leaders working on their own cannot ensure that the final assessment outcome from a programme is correct. It is therefore appropriate that a programme team ensure that there is an assessment plan that delivers. For example, not every module can test for skills such as oral presentation or group work. However, it is appropriate that every programme includes the development of these skills and that they are taught, practised and assessed in some way. Whether this is through summative means after training of assessors, or by formative means whereby the students' skills improve and they acquire a body of evidence in a portfolio to demonstrate the skills, is something to be decided at programme level.

For the theory of constructive alignment to work, there needs to be an integration of global objectives and local detail – a useful refrain for a module leader might be 'think globally, act locally'. This refrain is particularly apt for ES3, reflecting as it does the concept of space and the constant shifting in scale common to the constituent disciplines.

It is not only students who should be learning from assessment. Tutors should also be in a constant state of reflection about the usefulness and appropriateness of the approaches that they adopt. Most HE quality processes require a formal annual review for each module; assessment issues should be central to this review and report. From another angle, we should gather feedback and evaluative comments from our students about the assessment regime that we put them through. This input and reflection should form a natural part of our self-evaluation of the impact that our teaching, including assessment design, is having on the learning of our students. One area that this may uncover are the *unintended* learning outcomes that our students achieve – a characteristic of the learning process is that it is often accidental and unplanned, and we need to provide space for this even within a predominantly rationalist outcomes-driven approach. If we become aware of the *unintended* outcomes, then we may even think about including them as intended outcomes in the next iteration of the module.

**Case Study 4**

**Designing and implementing a School-based assessment strategy**

***Originator(s):*** Claire Guyer and Sarah Maguire, School of Environmental Studies, University of Ulster at Coleraine

***Key Words:*** Strategy; Alignment.

The initial prompt for this project came from the publication of the UK QAA's Code of Practice on Student Assessment.

The Teaching and Learning Development Unit within the School of Environmental Studies secured institutional funding for a project related to assessment. The project had the following aims:

- to develop an assessment strategy for the School in line both with subject benchmarking and the QAA code of practice
- to embed the strategy into School practice
- to develop and establish mechanisms to assure quality, transparency and staff compliance with the assessment strategy

To achieve this, all assessments were mapped for each student pathway through the school, with reference to national standards and benchmarks. This was achieved through one-to-one discussions with staff, and through work at the subject level. All modules were reviewed and modified to ensure clarity in levels and learning outcomes. Consideration was also given to the range of assessment types and their appropriateness both to the module and the pathway. In addition, assessment criteria were addressed through the adoption of generic Faculty of Science criteria. In addition, a policy for moderation of all assessment and internal quality assurance at the module level, including response to student module evaluation, was developed.

**Reference:** Presented at Good Assessment Ideas in Environmental Sciences Learning and Teaching "Swap Shop", February 23, 2001, University of Kingston, Surrey.

# 4 Subject specific assessment issues and themes

## *4.0 Introduction*

Having examined some generic aspects of the assessment debate, we are now going to consider seven issues and themes which have particular relevance to the ES3 subjects.

The first three of these relate to the nature of the subjects:

- interdisciplinarity;
- contested material;
- currency, topicality and real-world focus.

With these, our focus is primarily on how assessment can help stimulate student learning in these areas. The remaining four identify particular learning environments in which, and through which, students of ES3 can be assessed:

- fieldwork;
- practical and laboratory work;
- work-based and work-related learning;
- computer-aided assessment and assessment in virtual environments.

This is clearly a selective list, but in discussing these there are a number of particular challenges and opportunities relating to assessment in ES3 that can be drawn out.

### *4.1 Interdisciplinarity*

Interdisciplinarity is a key feature of the ES3 subjects. This is confirmed by the UK ES3 subject benchmark (QAA, 2000b, p. 4), which states that graduates should:

> "understand the need for both a multi-disciplinary and inter-disciplinary approach in advancing knowledge and understanding of earth systems, drawing, as appropriate, from the natural and the social sciences," and that "most tuition has an holistic, multi-disciplinary and inter-disciplinary approach."

Similarly, the UK's IES cites interdisciplinarity as a distinguishing feature of an environmental scientist, and seeks evidence of it in the courses that it accredits. However, Jones and Merritt (1999a) report that the UK Quality Assessment exercise found that few environmental programmes in HE actually achieve interdisciplinarity to a great degree. As interdisciplinarity is so key for the ES3 subjects, we need to look at how we can design assessment opportunities that allow our learners to develop and exhibit this capacity.

Interdisciplinarity implies bringing defined disciplines together, and using their combined approaches and bodies of knowledge to develop some greater (or at least different) insight into an issue or problem – some perspective that would not be possible if operating wearing the blinkers of one specific discipline. Such an approach goes beyond multidisciplinarity, where different disciplines are utilised and/or studied, but are not necessarily combined, towards a point where the conventions of traditional disciplines may be challenged. Interdisciplinarity therefore implies moving beyond disciplines, and thus some people favour the term 'transdisciplinary', or even 'undisciplined'.

We should note that interdisciplinarity may be seen to operate at the meta and micro level. For example geology might draw from physics, biology, chemistry etc., but it is also an overall framework within which sub-disciplines (e.g. petrology, palaeontology) operate.

It is also apparent that the synergies between the earth sciences, environmental sciences, environmental studies and closely related subjects like geography are not always fully explored. McGibbon (2001, p. 14) talks about "new integrated field courses" at one UK university that will see "groups of geographers, geologists and environmental scientists working together in ways that will enable them to develop respect for the complementary contributions

that each subject can make to understanding the environment." In some ways it seems remarkable that such a situation is so unusual that it deserves comment, yet it is symptomatic of the way that academia, and the institution of the university can sometimes create barriers between subjects rather than creating holistic frameworks within which they can work together. There are, though, also cases of long-standing collaboration between disciplines in fieldwork. For example, for the past 10 years the Geology and Physical Geography programme at the University of Liverpool has run field classes combining the two disciplines and involving staff from both departments.

Two major FDTL projects in the ES3 subjects have had issues of interdisciplinarity at their heart:

- the TALESSI (Teaching and Learning at the Environment-Science-Society Interface) Project at Greenwich University was developed to promote interdisciplinarity, values awareness and critical thinking in environmental HE courses, and has produced a range of resources available at: www.greenwich.ac.uk/~bj61/talessi/;
- the Hertfordshire Integrated Learning Project (HILP), although extending beyond the ES3 subjects, put issues of transdisciplinarity at the centre of work on skills development (www.herts.ac.uk/envstrat/HILP/).

