Enhancing
Teaching-Learning Environments
in Undergraduate Courses

ETL project

Subject Overview Report

Biosciences

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T·L·R·P Teaching & Learning Research Programme

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CONTENTS

1. INTRODUCTION TO THE ETL PROJECT

The Teaching and Learning Research Programme (TLRP) was set up in 2000 and invited bids for research studies designed to make educational research findings more relevant to practitioners and policy makers. Relevance was to be ensured by setting up projects in which educational researchers investigated ways of improving the engagement of learners and their attainments while working closely with colleagues directly involved in the design and teaching of courses. At university level, previous research on teaching and learning had tended to look for general principles that could be applied across subject areas, and had made considerable strides in describing how students learn and study, and in pinpointing some of the salient influences on their learning. However, colleagues in subject departments often saw the research findings as being too remote from their own experience and specialism. The ETL project was thus designed to look at teaching and learning across a range of subject areas.

Here, it is only possible to describe the research strategies in outline and indicate some of the main findings within the subject area, but further information about the work of the project, can be found on the project web site at http://www.ed.ac.uk/etl/publications.html. Electronic documents relating to specific aspects of our work will be indicated in the subsequent sections and these are also available on the project web site.

One of the problems in introducing educational research findings to colleagues in other disciplines is that the nature of the data collected, the analyses carried out, and the ways in which conclusions are reached, may be very different to those adopted in their own subject area. And given the complexities of teaching and learning, neither the ways in which concepts are defined and used, nor the approaches followed in gathering, analysing and interpreting data, can necessarily match the precision found in, say, the physical sciences. In consequence, researchers in education, as elsewhere in the social sciences, seek rigour by adopting research designs that come at a problem from several different directions and draw on complementary sources of data. That is the strategy deployed in the ETL project, which draws on substantial experience of combining large-scale surveys with finer-grained, smaller scale interview studies to investigate teaching and learning in authentic, everyday settings.

a. Outline of the research design

The guidelines established for the TLRP required projects to work collaboratively with potential 'users' of the eventual findings and also to draw on international expertise. We did this initially by appointing a panel of distinguished subject advisers and two international consultants who were eminent researchers into teaching and learning (Professor David Perkins of Harvard University and Emeritus Professor John Biggs who had posts in Australia and Hong Kong).

During the first year of the study, the project team analysed a representative selection of the national reports of assessments of departmental teaching quality that had resulted in excellent ratings, and followed these up with telephone interviews with a sub-sample of departmental staff. These analyses generated a framework for describing differences between departments in terms of administration, research, professional liaison, teaching and student support, as well indicating variations in the mix of students entering the courses in relation to the teaching.

In parallel with this work, the project team also developed two questionnaires for use with students. The first of these – the *Learning and Studying Questionnaire (LSQ)* - was given at the start of each course unit and asked students about their reasons for coming into higher education and choosing that particular course unit, but with its main focus being on the ways in which the students had been going about their studying up to that point. The second questionnaire – the *Experiences of Teaching and Learning Questionnaire (ETLQ)* – asked, first, about the ways students had approached their studying in that specific course unit, but concentrated on their experiences of the teaching-learning environment provided (i.e. all the various forms of teaching, learning resources, assignments and

assessment they had encountered). Secondly, it asked about the demands they felt the unit had made on them and what gains in knowledge and skills they believed they had made. Students also gave self-ratings of their academic progress which would be used in conjunction with actual grades awarded by the institution.

In the main part of the project, we have being working with academic staff in departments, usually over a two-year period, looking at one first-year and one final-year course unit in each department. During the first year of the collaboration, the research staff discussed with the course team the rationale for the course unit and the way it was taught. They then distributed the questionnaires at the beginning and the end of the course unit, when they also interviewed groups of students about their experiences. Analyses of these baseline data allowed the research team to report back to the course team on how the students had responded to their experiences of the teaching-learning environment that had been provided.

The reports back to the course teams were the stimulus to a new round of discussion and consultation. The focus of these discussions was the provisional findings of the project team, complemented by the course team's own perceptions and experiences drawing on, for example, staff-student liaison meetings, evaluation questionnaires and end-of-module assessments. The aim was to review the empirical evidence to pinpoint the manifest strengths of the unit concerned while also identifying where and how the teaching-learning environment might be fine-tuned to enhance the quality of the students' learning. Where appropriate and feasible, a collaborative initiative was agreed. This was implemented when the unit next ran and systematically monitored by the project team, enabling comparisons to be made with the unit as previously taught, assessed and organised. In consequence, the project's findings encompass both the baseline data and the data from the collaborative initiatives, and contribute not only to an understanding of the effectiveness of contemporary teaching-learning environments in higher education but also yield insights into how the effectiveness of these environments might be enhanced.

Key findings covering the project as a whole will be appearing on our web site as they emerge. Here we present a summary of the findings, and their implications, solely for this subject area.

b. Conceptualising teaching-learning environments

As with any major research undertaking of this kind, we have had to find a conceptual framework that is appropriate to the aims of our work and the settings in which it is being carried out, holds out the prospect of yielding fresh – and hopefully powerful – insights, and seems likely to prove worthwhile for practitioners and policymakers as well as other researchers. In part, the conceptualisations that we have arrived at originate in past educational research and particularly the extensive literature on learning and teaching in higher education, and therefore helped mould our work from the outset. But in part, and equally crucially, the conceptualisations were forged as the project unfolded and we strove to make sense of the data being gathered. Fuller accounts of that process are being given in other project publications. Here, for reasons of space, the focus is on the three constructs which resulted from it.

Approaches to learning and organised effort

The first of these provides a means of capturing the engagement of students, which is to be found in the well-established distinction between so-called deep and surface approaches to learning, or the extent to which students are focusing on extracting the underlying meaning of what they were studying or are content generally to reproduce what they have been given (Entwistle, 1997). However, this needed to be expanded to take account of emerging findings on the extent to which students are organising their studying and using their time effectively, while putting concentrated effort into their work. Organised effort is therefore an important dimension in the LSQ questionnaire which the project has devised and administered (Entwistle, McCune and Hounsell, 2002).

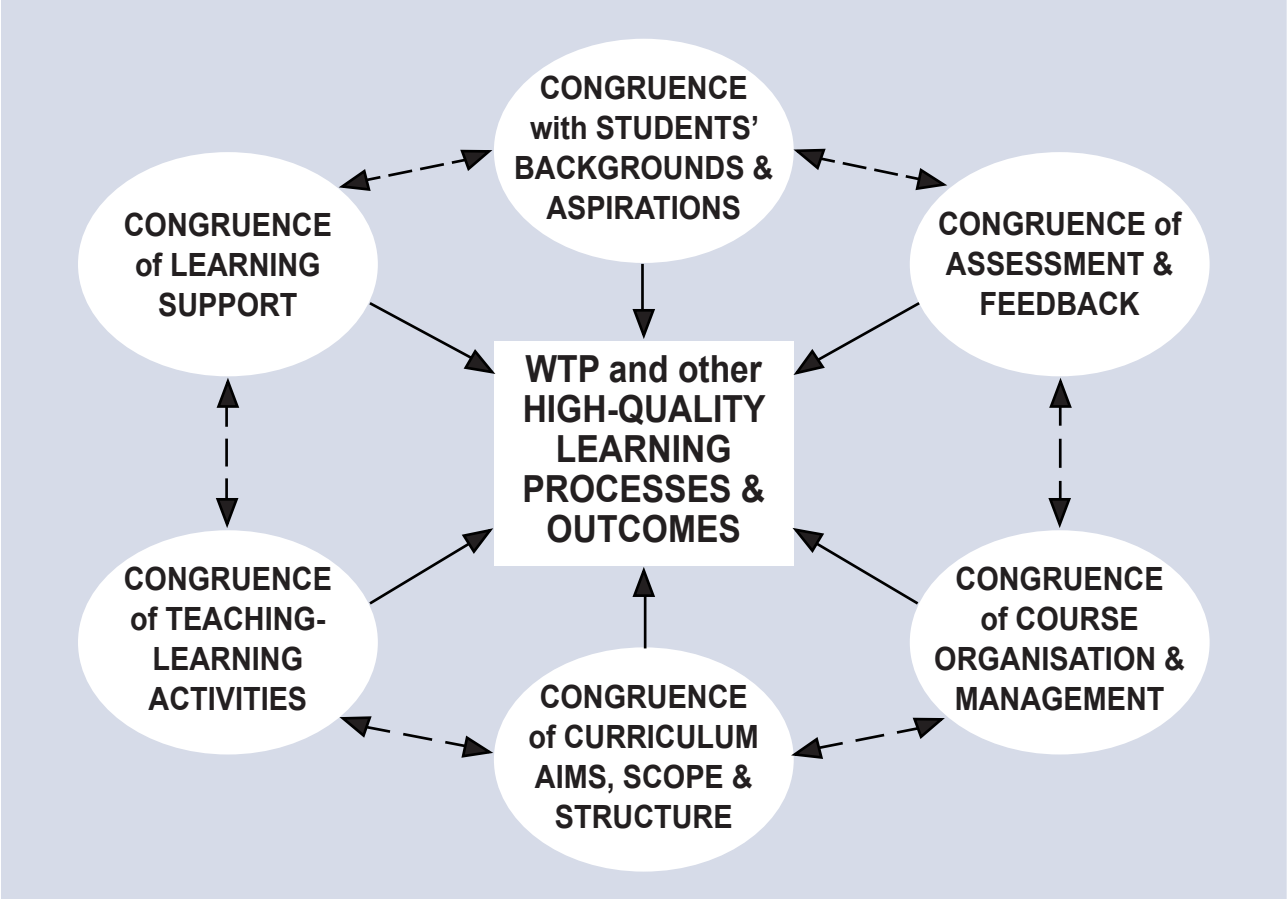
Ways of thinking and practising (WTP)

The second construct is a new one which has grown directly out of the project's work: ways of thinking and practising in a subject (WTP). The subject anchorage is intentional, reflecting a growing body of research about the powerful influences of disciplinary conventions and practices (see for example Anderson, 1997; Becher and Trowler, 2001; Hounsell, 1988, 1997; Lave and Wenger, 1999). WTP has been devised in an attempt to capture the richness, depth and breadth of what students can learn through engagement with a given discipline or subject area in a specific context, and particularly in the later, honours years of undergraduate study (Hounsell and McCune, 2002; McCune and Hounsell, 2005). In the course of the project's work (and particularly in the analyses of the student interviews), it became evident that as the students' grasp of a subject area began increasingly to resemble graduate-level mastery, so too did their appreciation evolve of what might be entailed not only in thinking like an established subject specialist, but also in 'doing the subject', i.e. tackling discipline-grounded activities and tasks in a manner which was akin, in some important respects at least, to that of the experienced subject practitioner. As conceptualised here, then, WTP extends beyond subject knowledge and understanding as generally defined. It can also encompass for instance a sense of how knowledge is generated within a subject, a critical appreciation of the limits of evidence and the contestability of findings, and a growing accomplishment in communicating the subject for differing purposes and to varied audiences.

Alignment and Congruence

The third construct, congruence, serves as an overarching conceptual model within which various key influences on undergraduate teaching-learning environments can be understood. It arose partly from the project team's review of the literature on teaching-learning environments, but it was also subsequently shaped by the initial empirical work undertaken in the first phase of the project

Figure 1.1: Differing Forms of Congruence within Teaching-Learning Environments



together with concerns, observations and reflections arising directly from the team's interactions with students and staff in the six unit settings. Prominent in the former was Biggs' work on 'constructive alignment' (Biggs, 1996, 2003), which stressed the importance of establishing course aims focused on understanding and seeking to ensure that teaching and assessment strategies were aligned with those aims. As the work of the project progressed, however, it was apparent that a much-modified description was needed of the 'goodness-of-fit' between what we have called ways of thinking and practising in the subject and the whole range of teaching and learning activities provided within the curriculum (Hounsell and McCune, 2002; McCune and Hounsell, in press). 'Alignment' implies a single 'line of sight' between a WTP and a particular teaching-learning strategy and method of assessment, whereas Biggs himself, and the student learning literature more generally, has stressed the importance of seeing the teaching-learning environment as an integrated whole – a web of interconnections in which any one element out of place can affect how students approach and carry out their learning (Eizenberg, 1988; Entwistle, 1998; Biggs, 2003). The term congruence was judged to convey this broader conception more clearly. The various dimensions of congruence that have emerged in our analyses extend considerably beyond the teaching-learning and assessment activities highlighted in Biggs' model, and are shown in Figure 1.1.

2. STUDIES OF TEACHING AND LEARNING IN THE BIOSCIENCES

There is a growing body of literature specifically concerned with undergraduate learning and teaching in biology. It is quite widely dispersed and thus often difficult to trace, and there is no major review of this literature that we have been able to identify in the course of our work in this field. The review is in three parts, focusing in turn on studies of what bioscience students learn, how they learn and are taught, and how they are assessed.

a. Studies of what bioscience students learn

A sense of what students can learn through their studies in the biosciences is evident in an increasing number of studies (for example, Bond, Bullen and Elliot, 2000; Jervis, 1999; Manuela et. al., 1998; Ryder and Leach, 1996; Séré et. al., 1998; Stefani et. al., 1997). We have not provided a detailed review of that literature here, as the benchmarking document for the biosciences (QAA, 2002) gives a very comprehensive overview of what biosciences students might be expected to learn. Figure 2.1 summarises what the report identifies as a 'good' level of attainment in terms of generic standards.