So how does the issue of interdisciplinarity connect with assessment? The following list points to some of the challenges posed:

- learning outcomes – if interdisciplinarity is a desired characteristic of ES3 graduates, then this should be expressed as a learning outcome at both programme and module level;
- learning opportunities - certain learning events, including assessment, must be designed that encourage students towards these outcomes *and* test whether they have been achieved;
- academics must be prepared to let go of some of their own disciplinary 'baggage' in designing and assessing interdisciplinary learning events;
- students must be made to feel safe in exploring and presenting issues and knowledge in ways that may run counter to, or at least challenge, what individual disciplines may see as acceptable ways of doing things.

To illustrate some of the cultural barriers that may need to be overcome, consider the following scenario:

**SCENARIO 1 – Assessment of a final year interdisciplinary project in Environmental Studies**

This scenario is based on a real example, although some aspects have been slightly exaggerated for effect. It relates to the assessment of a final year major project on a well-established, interdisciplinary Environmental Studies (ES) programme, which had an explicit set of assessment criteria and marking scheme.

A student on this programme conducts a final year project on 'Public Understanding of Local Urban Air Quality'. S/he is allocated to a supervisor with a background in atmospheric chemistry (i.e. an environmental scientist with a background in chemistry). The student is encouraged by their supervisor to place emphasis on analysis of secondary statistics relating to air quality in a particular place over time, and then to do a survey of public opinion to see if this matches 'scientific fact'.

Once the project is completed, a second marker is appointed: an environmental social scientist with some expertise in the 'public understanding of science'.

Both assessors apply the same set of published assessment criteria. However…

On reading the project for the first time the social scientist is naturally drawn to the questionnaire survey, and finds it to be simplistic in terms of design, conduct and findings. S/he notes a complete lack of engagement with the social scientific literature on public understanding of science. S/he doesn't place so much importance on the analysis of air quality data, as his/her disciplinary background favours primary data. S/he proposes a third class mark for the project.

Meanwhile the supervisor, in arriving at an assessment decision, sees the social survey as an ancillary part of the work. S/he is impressed by the statistical rigour of the secondary data analysis, and the understanding of atmospheric chemistry apparent in the literature review and therefore awards the project an upper second class grade.

The two assessors can't understand the assessment decision of the other. **continued...**

**...SCENARIO 1 continued**

So what issues have been revealed here? What implications do these have for how the programme organises the project supervision and assessment?

Firstly, it could be argued that it is the student who appears to be moving closest towards an interdisciplinary approach, in that s/he is combining scientific and social scientific methods and knowledge in the framing, design, conduct and presentation of the research. Conversely, both tutors, by the nature of the different academic disciplinary cultures that they have been trained in and tacitly reproduce, are operating from narrower perspectives. This situation is likely to be common where many academics in environmental science departments have not themselves done first or second degrees in interdiciplinary environmental science.

The second key issue is that the learning and assessment event has been designed in a way that militates against an interdisciplinary approach being adopted. Clearly there were at least two valuable academic perspectives that the student could have been exposed to, yet one of these was only brought in at the assessment stage. Had both academics been involved in the design and supervision of the project, then it is likely that the student would have had a more valuable learning experience, and would have more fully explored the potential that an interdisciplinary approach to his/her topic had to offer.

A subsequent modification to the delivery of this module resulted in an interim interview conducted by the second marker – this provided an earlier opportunity for different tutor disciplinary perspectives to be brought to the project.

This scenario illustrates how difficult it can be to create interdisciplinary learning experiences. Case studies 5 and 6 below show some possible approaches for achieving this aim.

**Case Study 5**

**The Broadland Case Study**

***Originator(s):*** Jennifer Blumhof, Agneta Burton, Marianne Hall, Andrew Honeybone, Department of Environmental Sciences / Hertfordshire Integrated Learning Project (HIPL), University of Hertfordshire

***Key words:*** Interdisciplinarity; Real World; Group Work; Problem Based Learning

Environmental Studies (ES) students on a level two 'Global Change' module were involved in the Broadland Case Study, an initiative that was developed across several academic departments and disciplines as part of the FDTL funded Hertfordshire Integrated Learning Programme (HILP).

The case study was sited on the Upper Waveney Valley, which was seen to have sufficient diversity of characteristics to serve the subject-specific needs of several disciplines. A set of problem-based learning resources was developed, in association with the Broads Authority. The task for the ES students was to explore how this area could be sustainably developed for tourism and recreation. Addressing this problem involved interdisciplinary analysis, transcending for example, wetland habitats, water quality, conservation management, tourism development and regulatory frameworks. In addition to subject content, a number of graduate skills workshops, including teamwork, information gathering, adopting an interdisciplinary approach, presenting posters and peer assessment, were included in the learning/teaching programme.

Students produced group posters exploring issues relating to the problem under investigation, alongside proposals for resolving them. The overall assessment and evaluation approach involved peer and tutor assessment of student posters, student evaluation of graduate skills development, and staff and student evaluation of the Broadland Case Study.

**Reference:** Honeybone, A. Blumhof, J., Hall, M. & Palmer, J. (2000) Integrating skills development with academic content in higher education, Hertfordshire Integrated Learning Project Guide, University of Hertforshire: www.herts.ac.uk/envstrat/HILP/broadland.htm.

## *4.2 Contested material*

Much of the subject content of the ES3 subjects is of a contested nature, both internally to the subject and between subjects (academic debate) and in the public domain (between vested interests: scientists, policy makers, communities, media, non-governmental organisations, corporations etc.). The design of appropriate assessment can provide opportunities for learners to explore the contested nature of the topics, but also develop the skills (e.g. critical thinking, understanding the appropriateness of sources) necessary for dealing with this, so that cynicism and relativism may be replaced by criticality.