In terms of the knowledge and understanding that students might be expected to acquire, the authors of the benchmark note that it is not possible to specify exactly what factual knowledge may be needed, given the width and diversity of the biosciences. Some suggestions are made, however, about the forms of subject knowledge and understanding which are likely to be important. These include, for example, a broad knowledge base, which provides the context for more specialised and in-depth understanding of particular areas. Looking at the research literature, one key theme in relation to students' knowledge and understanding is work that focuses on biological sciences students' conceptions of specific topics – such as natural selection or photosynthesis – and the relationships between these conceptions an students' approaches to learning and studying (Brumby, 1984; Hazel and Prosser, 1991, 1994; Martin, Mintzes and Clavijo, 2000). These studies suggest that university biosciences students may have misconceptions of key topics and that these misconceptions may at times be quite resistant to change. A similar picture has also been emerging in other subject areas such as social sciences (Beaty, 1987) and mathematics (Crawford et. al., 1998). As would be expected, the deep approach tends to correlate positively – and the surface approach negatively - with more developed or accurate conceptions (Hazel and Prosser, 1991, 1994).

The interpretation of these correlations is complicated by the finding that students with a better background knowledge of a subject at the start of a course may take deeper approaches to learning within it than students who had started with weaker background knowledge (Crawford et. al., 1998; Hazel and Prosser, 1991). This may perhaps occur because students with better background knowledge

Figure 2.1: Good generic standards in the biosciences (QAA, 2002, p.8)

- to be able to access and evaluate bioscience information from a variety of sources and to communicate the principles both orally and in writing (e.g. essays, laboratory reports) in a way that is well-organised, topical and recognises the limits of current hypotheses;
- demonstrated ability in a range of appropriate practical techniques and skills relevant to research in biosciences. This will include the ability to place the work in context and to suggest lines of further investigation;
- have a secure and accurate understanding of the explanation of biological phenomena at a variety of levels (from molecular to ecological systems) and be able to understand the relationship of evolutionary theory to their area of study;
- be able to plan, execute and present an independent piece of work (e.g. a project), in which qualities such as time management, problem solving and independence are evident, as well as interpretation and critical awareness of the quality of evidence;
- be able to construct reasoned arguments to support their position on the ethical and social impact of advances in the biosciences;
- be able to apply relevant advanced numerical skills (including statistical analysis where appropriate) to biological data;
- have well-developed strategies for updating, maintaining and enhancing their knowledge of the biosciences.

perceive the same environment as requiring a deeper approach than do students with weaker background knowledge (Crawford et. al., 1998). In their research with first year biology students, Hazel and Prosser (1991) demonstrated a small relationship between students' understanding of photosynthesis before and after a university course alongside a stronger relationship between the students' reported approaches during the course and their understanding at the end of the course. While this might be taken to suggest that the relationship between students' approaches and their conceptual understanding is not simply a function of their prior knowledge, a more complete understanding of these issues must await further research which more fully takes into account the complex web of influences on students' learning.

The benchmarking document signals the importance a range of skills relating to students' capacity to effectively conduct research studies and to engage with and critically evaluate the research literature. The Labwork in Science Education project provides some important insights in this area. This body of work sheds light on students' ideas about research, data and theoretical frameworks in the biosciences, although the reports from the study do merge findings from students of physics and chemistry with those from biology (see for example, Leach et. al., 2000; Ryder and Leach, 1999, 2000; Séré et. al., 1998). One salient finding from this research was that students studying science in upper secondary school and in the first two years of university often had problematic ideas about the nature of scientific inquiry, and that their ideas about the nature of science were not consistent over different contexts. For example, the majority of the 731 students in the study used 'data focused reasoning' on some occasions, a view that suggests that measurement is a simple matter of copying from reality, that conclusions just state what happened, and that differences of opinion can be resolved simply by collecting sufficient data (Leach et. al., 2000). Most of the research on these issues has been conducted at school level so the position in higher education remains to be confirmed by further studies. It does seem important, however, given that the authors of the benchmark note that students should realise 'that much of what they are taught is contested and provisional, particularly in the light of continuing scientific advances.' (QAA 2002, p4).

As the interdependency between science and public life increases, this may also suggest the need for more attention to be given to ethical education for students of the life sciences (Clarkeburn, Downie and Matthew, 2002). The benchmarking document indicates that students are expected to be able to debate issues in a mature and critical manner, including an engagement with moral and ethical themes. Clarkeburn et al. (2002) note that life sciences degrees in British universities rarely include ethics formally in their undergraduate curricula. Further, their research with third year undergraduate students at Glasgow University suggested that, while the students were well motivated to engage with ethical issues, their moral reasoning skills were rather weak. Involvement in three discussion sessions focused on ethical issues did apparently increase the students' ethical sensitivity but the authors indicated that a more extensive ethics programme would be required to develop the students' skill in moral reasoning.

Some of the more 'generic' skills picked up in the benchmark include numeracy, the ability to use information technology, interpersonal and communication skills, and the development of the capacity for lifelong independent learning. Numeracy and information technology skills are highly relevant given the recent explosion of knowledge in the area of bioinformatics, which involves the use of computers to analyse large data sets, such as those arising from the human genome project (Attwood, 2001; Wood, 2001). Mathematical skill in particular has traditionally been a problem for biosciences students (Milner-White, 2001). In relation to communication skills, one fruitful avenue of research has been those studies focusing on students' grasp of a range of communicative genres, from lab talk amongst bioscientists (Tapper, 1999) to students' understanding of what is expected of them in assessed written work or posters (Merry, Orsmond and Reiling, 1998; Orsmond, Merry and Reiling, 1997). Bringing together the wider literature with findings in the biosciences suggests that communication in the biosciences may not simply be a straightforward generic skill but rather involves students struggling to gradually come to terms with the often tacit norms and practices of academic communities (Anderson, 1997; Hounsell, 1988; Ivanic, 1998; Lave and Wenger, 1999; Prosser and Webb, 1994).

Given the rapid pace at which knowledge is developing in many areas of the biosciences, helping students to develop their skill in learning independently is an important function of degree programmes in the biosciences. One key aspect of the capacity to learn independently is students' ability to monitor, reflect on, and adapt their learning to accommodate the changing demands of their courses (Boekaerts, Pintrich and Zeidner, 2000; Vermunt, 1996, 1998). In their research with students on an introductory biology course McCrindle and Christensen (1995) found that students who had been supported to develop their skills in this area via the use of learning journals had significantly better learning outcomes for the course. Involving students in self and peer-assessment may have similar benefits.

b. Studies of how bioscience students learn and are taught

Not surprisingly, studies of laboratory and practical work are quite prominent within the literature on teaching-learning practices in the biosciences. Most focus on providing students with more practical knowledge, for example by making them familiar with computer-assisted learning materials (Jenkins, 1997). There is also discussion of students' perceptions of the advantages and disadvantages of computer-based lab modules (Eichinger, Nakhelh and Auberry, 2000), exploration of ways to improve laboratory learning through group working and structured reflection and discussion (Nicol, Kane and Wainwright, 1994), and innovation in the design of field work and field trips (Harland, 1998).

But applications of computer-based and learning technologies extend far beyond lab and practical work. They encompass the use of learning technology for visualisation and simulation, distance learning initiatives, and networked learning environments, (e.g. in molecular genetics (Calza and Meade, 1998)). Similarly, there are reports of initiatives concerned with computer-based tutorials, and email and electronic bulletin boards and computer conferencing, which can be linked to 'virtual learning environments' (Booth, 2001, Cann, 1999). Emphasis is placed on finding a balance between

the role of the teacher, as architect of students' learning experiences, and the role of information technology as a tool to aid in teaching and assessment.

Alongside these developments in the use of learning technologies, lecturing evidently continues to survive as a widespread method of teaching in the biosciences, yet it seems rarely systematically studied or discussed in the literature. A notable exception is a very recent study by Huxham (2005) of the use in lectures of 'interactive windows', i.e. interspersed discussions and problem solving exercises which are intended to enhance learning about discrete problems, and to counter the relatively passive learning which can be associated with lectures. His analysis points to interactive windows having a positive, if generally modest, impact on recall and learning.

A very different approach to teaching which is increasingly common in medicine and has also begun to make its mark in the biosciences is *problem based learning* (PBL). PBL approaches may make use of scenarios drawn from real life as a point of departure for the learning process, and problems can be taken from a range of sources, including research papers, newspapers and biographies (Dahlgren and Oberg, 2001). There is typically an emphasis on collaborative work in largely self-directed teams or groups (e.g. Rangachari, 2000), which may include tutors as well as students (Harland, 1998). Proponents of PBL argue that it has benefits not just in terms of fostering a critical grasp of subject-matter but also in developing students' capacity for 'metalearning', i.e. in 'learning to question as well as questioning to learn' (Dahlgren and Oberg, 2001), and in giving students fresh insights into themselves as learners (Harland, 1998).

But PBL can also be seen as a form of group-based active learning, albeit a quite challenging one in its implications for course development. Group-based active learning evidently takes many other guises in undergraduate biosciences, including collaborative poster presentations (Mulnix, 2003; Orsmond et al., 1997), paired exercises in research design and implementation (Turner, 1998), inter-group debates (Sutcliffe et al. 1999) peer-group problem-solving (Dobos et al. 1999) and team projects (see for example DebBurman, 2002; Schlegel and Pace, 2004; Wright, 2002). This widespread espousal of collaborative learning activities represents a substantial move beyond the relatively limited confines of the traditional tutorial, and in pursuit of various aims – to offer greater variety and challenge (and thus engagement) in teaching-learning activities, to provide experience in an appropriately range of subject-related skills, to promote greater reflection and analysis on students' part, and to achieve deeper understanding (Fyfe, 2000) and other high-quality learning outcomes.

c. Studies of how bioscience students are assessed

The literature on assessment in the undergraduate biosciences is not extensive, and concentrates in the main on new strategies and approaches rather than the traditional staples of lab and practical reports and unseen written examinations. And given the enthusiastic adoption in the biosciences of various forms of active, group- based learning, there is, not unexpectedly, burgeoning discussion on how these might be assessed as well as facilitated.

In a number of settings, and in first- as well as later-year courses, collaborative activities have been blended with student self- and peer-assessment (and particularly the latter). Pioneering work by Stefani and colleagues (Stefani et al., 1994, Butcher et al., 1995) showed that biosciences students could make 'rational and realistic' assessments of one another's work, but more recent initiatives to involve students in assessment – most commonly, of oral or poster presentations – have tended to focus on the formative benefits (i.e. in enhancing the quality of students' learning) rather than the relative reliability of students as givers of marks or grades (see for example, Orsmond et al., 1997, Orsmond et al., 2002; Langan 2005; Pandey and Magin, 2002). The recent publication of a practical guide to self and peer assessment (Orsmond, 2004) by the Higher Education Academy's Centre for Biosciences seems likely to help spread its introduction more widely.

A thread running through several discussions of assessment in the biosciences is the need to cope with the challenges of assessing as well as teaching large introductory classes. The growing use of multiple-choice questions (MCQs) as a means of assessment has been one common response, and

while concerns have been expressed across a range of subject areas about the risks this might entail of over-emphasising factual recall to the detriment of higher-order learning outcomes, bioscientists with expertise in test design have discussed how the dangers can be sidestepped or minimised (O'Hare, 2001; Harper, 2003; Wood, 2003). Assessed group presentations [Cooper et al. 2003) have been seen as offering another means of easing the marking burden on staff, while peer feedback on oral presentations, it is argued (Pandey and Magin, 2002) can open up worthwhile opportunities to complement tutors' comments with rich and supportive feedback). Another interesting development is in computer-based or on-line self-assessment for formative purposes, such as for instance assisting students in preparing for exams (Peat 2003; Pitt and Gunn, 2004). Finally, Hughes (2004) has explored how staff might cope with large marking loads in relation to lab 'write-ups' which chiefly serve formative purposes, while Crook and Park (2004), identify the need to take a student's as well as a staff member's eye-view in highly modularised systems, where systematic monitoring of students' assessment loads is called for because several different schools or departments can be involved in setting assessed work.

3. FINDINGS FROM PHASE ONE

In addition to reviewing the teaching and learning literature, the opening phase of the project included an analysis of teaching quality assessment (TQA) reports, and follow-up telephone interviews with staff.

a. Analysis of TQA Reports

The analysis of the TQA reports, and the subsequent interviews with staff in the departments concerned, were designed to generate insights into factors influencing the effectiveness of undergraduate teaching-learning environments, and thus to complement what could be gleaned from the research literature. The reports analysed covered thirty-seven highly rated departments, chosen so as to be broadly representative of the range of institutions currently offering undergraduate-level courses in the subject areas with which the project was concerned. This total included eight bioscience departments, on which eleven reports were available (since molecular and organismal biology had been reported on separately in three of the departments). The resulting analysis yielded a cross-subject summary of the features of high-quality learning environments. An inevitable limitation of the quality assessment reports was that they provided no direct evidence of the effects of different aspects of course environments on students' learning, nor did they have much to say about how the quality of the different aspects was judged. Their focus had been on evaluating the quality of provision. Nevertheless, the analysis of the reports is valuable in drawing attention to the wide range of factors seen as contributing to the effectiveness of teaching-learning environments, and particularly in highlighting learning support, on the one hand, and course organisation and management, on the other, as two groups of factors which might merit fuller investigation.

b. Telephone Interviews

The analysis of the TQA reports was followed up by telephone interviews with key staff in half of the departments concerned. These included ten interviews in four biosciences departments. The analysis of these interviews gave priority to two central concerns of the larger project: what the interviewees took to be high-quality learning in undergraduate biology, which is presented in the analysis as facets of ways of thinking and practising in the subject; and how high-quality learning was facilitated or 'operationalised', which is approached in the analysis from the vantage-point of constructive alignment.

Ways of Thinking and Practising in Biology

In interviewees' observations and reflections, a broad distinction was evident between two closely interrelated facets of high-quality learning in undergraduate biology: forms of understanding, on the one hand, and types of skills or competencies on the other. Both facets could also be differentiated

with respect to a foundation and a more advanced level, the former providing the essential building blocks out of which the latter could securely evolve.

- Foundations of understanding included a sound grasp of key terms, concepts and principles, biological structures, functions and processes; and systems and levels of organisation.
- Higher-order understanding encompassed the real-world application of understanding, interconnective and synoptic understanding and epistemic understanding.
- Fundamental skills in biology included experimental and practical skills; data- analysis skills, communication skills, critical reading and bibliographic skills, and student self-regulation.
- Higher-order skills were concerned with critical evaluation and interpretation of evidence, openness to changing one's ideas, arguing a case, experimental and research project design, and reflection and debate about areas within the discipline where knowledge is uncertain or where there are contrasting interpretations.

Taken as a whole, these twin facets and levels were taken as an important contribution to comprehending what is entailed for undergraduate students in learning to think and go about the subject like a practising bioscientist.

Constructive Alignment and the Facilitation of High-Quality Learning

In this part of the analysis, interviewees' observations and reflections were examined from the perspective of constructive alignment, extending Biggs' model to five aspects of alignment. Indications of curricular alignment to students were found in the responsiveness of curricula to diverse student needs and capabilities, and the articulation of developmental perspectives on how curricula and materials might best be staged or sequenced. As far as the alignment of teaching-learning strategies was concerned, the active promotion of ways of thinking and practising in the subject was evident in two forms: first, in a differentiated view of the functions of particular teaching-learning strategies, seen in combination rather than as discrete methods; and second, in a high valuing of tutorials, workshops and various other group-based activities in the pursuit of particular high-quality learning outcomes.

All the departments had in place mechanisms to offer students supplementary support with learning and studying. The alignment of learning support, however, was geared less to specific aspects of ways of thinking and practising than to the quality of student learning more generally, and so had an auxiliary role with respect to constructive alignment. And with respect to the alignment of assessment, what stood out from the analysis was not simply the variety of assessment methods used, but rather indications of how a given assessment method would be purposefully deployed in a particular course setting to promote and evaluate students' grasp of specific ways of thinking and practising in the subject. Projects also emerged as a prized component of final-year assessments, where they were typically used to help facilitate a cluster of high-level learning outcomes. However, some interviewees also pointed to aspects of present assessment practices which seemed to work against rather than for alignment.

Finally there was a small number of indications of the alignment of course organisation, but as part of a consideration of system-level course management issues rather than directly linked to high-quality learning outcomes.

4. SAMPLES AND SETTINGS IN PHASE TWO

a. Descriptions of the Settings

The main phase of the biosciences component of the ETL project was carried out in collaboration with three bioscience departments, drawn from contrasting university settings and varying considerably in size. All three departments were actively committed to research and to teaching in the biosciences,

while also valuing their links with the wider professional bioscience community. But each also had curricula and intakes of students which varied in ways that reflected to a significant extent the universities in which they were located, as will become apparent. Department B1 was to be found in a post-1992 university with a strong commitment to promoting wider access to higher education from hitherto under-represented groups and vocationally relevant degree programmes. B2 was a large cluster of bioscience departments that formed a faculty within an equally large and diverse 'ancient' university with a high research profile. B3 was a thriving department in a university which had been founded in the late 1960s and with a leaning towards science and engineering that reflected its origins in a college of advanced technology.

First-year course units

In each of these departmental settings, a first-year course unit formed a key focus of the project's work. The main characteristics of these three first-year units are summarised in Table 4.1. As the table indicates, all three units were second-semester foundation modules, with intakes ranging from less than 100 to over 600, and matching differences in the size and scope of their staffing inputs. Admission requirements in the three units varied with respect to the background qualifications of the incoming students, the grades typically sought and their broad age-profiles. And while each unit followed convention in their teaching-learning provision, combining lectures with opportunities for laboratory-based practical work and small-group activities, there were important differences in how these activities were configured which will be looked at more fully in section 5b below, which reviews the students' perceptions and experiences of the three units as teaching-learning environments.

Final-year course units

All of the three final-year course units investigated were specialised, honours-level courses taking place within a single semester, as table 4.2 shows. They had a combined enrolment of 83 students in the pre-collaborative year, and 47 students in the following year, when two of the three units were the focus of a collaborative initiative informed by the findings from the previous year. As the table also indicates, the three course units differed markedly in their approaches to teaching and learning and in their patterns of assessment. These differences will also be more fully examined in section 5b. below.

b. Samples

A total of 1741 *Learning and Studying Questionnaires (LSQ)* and 887 *Experiences of Teaching and Learning Questionnaires (ETLQ)* were collected from the students in the six course units, giving an overall response rate of 54 per cent for the LSQ and 50 per cent for the ETLQ. A total of 42 interviews were carried out with 117 students, and interviews were held with 32 teaching and support staff. The details are given in table 4.3.

5. KEY FINDINGS

a. The Students and their Learning

Backgrounds, Orientations and Approaches

The *Learning and Studying Questionnaire (LSQ)* provided information on the students' orientations to learning, reasons for choosing course units, and approaches to learning and studying in the biosciences. This information was collected at the start of each course unit, in the pre-collaborative and post-collaborative years, for all the participating cohorts except for B2L where the shortness of the module meant that only the ETLQ was administered.

Figure 4.1: Summary of First-Year Course Unit Settings, Biosciences

Unit theme & code	Biochemistry Foundation Module (B1F)	Biology Foundation Module (B2F)	Biochemistry Foundation Module (B3F)
INSTITUTIONAL SETTING	A post-1992 university strongly committed to vocational relevance and wider participation in HE	A very large and diverse 'ancient' university with a high research profile	A late 1960s university with a leaning towards science and engineering
Status of Unit Scheduling and contact hours	Second semester core module for students taking degree programmes in the areas of biotechnology and forensic science	Introductory Biology unit for students taking a wide variety of degree programmes linked to the Bio-sciences (e.g. anatomy, biochemistry, genetics, neuroscience, pharmacology)	Second-semester unit, compulsory for students taking degree programmes in biochemistry and in molecular and cellular biology
INDICATIVE ADMISSION REQUIREMENTS All three institutions accept applicants with a range of academic and/or vocational qualifications, varying by degree programme	Depending on the degree programme, the entry requirements vary from BBC to BBBB in Highers or from DDD to CCC in A Level. All programmes require either Biology or Chemistry. Applications are also encouraged from mature students and all those from disadvantaged backgrounds, for whom requirements are flexible	A Levels or Highers in two Sciences or Maths. Typical Grade Requirements BBBB (Higher) BCC (A Level) Applications are also encouraged from mature students and/or with Access Qualifications.	Depending on the degree programme, the entry requirements vary from BBB to AAB in A Level. All programmes require either Biology or Chemistry. Applications are also encouraged from students holding International Baccalaureate
STUDENT ENROLMENT	P – 107 C – /	P – 638 C – 630	P - 96 C – 88
Core Teaching Provision	Lectures Tutorials in degree programme groups. Group size ~12-17 per group. Practicals	Lectures Practical/Tutorial	Lectures Tutorials, with personal tutor. Group size ~4 per group. Practicals
Assessment (including weightings)	Two in-course MCQ tests (40%) Two lab reports (40%) Final Exam (integrative MCQs) (20%)	Course work: 5 lab reports and other assignments (50%) 2-hr end of course examination (50%)	Exam paper (2 hrs) (80%) Practical Work (20%)
Guidance/Learning support	Course handbook, includes quizzes on lectures Lecture handouts are put on the web, along with Web CT post-lecture quizzes. Also builds in 'review' sessions to go over points not understood. Additional drop-in tutorials offered to students without a strong background in chemistry	Extensive written guidance in course handbook and lab manual as well as on website Website also includes self-test questions and other support materials Associate lecturers provide one-to-one guidance to students	Lecturers have option of putting lecture notes and labs on course website Learning support is via tutorials (with personal tutor) and a parallel half-unit "Skills and Techniques". First lecture also includes guidance on effective studying (collab year)
STAFFING INPUT	3 Lecturers 1 Teaching Assistant	9 Lecturers 3 Associate Lecturers 14 Postgraduate lab demonstrators	9 Lecturers Post-doctoral lab demonstrators

Figure 4.2: Summary of Final-Year Course Unit Settings, Biosciences

Unit theme & code	Genomes (B1L)	Cancer (B2l)	Enzymology (B3L)
INSTITUTIONAL SETTING	A post-1992 university strongly committed to vocational relevance and wider participation in HE	A very large and diverse 'ancient' university with a high research profile	A late 1960s university with a leaning towards science and engineering
Status of Unit Scheduling and contact hours	First-semester module 2-3 hours p.w. over 12 weeks	Second-semester seminar option 6 hrs p.w. for 5 weeks	First-semester seminar option 2 hrs p.w. over 1+10 weeks
STUDENT ENROLMENT	P – 44 C – 32 final-year BSc Hons. or 1-year MSc	P – 25 C – / taking a range of biosciences undergraduate degrees	P - 14 C – 15 taking 4-year Masters degrees
Core Teaching Provision	Lectures Tutorials	Guest Lectures followed by problem-focused group discussion of data provided by guest lecturers	Paired student presentations + discussion, from choice of 10 topics
Assessment (including weightings)	Three-hour exam (60%) Two essays (each 20%)	3-hour essay exam (100%)	Presentations (50%) Two essays (each 25%)
Guidance/Learning support	Course handbook Tutorials, in which students are encouraged to raise issues arising	Extensive guidance in course handbook and web site Individual requests / enquiries	Pre-presentation class briefing Individual requests / enquiries
STAFFING INPUT	2 Lecturers	9 Lecturer + Guest Lecturers	2 Lecturers
OTHER	Research projects / placements for both BSc and MSc in second semester	Some of the students had completed professional placements in research environments	Masters students had spent their third year on professional placements in research environments

Figure 4.3: Samples and Response Rates, Biosciences

	B1F	B1L	B2F	B2L	B3F	B3L
Year 1						
no. or students	107	44	638	25	96	14
no. of staff	3	2	32	1	14	2
LSQ	46 (43%)	28 (64%)	140 (22%)	–	88 (92%)	13 (93%)
ETLQ	52 (49%)	24 (55%)	271 (42%)	20 (80%)	86 (90%)	14 (100%)
LSQ & ETLQ	33 (31%)	19 (43%)	84 (13%)	–	77 (80%)	13 (93%)
staff interviewed	1	2	22	1	3	2
group interviews	1	5	7	4	3	3
students interviewed	1	13	20	12	10	13
Year 2						
no. of students	–	32	630	–	88	15
no. of staff	–	2	30	–	14	2
LSQ	–	27 (84%)	472 (75%)	–	78 (89%)	14 (93%)
ETLQ	–	18 (56%)	273 (43%)	–	73 (83%)	13 (87%)
LSQ & ETLQ	–	10 (31%)	226 (36%)	–	64 (73%)	12 (80%)
staff interviewed	–	–	–	–	–	–
group interviews	–	4	8	–	3	3
students interviewed	–	8	11	–	13	13

Learning orientations

The students tended to show intrinsic orientations to learning (reasons for participating in higher education): wanting to develop knowledge and skills they could use in their career, to develop as people, to learn things which might let them help people, and to take interesting and stimulating courses. They were also keen to become more independent and self-confident. Few of the students demonstrated a lack of purpose by wondering why they had decided to participate in higher education.