### 4.2.1 Contested (scientific) knowledge

Under the auspices of the TALESSI project (see section 4.1 Interdisciplinarity), Jones and Merritt (1999b) discuss the importance of environmental science students in HE demonstrating critical thinking. They argue that for this to occur: "students need to be able to think critically about the nature of knowledge, and about the ways in which knowledge is produced and validated. Specifically, they should develop an awareness of the epistemological and value-based commitments that are present - though frequently unacknowledged - in all 'knowledge claims'; and, in particular, that they should be sensitive to the ways in which these commitments often vary between different disciplines" (p 349). The implications for science-based subjects are that students should emerge from their degree with an awareness of the limits, uncertainties and indeterminacies of scientific knowledge itself. Jones and Merritt (1999b) state instead that most environmental science graduates will emerge with a 'common-sense' view of science as 'proven-knowledge', 'objective' and 'value-free'. They suggest that a key ingredient of overcoming this is to bring the identification and discussion of values into students' work. Another helpful approach is to develop an appreciation of how knowledge is created within ES3 subjects and related disciplines, i.e. develop an understanding of how disciplines work.

**Case Study 6**

**Learning by simulation: mass media portrayal of global climate change**

***Originator(s):*** Peter Jones, University of Greenwich

***Key Words:*** Contested Material; Critical thinking; Interdisciplinarity; Role play; Topicality.

As part of a module on 'Environment, Politics and the Mass Media' students are set an assignment based around a simulated media debate about global climate change.

Students are asked to prepare a short (200-300 word) position paper, and a two minute oral presentation for two roles, from eight provided. These include activists, academics, journalists and corporate spokespersons.

A debate is staged with each student taking on one of the roles that they have prepared – within this they argue for their own position and against those opposing.

The assignment is summatively assessed through two written outputs: a 250 word letter for a broadsheet newspaper or magazine, and a 500 word article for a tabloid newspaper, both written from the perspective of one of the roles that the student prepared for the debate. These are accompanied by a bibliography of online and other sources that have been consulted during the assignment.

Successful completion of the assignment demands a critical appreciation of diverse points of view, together with a critical understanding of generic media devices used in the portrayal of current environmental issues. This leads to a deeper understanding of the contested nature of climate change.

**Reference:** materials provided by the originator.

### 4.2.2 Contested sources

The arrival of the Internet as an information resource was initially treated cautiously within academia, with concerns about the 'quality' of the information on offer, and students' ability to discern reputable from non-reputable sources.

**ACTIVITY 7**

*Developing students' critical awareness of the strengths, weaknesses and appropriateness of Internet sites.*

As an academic, what criteria do you use when deciding whether a web site is a helpful, useable and reliable source of information for your teaching or research activity? List them:

Examples of likely criteria include: authorship, last update, upload time, accessibility, navigability, printability, attribution etc.

One way to address the concern over students' uncritical use of Internet sources might therefore be to teach them how to do it critically, and an effective way to do this might be through assessment. For example, you might turn the critical analysis of websites into a specific assignment. Students may be asked to analyse a stated number of websites relating to a specific issue or theme, according to criteria set by the tutor or, more valuably, determined by tutor-student discussion. The work could be presented as a conventional report, a PowerPoint presentation, or even as a student-authored website with links to the reviewed sites.

It is clear that students should be encouraged to take a critical approach to all sources (popular and academic), not just the Internet. This means that students need to treat such work not merely as repositories of information, but as bodies of knowledge, values and opinions that can be debated and disputed (Case Study 7).

**Case Study 7**

**Developing critical engagement with academic journals.**

***Author:*** Peter Hughes, Environmental Studies, University of Sunderland.

For one assignment, worth 25% of the marks of a 20-credit final year module, 'International Environmental Affairs', students are asked to select one issue (e.g. whaling), one policy (e.g. Biodiversity Convention), one theme (e.g. lay understanding of global environmental change) or one concept (e.g. ecological modernisation) drawn from the module. They write a 1500 word literature review relating to this, drawn solely from academic journals published in the previous three years. The key skills and abilities being developed and assessed here are synthesis and critical thinking. The activity also ensures that students do engage with academic journals.

**continued...**

**...Case Study 7 continued**

The aspect that students have found most challenging has been moving beyond the individual analysis of a specific paper towards a synthesising account that shows an overall critical appreciation of the points being debated in a concise body of literature. However, most have responded positively to this challenge.

An interesting trend in recent years has been the increasing accessibility (in the students' mind) of journals through electronic sources. This has led to a more eclectic set of literature being incorporated, and therefore more guidance has to be given regarding judging the appropriateness of journals in terms of the topic under consideration, but also in terms of their variable academic quality.

Falling as it does within semester one of their final year, the assignment has added (and intended, strategic, programme-wide) value, in that the students find the activity extremely useful in developing skills for the literature review in their final year major project. Thus, when we think about module specific assignments it is also useful to think about their strategic, programme-wide role (see 3.10 above).

**Reference:** materials provided by the originator.

### 4.2.3 Contested issues

Contested issues are the stuff of the ES3 subjects, and ES graduates need to be able to understand the perspectives of a range of actor groups with different vested interests. We pick up some of the issues associated with this in the next section (4.3 Currency, topicality and real-world focus), but a number of learning, teaching and assessment methods can be utilised to help explore these different perspectives, including role-play, debates and mock public enquiries (Case Sudy 8).

**Case Study 8**

**Flood Hazard Management Games**

***Originator:*** John Harrison, Department of Environmental Sciences, University of Stirling

***Key Words:*** Contested Issues; Role-play; Real World

Two scenarios have been developed, based on imaginary locations within the same local authority, but involving real-world situations. One relates to a market town standing at the confluence of two rivers, and which experiences river floods, the second is a former port and seaside resort, which suffers both coastal and river floods. Case histories and resources have been developed for both sites.

Students on an environmental hazards module act in the role of environmental consultants, and are asked to submit tenders to the local authority for a full flood management plan. Reports are submitted verbally, in role, to local authority representatives (played by tutors). Written reports are submitted 10 days after the presentation. Students have previously received training in team work and environmental techniques.

From the initial briefing to the presentation of the report can last 8 weeks, during which time students form themselves into self-determined 'consultancies', and complete the required research. Tutor and resource support is available throughout this period.

The assignment makes up 50% of the marks for the module, with 10% being for the presentation and 40% for the written report. In a sense, the presentation acts as a formative stage in the assessment process.

The game generates the atmosphere of a competitive tender, and this professional environment is maintained in the presentations, with students often dressing for the role, and producing an array of well designed materials including leaflets, information packs and business cards.

The assignment has worked successfully over four years, with its positive impacts illustrated by one student comment:

"Flood study was very interesting and required a fair bit of searching – our plans changed several times. Very different to other coursework – we appreciated a taste of the real world."

**Reference:** Harrison, J., 2002. Flood hazard management: using an alternative community-based approach, *Planet*, **4,** 5-6.

### 4.2.4 Review

In this section we have reviewed three different dimensions of the contested nature of material in the ES3 subjects: the authority of scientific (and other) knowledge itself, developing critical perspectives on source material, and understanding vested interests within contested environmental issues. At the heart of all of these lies the issue of students developing critical perspectives, and therefore that must be a feature of assessment design. To conclude, McMahon (1999) has suggested that one other way in which assessment can be used to develop critical thinking in students is to involve students in the actual negotiation of its outcomes, and through this to begin critically engaging with their tutors' own knowledge, values and opinions.

## *4.3 Currency, topicality and real-world focus*

Earth Science, Environmental Science and Environmental Studies all involve the study of real-world and real-time topics where scientific understanding, social attitudes and policy responses are constantly evolving. Keeping up with this can be difficult enough within a teaching schedule, but we can also look at our assessment design to see how we can provide opportunities for students to address topical concerns, and also to be tested on how up-to-date their understanding is.

One problem encountered here is that of source material. Published academic sources, particularly books and to a lesser degree journal articles, struggle to keep pace with rapidly-changing events: there is always an inevitable lag between research, writing and publication. Yet it is these sources that we primarily steer our students towards as resources for study, particularly the completion of assignments. Academics can still tend to be a bit cautious about students making use of popular science weeklies, newspapers and websites in their assessed work. Yet it is the ready availability of these latter sources via the Internet that is really making it possible for students to keep pace with real-world events.

Take for example an international environmental agreement like the Framework Convention on Climate Change / Kyoto Protocol. Where once it may have taken two years for accounts of this changing policy regime to reach a text book, it is now possible to monitor in real-time the drafts of changes to policy documents, read, listen to and watch the speeches of policy makers and expert commentators, and engage with critical accounts of this process, all via the Internet (Hughes, 2000).

Another option is to get students to conduct research on contemporary environmental issues in their community (Hughes *et al.* 2001). A case study that involves bringing coastal zone agencies together with students at a mini-conference as the culmination of such an assessed group project is included below (Case Study 9). Case Study 10 illustrates the use of real-time environmental data in an assignment.

**Case Study 9**

**Developing external links through teaching and learning – the use of the mini-conference.**

***Originator:*** Ann Worsley, Department of Natural, Geographical and Applied Sciences, Edge Hill College of Higher Education

***Key Words:*** Real World; Topicality; Group Work; Work-related

As part of a final-year module, Coastal Zone Environments and Management, students are in part assessed through a small-group research project conducted over half a semester. Research topics are focused on the local coastal region. The project culminates in a mini-conference where the groups present their findings to their peers. Students are also asked to invite professionals to the conference, and a number of agencies, authorities and corporations are represented.

The awareness that real-world environmental professionals and practitioners would be present at the conference generated some student unease, but ultimately students reported that they believed their own presentations to be of a much higher standard than any they had conducted previously in their studies – in part because the desire 'to do a good job' in such circumstances stimulated greater preparedness.

This assessment event brought added benefits, including high levels of student motivation, increased self-esteem, and links between students (and staff) and external agencies. As one student put it: "Finding out about how some of the professionals work has been an eye opener. I am thinking of going into environmental work and it has been good to talk to them about my studies."

**Reference:** Worsley, A., 2003, Developing external links through teaching and learning in geography and environmental science: the use of the mini-conference, *Journal of Geography in Higher Education*, 27, 1, 69-78.

**Case Study 10**

**Use of real-time weather data in student learning and assessment.**

***Originators:*** J.A. Brey and J.M. Moran, University of Wisconsin

***Key words:*** Topicality; Real World; Computer-Based

A US-based introductory, online college course 'Online Weather Studies' has been developed in collaboration with the American Meteorological Society (AMS). Although assessed in a relatively conventional way, through weekly assignments and an end examination, it is the incorporation of "the study and analysis of perishable data" that makes this a useful example of ensuring currency and real-world focus through learning and assessment design. Learning activities guide students through analysis and interpretation of weather as it happens. Each week they produce learning activity assignments, which are sent by fax or email to tutors; they receive feedback on these assignments weekly. Overall, the co-ordinated provision of data by the AMS has resulted in a resource that few institutions/ departments could afford to develop and keep up to date on their own. The materials are now increasingly being incorporated into traditional campus-based courses.

**Reference:** Brey, J.A. and J.M. Moran, 1999. 'Online Weather Studies: a unique introductory course in atmospheric science delivered via the World Wide Web, *Teaching with Technology Today* 5(1), The Office of Learning and Information Technology, University of Wisconsin System, Madison, WI.

Materials can be viewed at http://64.55.87.13/amsedu/online/info/.

## *4.4 Assessing fieldwork.*

Fieldwork is one of the defining characteristics of the ES3 subjects, and reflects the diversity of approaches within the disciplines. There is also evidence that students learn better and more deeply in the field than in the class room (Kern and Carpenter 1984, Boyle et al. 2003). However, in principle a fieldwork module/component is no different to a campus-based module. It will have clearly specified learning outcomes and the assessment strategy should align with them. What does fieldwork typically aim to do? There are a number of different types of fieldwork, which broadly can be seen as training field classes and project field classes. The training classes provide the training in fieldwork skills that can then be applied in project field classes. Some training field classes unfortunately still amount to little more than lectures in the field. Common fieldwork learning environments include:

a) 'look-see' - lectures in the field;

b) methods training - e.g. sedimentary logging, measuring slopes, counting trees per hectare, keeping a good notebook, how to make a geological or geomorphological map;

c) synthesis training - e.g. geodynamics of an area such as the Alps, evolution of badlands in a neotectonic setting, the role of consumer preferences in the siting of shopping malls;

d) group project – e.g. forestry management, exploration geology project; and

e) individual project – typically the level 3 dissertation project involving collection of field data and the production of a dissertation based on that data and the literature.

All of the previous discussion concerning formative/summative and continuous/terminal assessments apply. It is crucial to think very hard about the learning outcomes. If you have taken a field class like a) above, then perhaps a terminal written paper would be appropriate, though it would be an incredible waste of resources. Does your institution still have field classes like that?