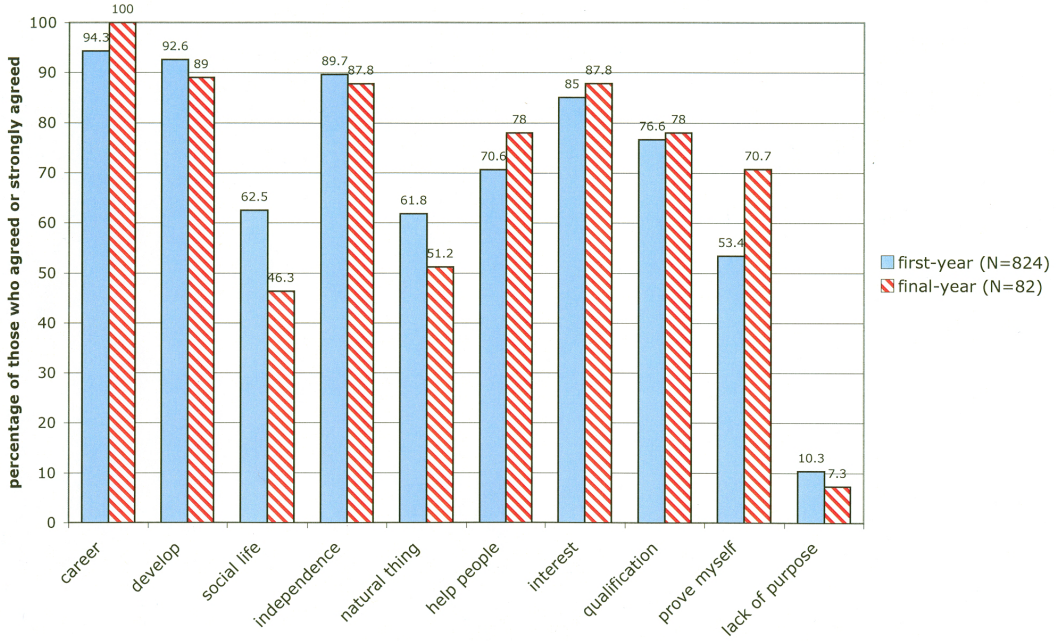
The responses of first- and final-year students are shown in Figure 5.1. Final-year students were more likely to want to develop knowledge and skills they could use in a career and to want to prove to themselves or others what they could do. They were less likely to be focused on a social life or to wonder why they had gone to university.

There were few differences between the responses of students studying first-year courses across the three course units. Among the final-year students, those studying B1L were more likely than the B3L students to be studying biosciences at university because they needed the qualification to get a good job and to want to prove to themselves or others what they could do, perhaps because the course unit was taken by a number of overseas students as well as UK ones.

Reasons for taking the course unit

The students tended to have intrinsic reasons for choosing which modules or course units to study. They tended to choose them because they expected to find them interesting, because they thought

Figure 5.1: Learning orientations (percentage of those who agreed or strongly agreed)

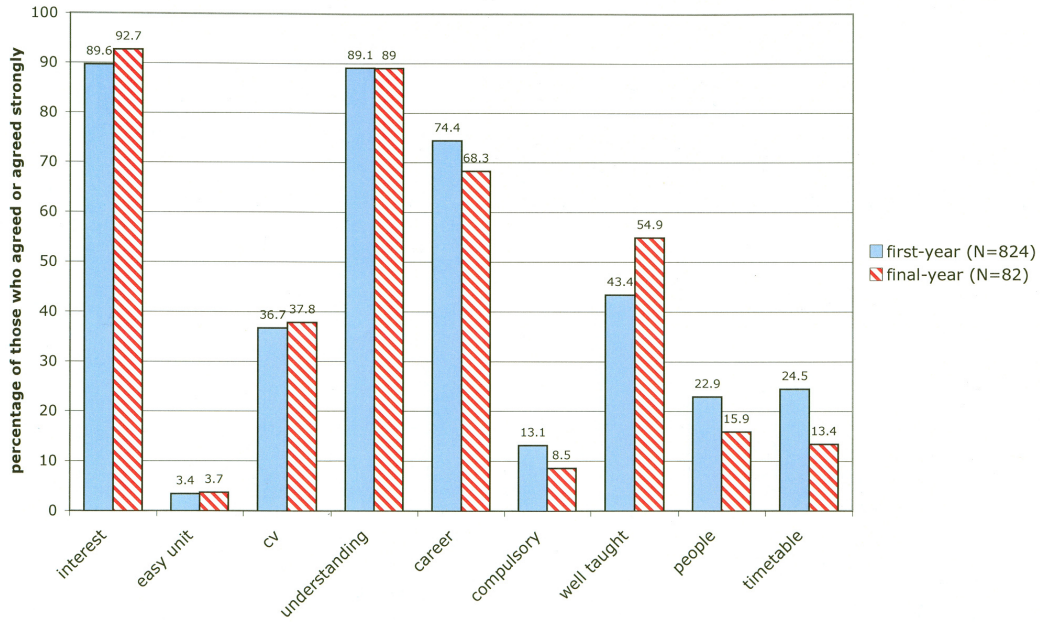


they would help them understand the subject better, and because the units covered areas they would need to know about for their careers. They also generally gave understanding that the course unit was particularly well taught as a reason for opting to take it. Few of the students reported choosing course units because they thought they would be easy.

The responses of first- and final-year students are given in Figure 5.2. Final-year students were more likely to choose course units because they thought they would find them interesting, or because they thought they would be well taught. They were less likely to give as reasons for choosing course units that they were compulsory , that people they knew were also taking the unit or that they fitted their timetable.

There were few differences between students taking different course units in first- or final-year units. The strongest difference was in the responses of final-year students: B1L students were more likely

Figure 5.2: Reasons for taking course unit (percentage of those who agreed or strongly agreed)



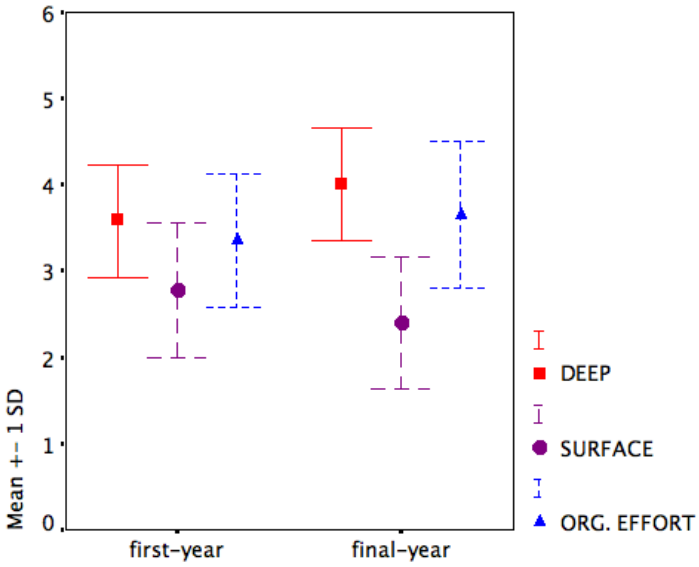
than B3L students to have chosen their course unit because it covered an area they would need to know about for their career, a response which corresponds with their tendency to score highly on a career-related learning orientation.

Approaches to learning and studying

The biosciences students were more likely to be taking a deep approach than a surface approach to their studying by setting out to understand the meaning of what was being taught, by relating ideas to their own experience, by looking at evidence and following arguments and by monitoring their studying to improve their learning. Their responses also indicated that they were likely to be organising their studying and managing their time, and to be putting in effort and concentrating on their studying.

These tendencies were stronger for final-year students than for first-year students. The differences between students taking each of the first-year courses units were not strong. The strongest difference between the final-year students was for 'organised effort', with B1L students more likely than B3L students to score highly on this scale (B1L Mean 3.83, SD .83; B3L Mean 3.29, SD .79).

Figure 5.3: Approaches to learning and studying (Mean +- 1 Standard Deviation)



Ways of Thinking and Practising in the Biosciences

At the same time that it has been updating the concept of approaches to learning, incorporating greater attention to monitoring studying and time and effort management, the project team has been tracing the contours of a new construct, *ways of thinking and practising in a subject (WTP)*. The explicit subject anchorage is deliberate and fundamental, reflecting a growing body of research about the powerful influences of disciplinary norms, languages and practices (see for example Anderson, 1997; Becher and Trowler, 2001; Hounsell, 1988, 1997; Lave and Wenger, 1999). WTP has been devised in an attempt to capture the richness, depth and breadth of what students can learn through engagement with a given discipline or subject area in a specific context, and particularly in the later, honours years of undergraduate study (Hounsell and McCune, 2002; McCune and Hounsell, in press). As students' grasp of a subject area begins increasingly to resemble graduate-level mastery, so does their appreciation evolve of what might be entailed not only in thinking like an established subject specialist, but also in 'doing the subject', i.e. tackling discipline-grounded activities and tasks in a manner which is akin, in some important respects at least, to that of the experienced subject practitioner. WTP therefore extends beyond subject knowledge and understanding as generally

defined, encompassing for instance a sense of how knowledge is generated within a subject, a critical appreciation of the limits of evidence and the contestability of findings, and a growing accomplishment in communicating the subject for differing purposes and to varied audiences.

In section 5b below, we look more closely at WTP in the biosciences, in relation both to first-year and final-year course units, and through the lenses of student and staff perceptions and experiences. Because of its highly grounded nature, the evidence for WTP derives in the main from the interviews. For the same reason, it seems more appropriate to examine the indices of WTP alongside the other findings on teaching-learning environments in the biosciences, since – as will be apparent – the characteristics of WTP which are to the fore reflect to a significant extent curricular and teaching goals and practices in the settings concerned.

b. Teaching-Learning Environments

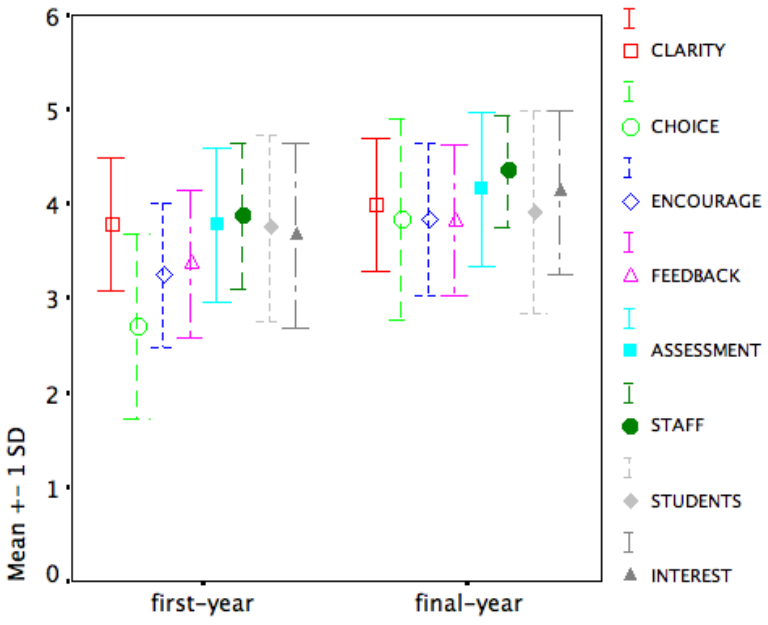
Introduction

Our findings on teaching-learning environments (TLEs) in the biosciences stem from two main sources of data, the Experiences of Teaching and Learning Questionnaire completed by students in the six course units, and semi-structured interviews with students and staff in those settings. We start with the former, which inevitably yields a much less finely grained picture of the six units as teaching-learning environments than does the latter, but which on the other hand does offer much more robust evidence of the incidence of particular perceptions across the samples of students concerned.

The Questionnaire Findings

The overall findings from the ETLQ are shown in Figure 5.4, which presents mean scores (+/- 1 SD) for each of the sub-scales of the ETL., which are summarised in Table 5.1. Figure 5.4 shows aggregated findings for both the first-year and the final-year samples, and therefore enable us to make broad comparisons between the two. Beyond the general picture of student satisfaction which emerges from these analyses, it is also apparent that, generally speaking, mean scores tended to be somewhat higher for the combined final-year sample relative to the sample of first-years. This does not seem surprising given that final-year students tend to be much more committed to the wider

Figure 5.4: Perceptions of teaching-learning environments



subject than do their more numerous and more diverse first year counterparts, many of whom will go on to pursue interests in other subject areas. Favourable perceptions are also more likely to be found amongst students who perceive themselves as having have relatively greater choice over what they study, as these final-year students evidently did.

Table 5.1: Perceptions of teaching-learning environments

	First-year		Final-year	
	Mean	*SD*	*Mean*	*SD*
Clarity and coherence	3.79	.73	4.06	.70
Choice allowed	2.70	.98	3.61	1.05
Encouraging learning	3.31	.75	3.92	.84
Set work and feedback	3.38	.84	3.83	.81
Assessing understanding	3.82	.82	4.21	.81
Staff enthusiasm and support	3.92	.78	4.39	.68
Student support	3.78	.98	3.96	1.00
Interest and enjoyment	3.75	.94	4.16	.91

First-year units

In Figure 5.5, the results for the three first-year course units are shown separately, presenting two sets of scores for course units B2F and B3F, where there was a second round of data-gathering linked to the collaborative initiatives in those two course units. As these results indicate, the profiles of mean scores across the three units are remarkably alike, suggesting that the students' overall perceptions of these three units as teaching-learning environments were both similar and positive, especially with respect to congruence or 'goodness-of-fit' of teaching and assessment approaches; the integration of teaching and learning materials; the extent to which curriculum aims were clear and the unit well-organised; assessment for understanding; and the supportiveness shown by staff and student peers. In each case, the lowest score was for the sub-scale 'Choice', which reflects the typical pattern for first-year undergraduate courses, where a predominant goal is generally to try to bring all the students towards a common baseline of knowledge and understanding, as a secure foundation for work in subsequent years. But across the three units, it should also be noted, the scores for the encouragement given to high quality learning and the effectiveness of feedback were somewhat lower. The score for perceived interest, enjoyment and relevance was also a little lower in B1F than in B2F and B3F.