Fieldwork training classes seek to train students in field skills; if these sessions fail to do this, then there is not really any point in going into the field. It is therefore perhaps appropriate to assess those skills. In the Department of Earth Sciences at Liverpool University all 'training' field classes are assessed synchronously with the class. The rationale for this is that if the students get fast feedback, while they are in the class, then they have a chance to improve by reflecting on feedback received. Similarly, if the course leader finds that some concept or skill has not got through to the students then there is a chance to remedy it. Each day, or set of days, has a task that students complete in the field. For a single day task the work is collected in at the end of the day, assessed that evening and returned the following day with some written feedback and general oral feedback (all students are present so there is not the problem of some missing oral feedback through absence as often happens in lectures/practicals). Longer

projects, especially group projects, are handed in at some deadline, assessed and returned the next day with feedback. Students receive formative feedback on their notebooks a few days into the field class via a 5-10 minute interview in the field (one member of staff delegated to this activity). They then get a final assessment on the notebook on the penultimate or final day, again via an interview in the field. The advantages of this method of assessment for the notebooks are that;

- formative feedback is instant and personalised;
- the student can clarify misunderstandings in the notebook;
- the staff member does not have to keep writing the same comment in every notebook (e.g. missing scale, orientation, caption, annotation etc. on sketch);
- the student gains experience of a *viva voce* style assessment.

The advantages of this overall approach are that:

- students can learn from their initial work and use this experience to inform their future work in the same class;
- students get used to doing the work in the field (including stereonets on tracing paper), and plagiarism is more difficult;
- staff can recognise what is and is not working; and
- all assessment is finished when the field class ends so staff do not go away with a box-load of marking.

The Department of Earth Sciences at Leeds University, (Case Study 11), takes a slightly different approach on a large level 1 geology field class, organising the students into formal groups, but with the same overall aim of improving student learning through assessment of outputs and provision of rapid feedback while still on the class.

**Case Study 11**

**Teaching Large Classes in the Field**

***Originator:*** Jane Francis, Department of Earth Sciences, University of Leeds.

***Key words:*** fieldwork, large classes, groups, posters, peer assessment, notebooks, continuous feedback.

At the University of Leeds the numbers of students in Earth Science classes has increased to around 100 in each year and encompasses four different degree courses.

All first year students go on the same field trip during the Easter vacation. The aims of the trip are to:

- introduce basic geological field techniques;
- introduce geological features in the field;
- develop observation/synthesis/model skills;
- develop integrated individual/teamwork skills.

The students divide themselves into groups of 5-6, supervised by 12 members of staff including post-graduates.

*Group Posters:* each group is required to produce two posters during the trip. Each poster is expected to summarise the geology on a theme (usually the previous two days' fieldwork) and the groups have around 5 hours to produce them using field sketches, data, logs, stereonets etc. The posters are marked and returned, with feedback, the next day. Marking all the posters takes about 2 hours. The posters are displayed the next day (with the marks hidden) and the students are asked to perform a peer assessment. The top three posters, as judged by the students, are compared with those judged by the staff - this provides a good learning experience, as the students tend to over-assess presentation. A prize is given for the best poster. The second set of posters is marked by the staff (but not peer-assessed to save time) and a prize is given for the most improved poster as well as for the best. The marks for the posters are 20% of the total. **continued...**

**...Case Study 11 continued...**

*Individual Posters:* the final day of the trip is to a mystery location; the students work in groups but have to produce individual posters. This individual poster counts as 30% of the assessment total.

**Field notebooks:** the mark for the field notebook is 50% of the total. Each evening the staff sit down with some of the groups and talk through their field notebooks, this way the students have continuous feedback and can improve their record taking skills.

Advantages of groupwork and posters:

- groupwork raises overall grades with some students improving by up to 10% if they have a groupwork component in their mark;
- peer pressure encourages students more strongly than staff pressure;
- students are forced to synthesise and present data;
- visual presentation encourages students;
- there is a notable decrease in the amount of marking.

**Reference:** Abstract 152 in the LTSN GEES Good Practice database: http://goodpractice.gees.ac.uk/cgi-bin/searchspec.pl?terms=152

A further interesting case study for assessment of fieldwork also involves group work, peer assessment and the development of research skills: Case Study 12.

**Case Study 12**

**Student-authored fieldtrails**

***Originator:*** David Higgitt, Lancaster University

***Key words:*** group work, fieldwork, peer assessment, self assessment, geography

This fieldwork formed part of a second level course in geomorphology (although it could be extended to other parts of the geography curriculum including human geography). While the course aims to introduce and reinforce themes for understanding and interpreting landforms in general, its execution and associated coursework are concentrated in a specific locality. The fieldwork involves students working in teams of four in an area close to the university, to produce geomorphological trails and information boards targeted at a designated audience (upper school or first year undergraduate geographers). The fieldwork sessions last 3-4 hours over a five-week period with two further weeks to hand work in. Assessment commences in week 4:

| Week | Class activity | Assessment activity |
|---|---|---|
| 1 | • Background to local geomorphology<br>• Introduction to trail design<br>• Definition of groups and tasks<br>• Teamwork activity<br>• Define peer assessment criteria<br>• Establish possible routes<br>• Arrange meetings outside class | |
| 2 | • Field 'lecture'<br>• Initial work on trail design | |
| 3 | • Trail design | **continued...** |

**...Case Study 12 continued**

| | | |
|---|---|---|
| 4 | • Group A guides others along part of trail | • Teacher assessment of input of individual Group A students<br>• Group B provides written feedback (assessed by teacher) |
| 5 | • Group B guides other along part of trail | • Teacher assessment of input of individual Group B students<br>Group A provides written feedback (assessed by teacher) |
| 6 | | • None |
| 7 | | • Submission of group work<br>• Submission of individual summaries<br>• Submission of peer assessment scores |

**Reference:** Higgitt, D. (1996) 'The effectiveness of student-authored field trails as a means of enhancing geomorphological interpretation', *Journal of Geography in Higher Education,* 20(1), pp.35-44. Abstract 124 in the GEES Subject Centre good practice database: http://goodpractice.gees.ac.uk/cgi-bin/searchspec.pl?terms=124

These case studies all involve assessment during the field class. It could be argued that assessment methods applied some time after the field class would test deeper learning, and this may be true. However, such assessment methods would not enable students to learn from their work and improve on it the next day. Fieldwork is expensive and it is thus imperative that best use is made of it. Assessment is central to this issue and provides a powerful drive towards improving learning.

One final case study (13) relating to fieldwork illustrates an assessment approach that steers the learner toward the process of working with others in the field, but also to reflecting on their own learning experience through reflective diaries.