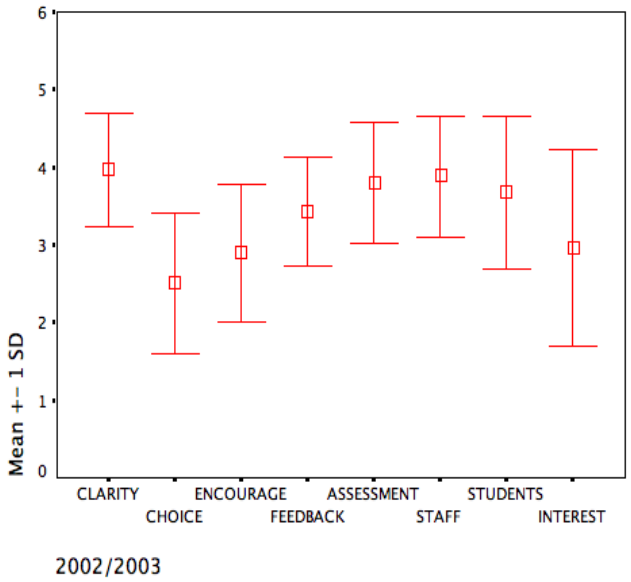
Final-year units

A high degree of commonality was also apparent in the students' questionnaire responses for the three final-year course settings, as shown in figure 5.6. All three modules were perceived by the students taking them as offering a well-organised, supportive learning and teaching climate in which teaching staff were enthusiastic and approachable, and in which interaction between students was encouraged. As was the case for the first-year units, scores on the effectiveness of feedback were somewhat lower, relatively speaking. The variations in the scores on the choice sub-scale no doubt reflect the scope given to the B3L students to choose their seminar topics, in contrast to the set curriculum followed by the B1L and B2L students.

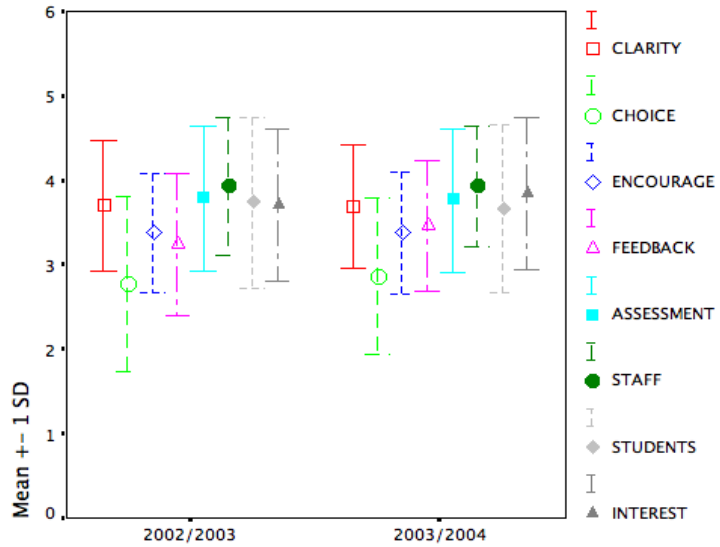
There were also certain differences in sub-scale scores for B1L and B3L which appear to be linked to the collaborative initiatives carried out in these two units, and which are therefore explored in section 5c. below.

Figure 5.5: Perceptions of teaching-learning environments, first-year course units

B1F



B2F



B3F

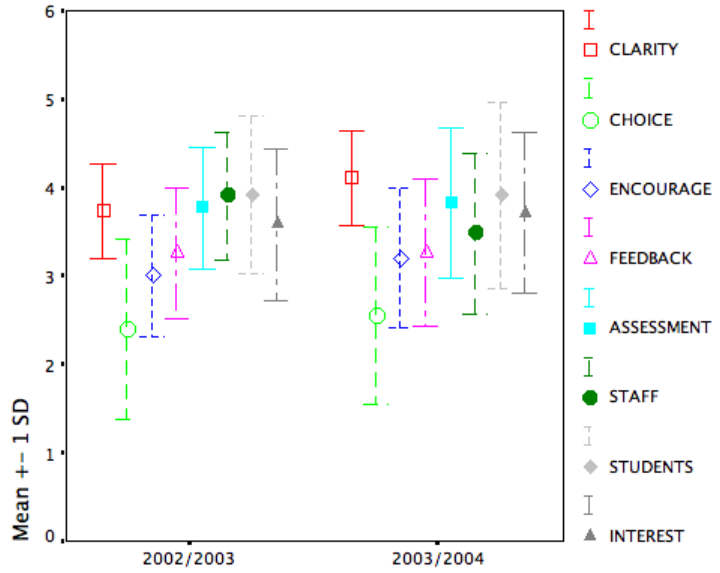
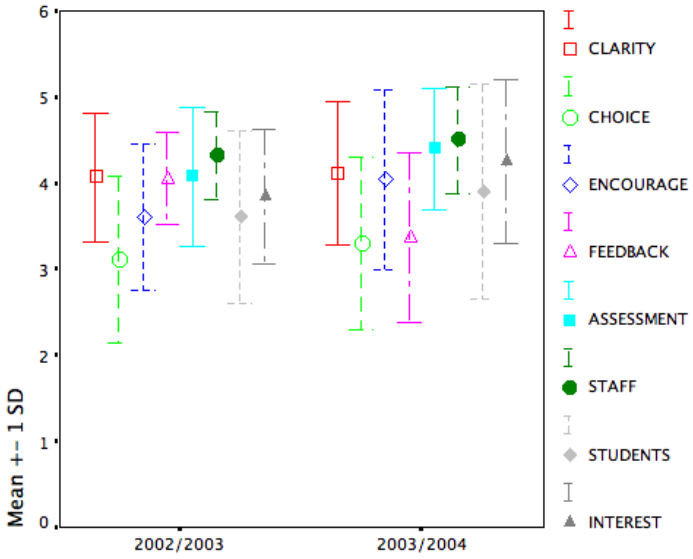
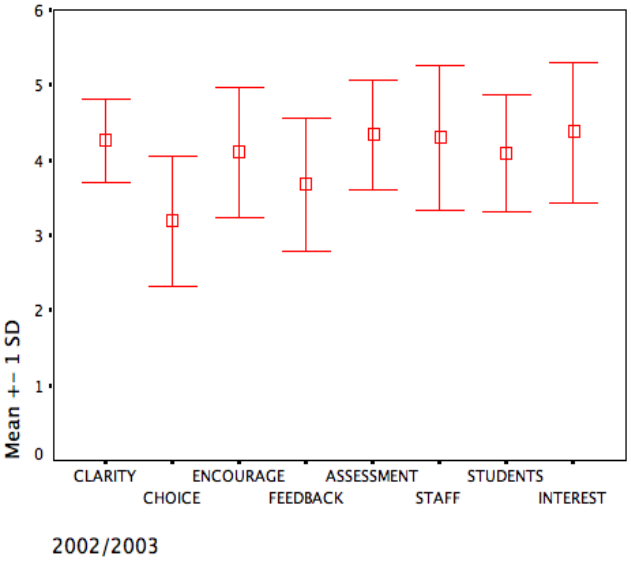


Figure 5.6: Perceptions of teaching-learning environments, final-year course units

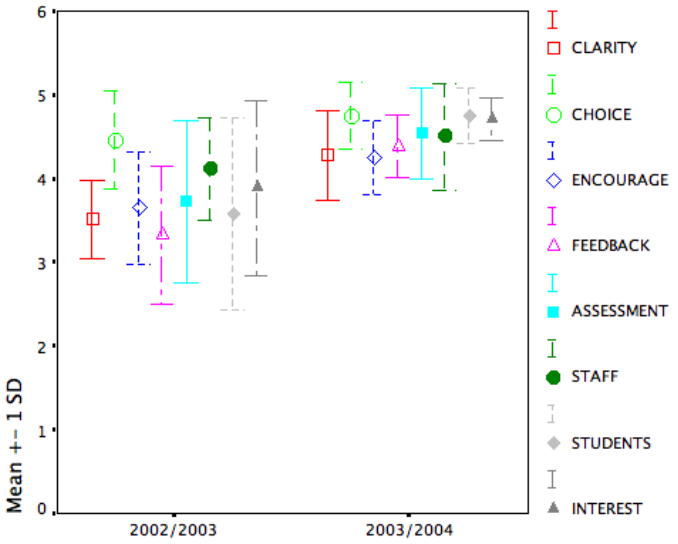
B1L



B2L



B3L



*Findings from interviews with first-year students and their teachers**

We turn now to the interview findings, which are extensive and complex, drawing on interviews with staff as well as students while also spanning the first and final-year units, where greater differences emerge between the units than were evident in the questionnaire findings. In the interests of clarity of presentation, therefore, findings on the first- and final-year units are examined separately, and within these two sets of findings, students' perceptions and experiences are distinguished from those of staff.

The interview findings presented result from an analytical framework which was partly guided by the project team's review of the literature on teaching-learning environments and the initial empirical work it had undertaken in the first phase of the project, and partly by concerns, observations and reflections arising directly from the team's interactions with students and staff in the six unit settings. Prominent in the former was Biggs' work on 'constructive alignment' (Biggs, 1996, 2003), in which teaching-learning environments are viewed as complex interacting systems, key components of which need to be in harmony if high-quality learning outcomes are to be achieved:

> 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.
>
> (Biggs, 2003, p. 27)

However, the project's pilot studies, together with the data beginning to emerge from the interviews, had suggested that – at least as far as the biosciences component of the project work was concerned – it would be fruitful both to re-conceptualise some aspects of constructive alignment and to broaden its scope (Hounsell and McCune, 2002; McCune and Hounsell, in press). The first of these considerations led to a concern with congruence rather than alignment, in an attempt to avoid the geometric connotations of 'alignment' (which can be taken to imply a single 'line of sight' between a given learning outcome and a particular teaching-learning strategy and method of assessment), and the better to acknowledge the day-to-day realities of contemporary mass higher education, where contextual constraints and opportunities could significantly limit freedom of action. The second consideration counselled widening the scope of congruence, in three chief respects:

- to take in congruence not only of teaching-learning and assessment activities but also of learning support and course organisation and management;
- to take appropriately fuller account of the quality of feedback in considering the congruence of assessment;
- to accommodate congruence with students' backgrounds and aspirations as well as with the learning outcomes prescribed by course teams.

A further concern was how best to encapsulate a curricular dimension. In the present analysis, WTP stands proxy for Biggs' constructivist outcomes, but WTP cannot simply represent high-quality learning outcomes in some very general sense, since how it is delineated and pursued is to an important extent a function of the particular curriculum goals and teaching-learning provision applying within a given course setting. A way forward was found in the analytical framework outlined in Figure 1.1 (p.5), where congruence is depicted chiefly in relation to the pursuit of high-quality learning processes and outcomes, but in which congruence with curriculum aims, scope

* Throughout this report, all interview quotes are for illustrative purposes. They are not intended to provide empirical substantiation for the themes and issues which they exemplify. That will be pursued in other outputs from the project, and necessitates much greater space than is available here.

and structure (including WTP) is also a dimension to be considered. The analysis which follows is organised around these dimensions of congruence.

Congruence of curriculum aims, scope and structure

The student interviews

For the first-year students interviewed, the bioscience course units they were studying were seen chiefly as pursuing two main and closely related goals, either of which could be predominant in a particular course unit: seeking to ensure that the students acquired an appropriately secure grasp of the foundations of the subject or a sub-discipline, e.g. an understanding of key concepts and biological/biochemical processes (core foundation); and offering students an initial acquaintance with the scope of the biosciences as a field of study and with the breadth of sub-areas and interests represented within it (broad grounding)

- broad grounding

  I What do you think the staff are expecting students to get from the module?

  S A wide range of knowledge I suppose, so that you can choose what your final degree should be. Just because I am medical biochemistry doesn't mean that I am actually going to end up doing that. I might learn about the animals and decide to do zoology or something. So I suppose they are giving you a broad spectrum of things so that you can make an informed decision.

  B2 FC JN03, lines 27-37

  I think they just want you to get a basic knowledge of quite a broad aspects of biology so that you can see that it is really wide and see that you can go on with lots of different aspects, go on further.

  B2 FC JN02, lines 21-33

- core foundation

  This particular course is just building on what we did in Biochemistry 1 and it does fit in very well, so the content is fine. It logically moves on and highlights, like [S4] said, the depth of the cellular processes that previously I don't think any of us were at all aware of just how deep these things could go and yeah provides a solid basis for future years of study.

  B3 FC D01, line 158

  I: So have you got what you wanted to out of it? Has it given you things that you wanted to learn?

  S2: Yeah, I think ... ... just further laying the groundwork in different areas. In Biochemistry 1 we did carbohydrate, synthesis and breakdown. Now we're doing fatty acids ... it's all kind of all interlinked.

  S1: It's not something that you sort of say 'Oh, I really want to learn about [...] metabolism' but you know, it's ... I think we all understand it is something, one of the basics that we have to learn in order to move on to other things, so ...

  B3 FC J01, line 26-32

However, there were also various indications that, while the students did not at this stage see themselves as bioscientists-in-the-making, they were beginning to glimpse aspects of the much richer vision of the subject evident in some of the staff interviews [see below], and represented in the construct of ways of thinking and practising:

I Do you think you have learnt much about being a biologist? Or a scientist?

S1 They do try and treat you or encourage you to go in that direction rather than sit there and think that you are a student in a lab. They do quite often remind you that, you know, this is you, this is you are a biologist or you are a scientist, you are researching this, you are looking into this. So they are always reminding you of that fact which you do get into that frame of

mind, and when you're sitting doing these experiments or investigations it is quite good. You do think of yourself as researching it or doing it scientifically as opposed to just sitting there doing it as schoolwork or classwork.

S2 They treat you much more as an equal which helps. It's not like teacher-pupil.

B2FC J01, lines 178-182

Well the lab we had today, we were kind of expecting certain results. We were expecting to go a certain way, but towards the end – I don't know who the [lab supervisor] was – but he explained that it may not necessarily have been because of what we were perceiving it to be. Which makes you think, well, if that's the case everything could be a bit like that – there could be more than one answer for everything. [..] So yeah, I think they're trying to make us think more about what we're doing, and I think that's probably the most important thing that they're trying to get us to do, is to make us investigate, think for ourselves, don't take things at face value.

B2 FC D01, line 58

S1: [My tutor] seems very interested in getting us to think a certain way, so the assignments that he sets are more about researching and learning how to read scientific papers, things that really are quite useful skills. {...}

I: Are there other things that come out of this as well?

S2: We've had three ... well four practicals we've had to do write ups about, so that's sort of encouraged us to do more research ourselves and things and taught us various lab skills.

B3 FC J01, line 103

I: I wonder whether you know whether you, you're all taking Biochemistry as your subject, do you see yourself as a kind of Biochemist in the making? Have you glimpsed what that's like?

S4: No [laughing]

I: That's a long way distant?

S4: Yeah. I found it very hard deciding what I wanted to do at University. [...]

B3 FC D01, lines 149-156

The staff interviews

References indicative of WTP can also be found in the majority of the interviews with staff involved in first-year course units, but particularly those in B2F. For the most part, the allusions to WTP took one of the following forms:

- a concern to try to wean students away from constrained forms of thinking and a relatively unproblematised view of biological knowledge which were perceived to be associated with school-level biosciences and Higher and A level syllabuses.

I mean, I tend to think at school level kids expect teachers to know everything and teachers are a little careful, you know, of admitting ignorance, because it's not expected of them. Whereas I feel the sooner we can change that attitude that students don't automatically trust everything we say, that we're capable of making mistakes, textbooks are capable of being wrong and they should be, you know, and you know read around things, get a general view, there can be disputes. There's very few irrefutable truths. There's a few, I guess, but you know. Not everything. Certainly encouraging them to be questioning is important.

B2F P L6 Lines 60-62

I think the concept that nobody knows what's right in everything is definitely what we're trying to put across [....] The idea that we don't have all the solutions yet, to challenge things, to question things, can both these people be right. I think that's very important at an early stage, a good healthy dose of cynicism I think will make you a better scientist [....] In then end of the day it's you and your data and you make up your mind what you think, keep your mind very open in case new data comes in [..] Not that we're training them all to be research scientists, but I think that's good training for being a human being.

B2 FP L5 Lines 29-31

- nurturing a more questioning approach by first-year students to their studies (including a less formulaic approach to work in practicals)

  AL1: I guess, in the 'Animal Behaviour' lab, the maggots don't always behave in the way that you would want them to. So I guess that's a kind of biological thing, you know, the students predict what's going to happen, and the maggots will either do it or not do it. And you say, 'Well, try to think why they do it, you know, do you always do what you're expected to do? .. No'. That kind of thing, the unpredictability of biology, maybe comes out in the Animal Behaviour lab. I don't know if it comes out in anything else, does it?

  AL2: I think, probably more in [this module] than [the preceding one], they realise that there are no, that there quite often aren't answers, direct answers. [In] chemistry, I would imagine, you'll eventually reach an absolute answer, it's almost like more of an absolute science than biology. . .

  SAL: I think that's right, 'cos [this module], there are questions, and there is no right or wrong answer.

  B2FP L1, lines 285-290

- (somewhat less pervasively) trying to convey a sense of the contemporary academic and professional practice of bioscience as calling for a much richer array of expertise than simply the mastery of a body of knowledge – including, in the case of B2F, ethical issues.

  We give them information, they have a relatively short period of time in which to assimilate the relevant facts. And that takes into account what [AL2] said, that somebody in that group has to present it to a larger group . . . And I think it combines skills of combining information, something that they're not familiar with, they probably haven't seen before, and discussing various aspects of an issue - something like cloning a sheep. [I: Dolly?! SAL: Yes]. They looked at it from the scientific side, how it was actually done, from the ethical side, from [...] the problems associated with it. And all the groups were given certain information that concentrated on one particular aspect of Dolly, and then they got together and one of the small groups had to put forward their ideas, and then it snowballed into a larger group. And that sort of took into account both assimilation and oral presentation [skills], in a restricted time period.

  B2 FP L1 Lines 178-179

Generally speaking, however, WTP tended to be seen as a more fundamental goal of undergraduate-level study rather than an immediately achievable objective in first year. As in the interviews with students, it was the goals of apprehending the sweep of the subject or gaining a firm grasp of its foundations which were most obviously to the fore:

- core foundation

  I think the [biochemistry foundation] module in itself, I don't think they're particularly excited about, as a rule. Because there's an awful lot of very basic information that they need to deal with, before they can do anything more exciting with it. Em it's a bit, I don't know, it's a bit like learning your tables. I mean it's absolutely, you know, even for doing things like genomics and all sorts of things like that, you need to have a basic idea of amino acid properties and things like that, but actually going away and learning them is not the most, I appreciate, is not the most exciting thing on the planet. And that's what I found as an undergraduate myself, em, that it's, it's really the sort of skeleton of what they're going to put more, they're going to flesh out later on. But it's really important that they have a good grasp of those key concepts by the end of the module.

  B1F P L1 Lines 34-35

- broad grounding

  SAL: "I think too a number of them are coming to do, say, physiology and sports science, and they can't see the relevance of animal behaviour or something like that ...

  AL1: "- Or plants!

  B2F P L1 Lines 300-310

Congruence of teaching-learning activities

As we noted earlier, all three first-year biosciences courses followed the conventional approach of combining lectures with opportunities for laboratory-based practical work and small-group activities in small-groups. However, there were important differences in the ways in which these activities were configured. First, while two of the three course units mounted these three kinds of teaching-learning activities in tandem, the other (B2F) offered weekly practicals which combined laboratory experiments with group activities of various kinds which included discussions, debates, writing assignments and poster presentations which sought to foster the development of a range of subject-based skills as well as enhancing the students' understanding of the interrelationships between theory and application. Practicals of this kind might therefore be more accurately described as 'practical-tutorials'.

Secondly, while subject-related skills in this and another unit (B1F) were nurtured as an integral part of the two course units, in the third course setting (B3F), the students took a quite separate biosciences half-unit specifically concerned with skills development.

And thirdly, in the two units which offered tutorials as such, these took different forms. In B1F, the tutorials were led by the module coordinator and a teaching assistant, and directly linked to the lectures, all of which were given by the module coordinator. In B3F, links between lectures and tutorials were much more indirect. Each student had been assigned to a personal tutor (all of whom were mainstream teaching staff in the biosciences department concerned) and personal tutors had a degree of discretion over the content and frequency of tutorial meetings.

The student interviews

While ostensibly the differences between the course units in the ways in which teaching-learning activities were configured may not seem substantial ones, in the student interviews (which were carried out only in B2F and B3F), they proved to be influential in foregrounding particular issues and concerns.

For the students in B3F, a prime concern was the variability in tutorial provision and the questions of equity to which this gave rise. While some tutors were singled out for praise, others were felt to be much less supportive. And across the students interviewed, these disparities in tutorial provision were evidently common knowledge, and prompted questions on the students' part about why the many instances of good tutorial practices which were in evidence in the department had not been more widely shared:

S1: [..] We have four different modules, one of which is biochemistry, and then every other week we have a tutorial with our tutor which is just about everything. So [the tutor] might set you some work relating to molecular and cellular or biochemistry, which you're then, you know, supposed to do and hand back, but it's not specifically for biochemistry. Some people's tutors aren't as reliable as others, so you won't get set work or actually have tutorials.

S2: It depends what their focus is, and depending on what your work will be set on. If they're interested, say, in a particular thing, it's more likely that you're going to have something set on that.

S3: [..] When I hear about people talking about work that they've done for biochemistry in their tutorials, it's almost like having a classroom environment where they sort of go over questions and things ... And I think that, if I'd had that, it would have really helped. But I haven't.

S4: I would have gained a lot from having practice with my tutor. I've seen [him/her] once this semester. [He/she]'s never in the department, [he/she] travels a lot. And all of the people in our tutor group are very disappointed with [him/her], because I talk to friends who are getting set work, and going through exam questions and things, and we don't get anything like that.

S1: There's far too much variation there. Some people are doing nothing, and some people have, every other week, they have work set.

B3FP D01, lines 126-134

While these concerns were not so apparent in the second (collaborative) round of interviews, they had clearly not diminished altogether in the perceptions of some of the student tutees.

In B2F, views diverged quite sharply on the skills component of the 'practical-tutorials', which had included group work, a debate, poster presentations and a letter of guidance to a GP. While for many students the various skills-focused activities had been engaging, stimulatingly varied and even imaginative, for others the skills component had seemed to overshadow or get in the way of other aspects of their learning. These students found it hard to see the relevance of some of these skills to studying biology —the most prominent examples being group work (when some group members were felt not to be 'pulling their weight'), poster presentations, and an exercise in interpreting and communicating research findings – the Pertussis Enigma – which had included drafting a briefing letter to a GP:

> The whole poster and debate [..] that was working together, but I'd have probably preferred it if it was working together while learning something you were going to be examined on, something that was going to be useful for you. And working together like that is a really useful skill to have but I'd have preferred it if it was something that we needed.
>
> B2F PV 03, lines 113-116

> That's like we got a report to write up [..] cos if you do want to carry on and do Science things you're going to have to be able to write up reports and so that was quite useful to do. And then the stuff like the Pertussis enigma' when we had to get pieces of information and write about it I thought that was a bit of a waste of time. Something you might do for English not your Biology
>
> B2F PV 04, lines 128-130

> [The 'Pertussis enigma' lab], I think, was a really good one because in the lab beforehand ... we had a discussion. Each of us were the different panels and we all went over it. [...] And you'd already had to put yourself in that situation and see how difficult it was to come to a decision about whether you use the vaccination or not. And you'd already done a role play of it, you know, so you knew how difficult it was. .
>
> B2 FC V02, lines 56-60

These two course-specific concerns aside, the interviews as a whole echoed the questionnaire data in indicating that the perceived congruence of teaching-learning activities within the two units was, broadly speaking, fairly high. For the majority (but not all) of students interviewed, it was the lectures and practicals which had been most favourably received, as in the following examples:

> S1 The [lectures] have been good as well. Certainly they do link in with each other, the lectures and the labs. So it is quite good because you can get your background information from the lectures and then go and do your
>
> lab. [..]
>
> S2: All the lecturers are really good.
>
> B2 FC J01, lines 72, 76

> I thought [the dissection lab] was excellent, I don't know, just to have the experience and you did think about it. You understood everything much, much better and so much clearer after you'd actually just been in there and seen it for yourself rather than just reading about it or seeing the diagrams. You've actually physically had to do it.
>
> B2 FC J01, lines 94-100

Finally, an important point to make about the teaching-learning environments represented by these course units is that lectures, tutorials and labs/practicals could be complemented by a variety of supporting learning-teaching resources, including locally produced materials such as course handbooks and lecture handouts, one or more textbooks, and unit-specific websites that might include self-review quizzes, model answers for already completed assignments, examples of exam questions, further reading, and other useful websites and sources of information. Making the most of such contemporary teaching-learning environments would therefore call for an integrated learning strategy, as some of the students observe:

S3: Sometimes you miss points, I think. The [lecture] handouts are ... they are good, good ways just to aid you in learning and you can listen to the detail.

S1: I think them putting the lectures up on the web afterwards is always a good reference and quite a few of the lecturers in [the module], not all of them but most of them have provided example questions, example calculations, which has all been helpful.

S4: [..] When I'm listening to the lecture, I might not take all of it in. I may understand like the basic idea but afterwards I need to have like ... the handouts are such an important part because otherwise you have nothing to look back on. I mean obviously you've taken notes but that helps you keep focused I think as well.

B3 FC J01 lines 54-68

> The lecturers are really clear with what they're talking about. The overheads help you a lot because, you know, they've got the main points there, you know what you're writing down. And, like, the document.. the information document that you get given for each module that tells you about the lectures and stuff, you know, it gives you guidance about where you're gonna read in your textbook and stuff like that. So you can even have it all ready before the lectures. Em no I just think they're really.. they guide you well, you know what you're doing, and they're really clear. And most of the lecturers are really passionate about it, so it makes it interesting.
>
> B2 FC V01, line 44

The staff interviews

From the perspective of the staff, a teaching-learning strategy pivoting around lectures was a 'given', and especially given the pressures of student numbers and constrained resources. And as the student comments cited above have suggested, some lecturers – but by no means all – saw course web sites as a means of making Powerpoint slides or lecture notes and other materials readily accessible, and thus helping to complement the lectures in their delivered form.