**Case Study 13**

**A field class assignment involving the use of reflective diaries**

***Originator:*** Sheen Wurthmann, School of Built and Natural Environment, Glasgow Caledonian University.

***Key words:*** induction field module, reflective diary.

This case study concerns an innovative group-based field project, used as an induction exercise, involving the development of reflective diaries or journals during a project relating supply and demand in the forestry industry. Groups have to calculate the volume of timber on Kindrogan estate and then estimate the number of days that timber from the estate could supply the branch of IKEA in Glasgow. Calculations have to show how the amount of timber and the needs for timber at IKEA have been estimated.

As well as solving the above problem, students are asked to submit a reflective journal describing what they learned (rather than did) on the field visit. A briefing sheet on learning journals was provided. Within the journal they were asked to show:

- what they had learned while on the module - academic knowledge;
- what they had learned in practical and communication skills – presentations, data handling, instrument use;
- what they had learned in personal skills – group work, team work, leadership, time management, health and safety, friendships, staff etc.

**Reference:** material submitted by the originator.

## 4.5 Assessing practical & laboratory work

Practical and laboratory work provides the ideal learning environment for students with kinaesthetic learning preferences (see http://www.vark-learn.com). These learning environments are where students can *do* things, individually or in groups. As a result, most learning outcomes would take the form of:

- able to manipulate equipment;
- able to observe, record and interpret relationships between minerals;
- able to measure appropriate properties of a set of objects and statistically analyse their significance;
- able to maintain a proper laboratory notebook; and
- able to work with others.

Practicals are thus a good learning environment for satisfying many of the broad aims that a programme may have. Assessment should reflect this, and common methods include:

- formal practical examination of unseen material;
- assessment of practical/laboratory notebook/handbook; and
- oral examination for group work.

Professor Chris Paul at the University of Liverpool has utilised an interesting approach. He has constructed a computer-based assessment for his level 1 palaeontology practicals using the TRIADS engine (see Boyle et al. 1997, http://www.derby.ac.uk/ciad). The assessment asks questions about the outcomes of the practicals. Students bring their practical handbooks to the examination and have to consult their practical work in order to find the answers to the questions. The answers to these questions cannot typically be memorised because the questions refer to a specimen catalogue number rather than the specimen name. Students thus have to consult their practical handbooks for answers. The assessment helps to confirm the importance of a well-kept, well-structured handbook.

One possible problem with the above approach is that any inadequacies in handbook preparation are not discovered until the terminal assessment. An alternative approach has been presented by Tony Garrood, in which he assesses practical books as students leave the practical (Case Study 14).

**Case Study 14**

**Exit assessment of laboratory work in environmental sciences**

***Originator:*** Tony Garrood, University of Huddersfield

***Key words:*** assessment, feedback, laboratory, recording

*The initial problem*

The high cost/low benefit of formal report writing arising from practical laboratory sessions. The time cost to students in writing reports was high, as was the time spent by staff on assessing them. Any feedback was far too late (4 + weeks) to assist the students' learning. They had little incentive to think about the meaning of the results at the time. The quality of data recording in the laboratory was abysmal.

*What the new practice tried to achieve*

Rapid and effective feedback to students on their performance before they left the laboratory.

*How was practice changed?*

Students were told to purchase a hard bound field and laboratory notebook to be used for recording of all data - including units. This was inspected by staff and assessed as the students left the laboratory and a mark given. Brief questions were asked about the meaning of results and another mark given.

*What were the gains?*

The students got instant feedback as to how they were progressing. Staff got instant feedback about how well students were learning, and any particular problem areas in the practical. Students thought more about what they were doing. The quality of recording (data, units, observations, modifications, etc.) improved immeasurably.

**continued...**

**... Case Study 14 continued**

*What were the losses?*

Practice in formal report writing - but one per module was retained. In order to remove bottlenecks with large groups, the postgraduate demonstrators were trained to share the assessment procedure - but this turned out to be a bonus too, as the demonstrators were more involved in the aims and objectives of the practical session.

**Reference:** Presented at the Good Ideas in Environmental Sciences Learning & Teaching 'Swap Shop', University of Kingston, Surrey, on 23 February 2001. Archived as Abstract 185 in the GEES Subject Centre good practice database: http://goodpractice.gees.ac.uk/cgi-bin/searchspec.pl?terms=185

## 4.6 Work-based & work-related learning

Gray (2001) writes: "Work-based learning is learning at higher education level derived from undertaking paid or unpaid work. It includes learning for work (e.g. work placements), learning at work (e.g. company in-house training programmes) and learning *through* work, linked to formally accredited further or higher education programmes." Work-based learning (WBL) is increasingly available to undergraduate students through 'sandwich' years, placements and so on. However, it is also increasingly being offered as evidence for mature student entry onto higher education programmes. In the latter case, universities have to design mechanisms for evaluating and accrediting work-based learning that they did not set the aims and intended outcomes for. Assessment of this is not straightforward. Fortunately, the former situation is more common in ES3, which provides scope for alignment of aims, outcomes and assessment at the planning stage.

A key aspect to consider is the idea of a 'learning contract', which allows learners to negotiate non-standard programmes of learning (Goodwin and Forsyth 2000) that satisfy both their own needs and the needs of their employer. Because work-based learning is typically novel and innovative, traditional assessment methods, such as the terminal three-hour written paper, are not appropriate. However, assessment methods still need to be reliable, valid, affordable and useable. An additional issue is that of authenticity since the student is outwith an institution's normal mechanisms for observation and monitoring to check that work is completed by the person claiming it.

Work-related learning (WRL) is a broader term that refers not just to direct work experience, but any learning initiatives that stimulate closer links between students and employers, or that help students develop enterprise and employability skills. The Real World project – an FDTL initiative across Agriculture, Environment, Forestry and Organismal Biosciences – has produced an online resource that serves as the best starting point for seeing examples of WRL and WBL in the ES3 subjects: http://www.careers.ncl.ac.uk/realworld/.

Assessment methods that may be appropriate include:

- self and peer assessment
- assignments, projects, dissertations
- reflective diary
- portfolio
- poster presentation
- oral presentation
- observation in the workplace
- viva

The last three methods clearly assist with authenticity.