> So, I think I always try and have well-structured overheads and they subsequently go on the web, so if people don't want to copy them down and they'd rather listen then they haven't lost out. Because actually I think people who do that and take much less in the way of notes and then go back to the web afterwards are probably making better use of their time.
>
> B2F P L6 Lines 10-15

> I provide them with these quizzes where they can go through the lecture and they can try and answer the quizzes. And the quizzes are of a similar kind of nature to the short test questions, though obviously not the same but it gives them an idea of what to expect in their assessment. And I also have a list of additional resources which are just book chapters but they can go up and look up additional information in. And web-sites, I give them a list of, well there's textbooks obviously and then web-sites that they can go which are often associated with textbooks and some of those are good. How many of them actually access them, I'm really not sure, but I do provide that.
>
> B1F P L1 Line 176

Staff in all of the course units made reference, to varying extents, to the possibilities open to them – albeit limited ones –in seeking to alleviate the potentially dysfunctional consequences of lecture-based teaching to large classes of students, by trying to foster some degree of engagement or interaction:

> Sometimes I do find it quite hard to sort of motivate them. I try to do that by having the tutorials quite interactive actually, get them to do things in their tutorials so they get a sense of achievement by acquiring a skill of how to deal with particular information or whatever, and trying to give sort of interesting examples or asides when you're in a lecture about, talking about a prostaglandin so I'd explain when prostaglandins were first purified ... oh, just those kind of things. People sometimes remember those, and also just trying to be quite enthusiastic about what I'm talking about.
>
> B1F P L1 Line 180

> Particularly with a large class, you have seen it, it is sizeable, you give a performance and you try to get information across with an enthusiasm and the interconnectivity. So I see the learning outcomes as something that the students ... they could take those and really not go to the lecture, if they didn't want to. If they had the learning outcomes they should be able to take those, go to a text book and say ... look at the first one - 'be able to describe X', look up X in the text book, gather the information and be able to do it. So I would use the learning outcomes to help a student understand what was required. Even if they completely missed the point of the lecture. My concern would be that people do sit there, they take loads of notes and they are scribbling away and nothing is happening.
>
> B3F P L2 Line 192

> I try, whenever possible, even with a big lecture of 300, of actually asking students for answers to things. And you don't actually pick on a student 'cause that just embarrasses them. But you say, "Here are the questions, anyone know the answer?" and there's always a few hands that go up. And this kind of involvement, and you actually stop and say, "Have you all understood?" and there is, of course, a silence, and so I say, "That's no good! Can you all say 'yes' or 'no' and say it now!" and then enough of them, well you get an impression.[..] I find it quite fun, because I think when you can try and interact a bit it's actually, it's a more, it's often a better lecture.
>
> B2F P L6 Lines 92-93

Congruence of assessment and feedback

The student interviews

The assessment regimes in the three first-year course units all combined, in varying weightings, coursework assessments with terminal exams involving multiple-choice (MCQ) and short-answer questions. What (Knight, 2002) has termed 'lower-stakes' assessments – i.e. exercises and tasks which chiefly serve formative purposes and for which any grades or marks awarded make little or no contribution to students' overall grade for a unit – also featured in all three units in some form or other. However, there were also aspects of assessment which were specific to each of the units. In B1F, students had the option of re-taking the in-course MCQ tests which contributed two-fifths of the assessment for the unit, thus incorporating a formative as well as summative function. The coursework assignments in B2F were the most obviously innovative and intentionally varied, designed in conjunction with the practical-tutorials to nurture the development of an array of subject specific skills. And in B3F, the exam papers had the highest overall weighting of the three units (80%), although there were differing views amongst the students about the appropriateness of this, as in the following comment:

> S4: I found that because they are one-hour exams, what you've got time to answer doesn't necessarily reflect the work that you've done.
>
> S3: Mm. That's what I think. You do a semester of work and you have to prove yourself in an hour!
>
> S4: Sometimes you have six questions in an hour, so it's ten minutes a question. You've hardly have got time to actually try to think what the instructions meant. [...]
>
> S1: Because I've worked in the Biochemistry world a little bit I can kind of understand why they have the exams in that way because it's ... if it was a perfect world you could just say 'Right I need to know about this', go away and learn ... read it in the book and use it but they actually ... when you're on the job they just say 'You've got to know that. Just go and do it.'
>
> B3 FC V01, lines 193-196

From the standpoint of congruence, nonetheless, it was formative assessment, or assessment-for-learning as it increasingly being called (see e.g. Black et al., 2003), that the greatest source of concern was to be found amongst the B2F and B3F students interviewed. In both units, there was dissatisfaction with the adequacy of feedback, as widely expressed in comments such as the following:

> S5: For the Pertussis enigma [assignment], I totally got the wrong end of the stick. [. .] I read the instructions, and I felt there were hidden things that you had to put [in] that they didn't

explain. And I got 8 out of 20, and I've got nothing written on my [feedback] sheet at all.

S3: Mine's the same. I got 10, and it's got NO comments on it whatsoever.

S5: And they tell you to do it in double-spacing, so they can write things in, but they never do . .

S3: I mean, if we're getting half marks, it must have a lot wrong with it . . [S5: Exactly.] But it's not telling us anything.

B2FP D02

If you've got 10 out of 20 you expect to have some comments written like why you've got that, but there was no comments at all.

B2FP V01

I: Did you get some feedback on these exams that you've had?

S2: We don't really get feedback on it – you get a mark – but even in coursework you just get a mark and maybe a couple of ticks or [S1: 'Good'] or 'put this in capital letters instead' or something, and that would be it.

S1: You don't really get any feedback on anything.

B3 FP V01, lines 39-41

But it was not just the quantity and helpfulness of feedback comments which were a cause for concern for many students. Student dissatisfaction extended in some cases to delays in receiving feedback, uncertainty about what the ground-rules were for buttonholing tutors in search of further guidance:

If you get [your coursework assignments] back then you should be able to learn from your mistakes. But they come back too late for you to learn from your mistakes, to help you with your actual exam. Cause that happened last year. I think it was right up until about the last week before we got some information back. And I thought well, what's the point?

B2 FC V01, line 228

I understand that they have so many to mark in a short space of time, but it would be nice if they could put more information into the marking. But if they can't it would be good to know if you have a question regarding your lab report, that needs further explanation, who to go, whether you should go and see X PhD student, or if you should go and see the lecturer who was in charge of that practical, or if you should go and discuss it with your tutor. Just who it should be.

B3 FC J01, line 215

And while some students felt that they had been given clear guidance on assessed work, there were others who felt considerable uncertainty about what staff expected.

The majority of it is written down. They do go over it but if you are in doubt it is always in your lab manual. It really clearly states what you're supposed to do and if you're having trouble getting the information you have just got to go to your text book or go and ask somebody.

B2 FC J01, lines 162-166

S1: It's kind of hard to tell what they want from you as well. Like, so hard for exams because you don't get any syllabuses or anything. You don't know what you're meant to be doing – you can't learn everything.

S2: It's a different way of working and it's not really something that we're given help with, understanding how it's different, I think.

B3F, PV 01, lines 11-17

The staff interviews

In the interviews with first-year teaching staff – and in obvious contrast to the student interviews – any comments on the provision of feedback are relatively scarce. This would seem to suggest a pervasive lack of awareness, on the part of the staff, about the strength of student concern about feedback, or perhaps a reluctance to endorse a student view of its importance.

The comments made by staff about assessment generally vary quite a lot from one interview to another, reflecting to a significant degree the extent to which, with the exception of B1F, assessment roles are differentiated. In B3F, for example, the lecture-givers mark the exam questions relating to their lectures, while postgraduate or post-doctoral demonstrators mark the practical work, and formative assignments set in tutorials are marked by the lecturers responsible for those tutorial groups. And in B2F, some of the marking is assigned to subject specialists, some is undertaken by the core course team (particularly the associate lecturers), and MCQs are computer-marked with the aid of a systems analyst.

One theme however, which recurs across the three course units is an awareness of the need to balance quality and economy in assessment methods and procedures. It is therefore conceded that while it is difficult to devise MCQs which address higher-order learning outcomes, they do have a significant contribution to make in (in combination with other assessment methods) in coping with the pressures of student numbers and constraints on resources:

> Partly the assessment is defined by the amount of marking load that people can stand, given the amount of teaching that they're doing, the number of different commitments you have as a teacher. So, we are forced to do a lot of it either as straight multiple choice or as other kinds of problems that can nevertheless be marked by computer.
>
> B2F P L6 Lines 72-73

> I'm not 100% happy with using a lot of multi-choice assessment but it does make it feasible to handle a large group of students and they do do lab reports, so they do actually have to write something which I think is actually quite important 'cos they need to be able to construct and synthesise ideas, which a lot of them find quite, they find that itself quite a challenge. So, I think it's important to keep some report writing in the module. But I think the way it's assessed works reasonably well because it does mean that, by having the mid short test halfway through, sometimes you can pick up problems, and also it can sometimes give students a bit of a wake up call.
>
> B1FP L.1, lines 155-156

Congruence with students' backgrounds and aspirations

In all three settings, as in first-year courses in contemporary mass higher education generally, the students enrolled were from a diversity of backgrounds, as was noted earlier in section 4a. In B3F, for instance, a recent policy initiative by the University had meant that students with international baccalaureate qualifications were welcomed alongside those with A levels. And in B2F (as in B1F), it was not essential to have studied biology or a cognate science subject to an advanced level, and applications were encouraged from mature students. But the students in the three settings did not simply differ in their backgrounds or qualifications on entry: they also varied in their aspirations and onward intentions – most strikingly in B2F, and whether in the differing but bioscience-linked degree programmes they would be going on to pursue, or whether their intentions beyond the first year lay in other subject areas.

The student interviews

Some of the students interviewed in B2F and B3F (and especially those from non-standard backgrounds) felt that while the bioscience departments had opened their doors to a wider pool of students, there had not consistently been a corresponding change in their practices. This was most evident in their efforts to cope with the demands of studying biology at university level. For those from traditional backgrounds, this was relatively plain sailing, as in the following two typical examples:

> S2: I did Higher Biology, so it's kind of like revision for me with a wee bit more added in. [..]
>
> S3: It's quite similar to what I've done in the Higher and I did Advanced as well. [..] I think maybe it's just taking it to a higher level and learning a wee bit more about things that I didn't really know before.
>
> B2FC V01 lines 64-76

> I did Maths, Biology and Chemistry at A level and I think I've tried carry out my studying in similar ways to how I did it at A level. .. it's built on a lot of what I did at A level but taking it much further.
>
> B3 FC V01, lines 4-17

For the non-traditional students, however, the experience had often proved much more challenging:

> I did the Access [course] for science and technology. So that basically got me a ticket to get into uni ... But ... thinking back on it, the course was somewhat limited. It was just chemistry or physics you could do, pretty much. And it was mainly mathematics.
>
> B2 FC D01, line 238

> I worked for eight years and then decided to go back to Uni.. When I came here it was basically hell because I had no Biology knowledge, quite small Chemistry knowledge, so the first term was a bit of a nightmare, lots of work, much, much more work than I thought was involved. [...] The second term, is much better now ... it's ... because now we actually have got to rely on what we did for the first term, so it's kind of leveled out.
>
> B3 FC V01, line 11

> I did the French Baccalaureat, so I had a very big transition from the French system to the English system. I found that there was a lot that they'd covered in A levels that I had never ... So I found the transition really hard and I had to look up a lot of stuff for myself.
>
> B3 FC D01, line 27

As was widely recognised by students in their interview comments, the two departments had support strategies in place which could enable them to engage with student diversity, including a tutorial system (B3F), group-based practical activities designed to promote peer interaction (B2F), supplementary learning-teaching resources, and staff who were generally perceived (as was also evident in the questionnaire data) as approachable and supportive. For the students from non-standard backgrounds, however, the concern was whether their needs had been sufficiently recognised, particularly by some members of staff:

> I spoke to Dr X briefly and he said that really if you want to do well, then you do need to be working all the time practically and, for me, as well that's just not physically possible. I spend three hours commuting a day and I have a part-time job, so I literally maybe can do ... just nowhere near that! [laughing] It's just not going to happen. Which I think doesn't matter so much this year, but I do worry about next year.
>
> B3 FC J01, line 75

> [There are] a lot of international students in the course and I know that a lot of us struggled really hard in the first semester. It was very, very frustrating when we kept hearing all the lecturers saying 'And you will have done this in A level.' [All agreeing] 'We haven't done A level!' We get [an end-of-module questionnaire] questionnaires all the time and it says 'Was there a good assumption of previous knowledge?' Every time I had to put No' because there was a lot of things that I had no clue about. And I can do the extra research, but it takes a lot of time, and when lecturers don't realise that you're doing that and they're just skimming through everything, it is very frustrating.
>
> B3 FC D01, lines 181-183

> S4: I've found one of the lecturers — I don't usually ask questions but once I did after the lecture and he half dismissed it saying, em ... well as if it was written there, or that my question wasn't worth answering, so ...
>
> I: You felt a bit like, put in your place?
>
> S4: Yeah, and that wouldn't encourage you to keep asking questions.
>
> S1: But with my personal tutor, I mean you can ask him anything and he's always willing to help, which is really good.
>
> B3 FC D01, line 70-73