**Case Study 15**

**Work-based learning within a four year integrated MESci master's degree.**

***Originator:*** Alan Boyle, Department of Earth & Ocean Sciences, University of Liverpool.

***Key words:*** research skills, communication, working in a research team, publishing skills.

Earth Science departments are increasingly offering four-year undergraduate masters (MESci) programmes, with the fourth year aimed at developing research skills and capacity. At Liverpool University, such students undertake a research module (30 credits), which operates in the form of a work-based learning project. Students choose from a list of topics offered by the departmental research groups, or conceive their own project that must fit in with one of the extant research groups. Either way, they negotiate the exact details with the research group concerned and then work as a researcher in that group, which typically comprises a mix of permanent academic, post-doctoral and post-graduate personnel. The project is always for real, addressing one of the research group's primary aims, not contrived; the intention being to develop the students as researchers who can work in a real research group. The assessed outputs address the key ways in which earth science researchers present and publish their findings:

1. a web page;
2. a poster, defended at an open departmental poster day;
3. an oral presentation;
4. a report written in the format of a manuscript for publication in a scientific journal.

The intention is that where the research results merit it, item 4 above will be submitted for potential publication.

**Reference:** material provided by the originator.

**Case Study 16**

**Work based learning for academic credit**

***Originator:*** J. Jones, School of Biological and Earth Sciences (BES), Liverpool John Moores University.

***Key words:*** experiential learning, reflection, portfolio, seminar.

Jones (2002) has presented a case study of work-based learning operating in the School of Biological and Earth Sciences (BES) and available to students on degree programmes in Earth Sciences, Geology and Physical Geography. Work-Based Learning in the Centre for Social Science (CSOC) is available to students on BA/BSc programmes in Geography. The work based learning process comprises several stages:

- acquisition of an appropriate placement;
- production of a learning agreement;
- completion of the placement;
- assessment of the evidence of learning.

Students' expected learning outcomes are that they will be able to:

- demonstrate a knowledge of working practices in a selected employer site;
- assess how an organisation achieves its aims with reference to the structure of internal management and the definition of staff responsibilities;
- explain the economic/environmental context within which an organisation operates;
- demonstrate the basic skills required for the completion of work-related tasks and activities;
- evaluate the experiential learning in the light of concepts relevant to the degree programme curriculum;

**continued...**

**... Case Study 16 continued.**

- reflect on and monitor their experience, and identify personal development.

Assessment is by submission of a portfolio of evidence of learning (worth 85% module mark) and presentation of a seminar (worth 15% of the module mark). The nature of the material presented in the portfolios will be diverse due to the variety of placements. Invariably, it will include some reviewing of the scientific literature, data acquisition, handling, analysis and interpretation. Assessment of the seminar is based on the student's ability to present relevant information professionally, employing audiovisual aids in an effective manner.

The students' views are very positive:

*" a thoroughly enjoyable module and very worthwhile"*

*"the placement has benefited a wide range of aspects of my degree"*

*"it should be a core module for all level 3 students"*

*"a varied and enjoyable placement with a good mix of practical and more academic tasks"*

*"made subjects learnt through university easier to understand"*

*"different kind of module to any other; excellent way to gain experience"*

and employers indicated a high level of satisfaction with the students' key skills and abilities. The principal drawback seems to be finding enough placements!

**Reference:** Jones, J., 2002. Linking the worlds of academia and work: work based learning in the geosciences. *Planet*, **3**, 5-6.

## *4.7 Computer-aided assessment (CAA)*

Computer-aided assessment (CAA) is commonly seen as an aid for effortless examination of large numbers of students. This is frequently the case for the examination itself (assuming there are sufficient computer terminals for the number of candidates), but with CAA the effort is all front-loaded. The work is all before the examination - getting it correct - and then keeping fingers crossed that there are no hardware problems on the day. The major advantage of CAA is its reliability (assuming the hardware works as planned); the computer always marks the same item the same way. The major drawback is that there is a limit to what can be assessed by CAA: the holy grail of automated free text marking is still a chimera.

The increase in uptake of virtual learning environments (VLEs) has prompted further consideration of bringing CAA into the delivery of modules, for both formative and summative purposes.

Computers commonly allow four modes of interaction with the user:

1. point and click to select an object or position on the screen;
2. drag and drop to place an object on the screen;
3. multiple point and click, or drag, to draw an object on the screen;
4. text/numeric entry.

Speech interaction is still not really usable, due to the need to train a computer to recognise a particular voice (problems of matching students and computers), or to train students all to talk the same way.

The most commonly used form of CAA is to deliver a series of multiple choice questions (MCQs). These often existed previously in paper form, and have simply been converted to be delivered and marked by computer. There are many systems to deliver such things: some relatively expensive (QuestionMark') and some free (CASTLE - http://www.le.ac.uk/castle/, TOIA - http://www.toia.ac.uk/). A current international development concerns the need for standards to allow question and test interoperability (QTI), recognising the need to be able to transfer questions between different computer delivery systems. The reader is directed to the CETIS site for further information on QTI (http://assessment.cetis.ac.uk/) and the CAA centre (http://www.caacentre.ac.uk) or to Bull and McKenna

(2001) for further information on CAA systems in general. MCQs are excellent for testing knowledge, but can also be set up to test higher order learning. It is important that MCQ performance is analysed after any assessment using standard item analysis tools (e.g. the freely available tool TiaPlus, available from Cito Groep (http://www.citogroep.nl/e_index.htm). These analysis tools check:

- how easy or hard a question was;
- whether or not a particular distracter was selected (if not then it should be replaced with a different, better, distracter);
- that questions discriminate between high-achieving and low-achieving students; did the right people get the question right? This is typically a statistical test such as point-bi-serial index, which correlates overall performance in the test against student performance in individual questions. An index >0.4 suggests the question performed very well. A low index of <=0.2 suggests discrimination is poor (good students got it wrong, and poor students got it right) indicating there is some ambiguity in the question stem or one or more of the choices. Such questions should be investigated and either modified or discarded.

If these checks are not done, it is quite likely that an MCQ test will be reliable but invalid in that it has scored everything objectively, accurately etc. but that the questions have been constructed in such a way as to not address a learning outcome properly.

ES3 is fortunate in that it has hosted one of the major CAA projects within the FDTL scheme: the TRIADS (Tripartite Interactive Assessment Delivery System) project conceived jointly by staff at the Earth Science departments in Liverpool, Derby and Open Universities (Mackenzie 1999, 2000). TRIADS is the most advanced available set of multimedia tools for developing CAA, going well beyond simple MCQs, and offers over 20 different question styles. The TRIADS system is now maintained by the Centre for Interactive Assessment Developmnenbt (CIAD) (http://www.derby.ac.uk/ciad/). Further information on the TRIADS project and access to a demonstration of question styles can also be found at http://www.derby.ac.uk/assess/newdemo/mainmenu.html.

**Case Study 17**

**Integration of computer-aided assessment with learning**

***Originator:*** Don Mackenzie, Centre for Interactive Assessment Development, University of Derby.

***Key words:*** CAA, TRIADS, integrated learning and assessment.

Don Mackenzie at Derby University developed the TLTP-funded 'Field Safety' courseware module for the UK Earth Sciences Courseware Consortium (UKESCC) using the TRIADS engine. This courseware module provides wide-ranging training in field safety applicable to any ES3 student. Formative assessment is embedded into the courseware so that students are consistently confronted with scenarios they have to respond to and can learn from by their mistakes. Formative feedback is given. Such models, where computer-aided learning and computer-aided assessment are interwoven, can be set up so that learners are sent back to reflect further on material if they fail assessment parts, or they may be directed to other resources on the web, for example. This type of integrated learning and assessment approach, where the software makes diagnostic decisions on a student's pathway through the learning material on the basis of their assessment, has much potential for fostering student-centred learning. Such computer-mediated techniques are particularly suited to 'hurdle-type' assessments where students must demonstrate competence at a minimal level, and continue taking the combined learning and assessment until they do. Complete transcripts of all student interactions can be stored and reflected on.

**Reference:** Field safety courseware module from http://www.ukescc.co.uk

**Case Study 18**

**CAA to promote independent learning**

***Authors:*** Alan Boyle and Chris Paul, Department of Earth & Ocean Sciences at Liverpool University.

***Key words:*** CAA, independent learning, TRIADS, calendar-limited assessment

Since 1997, geology students in study years 1 and 2 at Liverpool University have been directed at regular intervals toward independent study of UKESCC courseware modules. They are then presented with open-book online CAAs (TRIADS-based), which they have to complete in certain time windows. They are told that they can do the CAAs as many times as they wish, and that their highest score will be recorded. Each CAA is constructed with built-in random question generation so that students sat next to each other do not have the same question, and if they repeat the CAA it will be different in some way. So, for an MCQ question, there will actually be a bank of questions relevant to a particular intended learning outcome and the CAA selects the actual MCQ at run time, from a set of similar difficulty. For a calculation question, the values in the calculation can be set at run time. The calculation always involves the same calculation process, but the answer is different because the values are randomly set within reasonable limits. Students demonstrate a number of strategies:

1. Do test once and be happy with score.
2. Do test, get a high score (even 100%) and do it more times.
3. Do test quickly with crazy answers, and then repeat more slowly.

The first strategy is no problem. The second is fine, too; it implies the students are using the randomisation features in the assessment to test themselves further in the knowledge that they will not lose their high score. The third approach is also fine. These students want to see the sorts of things covered first, and then commit fully.

Student feedback is positive and often along the lines "I like to be tested to see how my learning is developing". The assessments are summative, in that they contribute around 7% each to the module mark, but they also fulfil a formative role. From session 2003-4, the courseware and the assessments are being delivered through a BlackBoard'-based virtual learning environment.

**Reference:** (Boyle et al., 1998)

An innovative approach to assessment (Case Study 19) within the context of online models for climate, has been developed by Rowland Gallop at the University of Worcester. He couples formative and summative assessments with student reflection on their own and others' learning, with the outcome that students' grades improved.

**Case Study 19**

**Using on-line climate models and a conference server to assess students' understanding of climate models**

***Author:*** Rowland Gallop, University of Worcester

***Key words:*** summative, formative, reflection,

This assessment is part of an Environmental Science module called 'Modelling the Earth's Climate' which is intended to allow students to learn how climate models work. It was created after observing that students were generally tending to tackle assessment in a shallow manner, and as a consequence were not gaining the grades that they might.

In an attempt to deal with this, the assessment was broken down into a series of formative assessments using simple climate models, which take place throughout the module. A summative assessment, using a more sophisticated model, takes place at the end of the module.

**continued...**

**... Case Study 18 continued.**

Each of the models was written in JavaScript and put on-line so that students could access them at their convenience. For each model a series of questions was posed to probe students' understanding of the model. The students were expected to put their answers to these questions on a BSCW Conference Server for other students to read, and were further expected to comment on one another's answers and to probe each other's understanding. The system also allowed problems that the students were having with their understanding of the models to be picked up.

For the summative assessment the students are asked to place a summary of work in progress for their final assignment on the conference server. Each student then has a week in which to ask two questions of each of the other students, and a further week in which to respond. The assessment is based on their responses to the questions asked. This carries 40% of the final mark for the module, the other 60% being for a standard 'write-up' of the set assignment.

There are indications from informal student feedback that they are thinking more deeply about the questions as a consequence of sharing their ideas and questioning one another. This backs up work done on another module the previous year where a similar approach was tried and students' final grades were significantly improved. Further formal analysis remains to be done.

The downside of the method is that it can be time-consuming for both students and staff; in particular the marking of the assessment can take significantly longer. However, it does make marking a much more enjoyable experience.

**Reference:** Information about the module can be found at http://www.worc.ac.uk/Ltmain/Rowland/mec/ and as Abstract 184 in the GEES Subject Centre good practice database: http://goodpractice.gees.ac.uk/cgi-bin/searchspec.pl?terms=184

Presented at the Good Ideas in Environmental Sciences Learning & Teaching 'Swap Shop', University of Kingston, Surrey, on 23 February 2001

# 5 Quo vadis?

Assessment is now quite rightly at the head of the agenda for change in UK Higher Education (e.g. look at the nature of projects supported by the latest phase 4 of HEFCE's Fund for the Development of Teaching and Learning at http://www.ncteam.ac.uk/projects/fdtl/fdtl4/projects.htm). There is abundant evidence that assessment governs the way in which learners learn (e.g. Biggs, 2003; Gibbs, 1999), indicating assessment should be varied in order to encourage students to learn appropriately for the desired course objectives. There is also evidence that style of assessment affects the final grade that students get, and that a multimodal assessment strategy offers better overall grading of students (Boyle 2003). The following quote from Biggs (2003, p. 210) is, perhaps, appropriate to end this volume:

> "Students will always second-guess the assessment task and then learn what they think will meet those requirements. But if those assessment requirements mirror the curriculum, there is no problem. Students will be learning what they are supposed to be learning."

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