The staff interviews

Notwithstanding these student concerns, it would be misleading to give the impression that the majority of the teaching staff are oblivious to the difficulties faced by students from a variety of backgrounds. On the contrary, there were frequent references in the staff interviews to the challenges of teaching large and diverse classes of students, but there was also an acute sense of the limited scope available to staff – against a backdrop of constrained resources – to familiarise themselves with students' wide-ranging needs, or to address these systematically:

> It's very difficult to get a feel for what they're like in lectures there, because it's quite a sort of anonymous way of teaching. They turn up and they are well behaved - that's really about as far as it goes. And I see their examination answers, and there's clearly ... based not on multiple choice so much, but [on their] short written answers, you get a feeling for just how switched on and how into this part of the subject they are, and there's enormous variability I find. Some are really very good for first year students and some are really very poor. So, the range is enormous. [..] I know from teaching it at other years, other higher levels, that quite a few people who continue to do biology, haven't done biology at school. So, biology in level 1 is their first contact with biology ... so, for that reason I suppose it's not surprising that some people find it more difficult to get into than others.
>
> B2FP L.11, lines 16-21

> You know there are a large number of students in the class. So you don't really get any kind of feeling of, of coherence etc. You know they seem to work quite well together, but that's quite a difficult thing to judge when you're standing in front of a hundred odd people. And I think you might, that might be something that might be more apparent in practical classes. That's one of the reasons why we do try and have the same group of students in the tutorial group and they'll be in that tutorial group for all their different modules on that programme. I think the idea is to give them a feeling of belonging to a group. 'Cos the problem with the modular scheme is you're in and out of different modules with maybe, as in this case, maybe a hundred students on them, most of which aren't on your course. Em, so, especially at first year level, it's quite easy for students to feel lost kind of anchorless.
>
> B1F P L1 lines 38-43

> I think originally, ambitiously, I wrote something like 6 lectures, I realised very quickly that it was too much for them, they were not really ready for it and to some extent they didn't see that it was all that relevant that they should spend all that much time on what they saw as a fairly obtuse academic aspect of chemistry. So it has gone down to about four lectures which I think is about right for them. I have toned it down probably as the years have gone on. This year ... I go slower and slower and labour the points more and more ... it is a big class and it is more diverse than it used to be as I was saying. I find you have to labour it. If you do that and you not too ambitious then you can get the points across.
>
> B3 FP L.1, lines 192-193

Congruence of course organisation and management

An increasingly common feature of large-enrolment first- and second-year courses in contemporary higher education is the deployment of a sizeable course team drawn from a mix of backgrounds, and this was also the case, to varying degrees, with these three first-year bioscience units (Hounsell, 2004). The size of teams varied from 4 in the case of B1F to 26 in B2F (as was indicated above in Figure 4.1) and they included mainstream lecturers*, associate lecturers (who had teaching-only contracts), post-doctoral lab demonstrators, postgraduate teaching assistants and a systems analyst, together with varying levels of administrative and/or clerical support. But such teams can also differ in two other crucial respects: first, in the extent of differentiation of roles (e.g. distinguishing teaching, assessment, learning support and course management roles) or sub-roles (e.g. within assessment, differentiating responsibilities for devising assessments, marking and giving feedback on coursework, marking exam scripts, or collating and reviewing grades); and second, in the breadth and focus of effort (

* The term 'lecturer' is used here to refer generally to mainstream academic staff with teaching and research responsibilities. The individuals concerned held posts as lecturers, senior lecturers or professors.

compare, for example, having responsibility for practicals over a whole semester or year, where effort is distributed, to responsibility concentred around four successive lecturers). As figure 5.8 shows, the three course teams varied significantly along these two dimensions, with B1F having the least differentiated roles and the most distributed effort, and B2F the highest concentration of effort and the most differentiated roles.

Figure 5.8: focus of effort and role differentiation in the three course units

		breadth and focus of effort	
		distributed	concentrated
role differentiation (teaching, assessment, and learning and technical support roles)	low	**B1F**	
	high		**B3F** **B2F**

There are of course manifest advantages in deploying a large and disparate course team with compartmentalised roles, not least in terms of being able to draw up on a breadth and depth of collegial expertise, flexibility in scheduling of classes and accommodating leave, and economies to be had in hiring postgrads and others to cope with a burgeoning demand for tutorial and practical classes. But there are also potential limitations and drawbacks, as was acknowledged by students and staff and is illustrated in the interview extracts below.

The student and staff interviews

One potential drawback of a large and disparate course team is that it can exacerbate (or at least, fail to ameliorate) a sense of impersonality and distance :

> Half the lecturers I probably couldn't recognise them if they walked past me. I wouldn't even say that that person taught me something in biology because the lecturers are constantly changing and you don't get any personal relationship with them.
>
> B2 FC JN 03, line 129

> S4: How many lecturers did we have in that course?
> S3: Yeah
> S4: Seven, eight, nine?
> S3: Loads.
> S4: So you know, they would come for two or three lectures and then go ... Sometimes I did not even know their name, to be honest. [...]
> S2: We get these assessments kind of 'What do you think of this lecturer?' at the end of [the preceding module], you could hear everyone, sat there in the lecture theatre going 'So which was that lecturer? What did they lecture on?' ... Such a rush of different people.
>
> B3 FC V01, lines 21-27

A second is that as lines of communication become attenuated, so the possibility increases of messages not being passed on:

> S1: I was discussing with Dr X, after the practical, the nature of the calculations involved ... and I was saying that I'd realised that after going through step by step, that I could actually

condense all those steps into a formula and just do one calculation to summarise the whole thing and asked whether it mattered whether I did it step by step or with the formula, did he mind? He said 'No, either. There will be no penalisation for which ever way you did it.'

So I did the first calculation step by step, to show I knew how to do it and then I did the second one with the formula and I got only half marks in my second calculation for not explaining my calculations — even after I'd specifically asked Dr X that that wouldn't be a problem. I'm assuming it's nothing to do with him, but it's just the [doctoral] student who marked it obviously wasn't aware of that. Maybe there needs to be ...

I: ... Maybe they need to talk more to each other about it ?

S1: Mm.

B3 FC J01, lines 114-130

And thirdly, there are risks of inconsistency in practices which can give rise to perceived inequities (as in tutorial provision in B3F), or a sense of student disappointment or even frustration that exemplary practices on the part of some members of staff seem to remain invisible to other colleagues, and so are not more widely promulgated. In all three course units, steps were taken by module coordinators to obviate such risks in tutorial or practical work by dint of careful advance briefing or training, but it appeared to be less straightforward to influence lecturing and assessment practices

S1: It would be good if every lecturer gave out handouts.

S2: Yeah.

S1: It certainly makes it a lot easier in the lectures to actually listen.

S3: Especially when you're coming to revise as well. Having a full set of notes rather than what you've tried to write down through the lecture.

B3F PJ 01, lines 344-352

S1: Sometimes they say 'Be more concise' but then another time I thought 'Well I'll try being more concise this time' and actually I got less for doing that! So then the next time I thought 'I'll go back to my other way' and it worked better! So it's been confusing.

S4: I think every time they are corrected by different people anyway. Some of the correctors have said 'You should do it like this' when the person before had said to do it the other way, so then we get marks taken off because we try to make an effort.

B3 FC D01, lines 93-97

But nor did these challenges in harnessing and coordinating the efforts of large and disparate course teams go unnoticed or unacknowledged by staff themselves. There were practical limits on what might realistically be done:

The report-back sheet [an assignment pro forma] generates a mark which goes back to the students. But although all the markers are asked to annotate the report sheets, some don't. And it's a bit frustrating when a student comes and says, "This says 'Excellent', [but] I've got 15 out of 20. If it's 'excellent', why haven't I got a higher mark?" . . . And they're right. I mean, 15 out of 20 is 'pretty good'.

B2FP L.1, lines105-107

Team-taught courses have their pluses and minuses. Students are often very worried by team-taught courses because they find it hard to carry material over from one lecture into the next. They find it hard to see the thread that runs through the course. If you are aware of that, and you work hard at trying to pull things together, then I think that team-taught courses are very good, because you can have somebody who really knows about some particular topic. [...] But one hasto bear in mind that there are cracks between [laughs] that people can fall down.

B3F P L3 Lines 47-48

I guess that's part of the problem from our side. I'm not sure all of us have a complete view of [the course unit]. The course coordinators have to, to some extent, who each have their input to it. I'm not convinced we spend enough time as a body, getting everyone together to review where we are and where we're going. [...] You try to go along to meetings when meetings are called, but you're not always available, and since it's such a large course with so many people, having everyone there every time is not [feasible].

B2F P L7 Lines 11-16

Findings from interviews with final-year students and their teachers

The main findings from the interviews with final-year students are dealt with quite succinctly below, since they have already been systematically reported, both in an extended conference paper (Hounsell, McCune and Nisbet, 2003) and in a somewhat shorter journal article (McCune and Hounsell, in press). Neither congruence with learning support nor congruence with course organisation is explored in this section, since these dimensions have much less salience in the much smaller and more homogeneous classes typical of final-years honours units. Congruence with students' backgrounds and aspirations is also much less relevant than in first-year units, though it did have some resonance in pinpointing the little-noticed step-change the students had experienced in the later years of undergraduate study, as they underwent a process of adjustment to the demands of honours-level study.

Congruence of curriculum aims, scope and structure

The student interviews

In the analysis of the interviews with the final-year students, two broad themes concerning ways of thinking and practising (WTP) emerged. The first of these derived from the students' accounts of the importance of their engagement with the primary research literature and with experimental data. It seemed clear that they were developing a grasp of how to locate appropriate and up-to-date sources of information and to select what was relevant within those sources. This had also meant getting to grips with how knowledge was generated in the subject area and understanding that interpretations could be challenged and that it was therefore legitimate, and even expected, that they would put forward their own perspectives. Not surprisingly, many had found this challenging.

> That's the whole idea, is to get used to proper science. If you're gonna become a scientist, you need to quote papers, you need to have proper up-to-date references. That's one thing they're really pushing you to do this year, they're trying to turn you into real scientists. So if you write essays you're not gonna get a good mark. Even in exams, if you don't use references, you're gonna struggle to get a 2:1.
>
> B3LP V01

> So, when we are reading [scientific articles] we don't have to say, 'Oh yeah, okay, these are the conclusions, yeah cool.' But we have to say, 'Why did they do these experiments, why not others? Okay, why is this working this way, why these conclusions?' […] we have to prove that we are understanding the concepts.
>
> B2LP D01

> S2: Yeah, you have to find various papers and understand them by reading them and then you have to summarise what they're saying, obviously whether you agreed with that or not. And studying [this area] there's lot of disagreement, you know they're not all saying the same thing or coming from the same line of thought. So they have different opinions. [S1: yeah] […]
>
> S1: So long as you've got evidence to back up your ideas with. As I say, it's not what it is just because it is, you've got to give evidence.
>
> B1LP V01

The second theme centres on the students' sense of whether they were learning to communicate in distinctive ways as they moved through their studies. While this had included many familiar requirements of scientific communication (precision, for example, or acknowledging sources), it had also entailed other, more elusive aspects of mastering the conventions of written and oral discourse in the biosciences. One part of what they appeared to be learning was coming to terms with the variety of forms of language, and different communicative genres, required for different aspects of their studies within the subject:

> And for me, okay, the hardest part is going to be we cannot use any lab slang. So, we cannot say, "Well, we put to the proteins to centrifuge", we have to say, like "we pelleted the protein", but I

mean for everything.[…] So, it's really technical, and it's really a good command of the language.

B2L V02 , lines 561-569

S2: In my project I was supposed to write something scientifically and I just wrote an essay, 'cause that's how I do it, and when I'd seen my supervisor's version of the same thing, it was like, 'Wow, can't do that yet, at all.'[…] Well in comparison to his. He […] referred back to other articles that he's written and other people's work whereas I only did it to my work. [His] was more scientifically written, presented, written in a certain way. Whereas mine was just like the introduction, the method, the results as normally. And his was much better obviously, 'cause he's had more experience in it. […]

S4 : We're trying.

S1: It's just practice I think.

S4: I mean it's only the first time that we're doing something like that, so in the beginning it's always difficult. Further on, we're more experienced. I think we'll do fine, hopefully.

B2LP V02, lines 497-520

Another part entailed developing expertise in meeting the needs of a range of audiences, each of which placed different demands on the students:

You expect the people reading it are going to have that basic understanding so you don't need to explain the basics […] I suppose not to be too afraid of being overly scientific about it, because, if it's going to be read by peers and they'll be able to critically assess it that way and understand it easier too.

B1L JN03 127-128

For the group meetings [that we had when I was on placement], we would just be sitting around the table having a chat, it wouldn't be a formal presentation or 'polished' results. You would just say, "This is the preliminary result I got from such and such an experiment, what do you think of this, is there something I could improve in my experiment?". Just a general chat. Whereas if you move up to sort of department meetings it would be 'polished' data that you're presenting in a formal manner, so you would have to sort of be able to say, "These are the experiments that were done and these are my results. I had a chat with people in my group, they suggested that I should do this, so that's what I did and here are my 'polished' results". [...] You would have to give them a lot more background information than necessarily you would with people who work on the same thing as you.

B2L JN02 127-136

The staff interviews

A rich variety of indicators of WTP was also evident across the full set of interviews with the teaching staff for the three final-year units. There is not the space here to present an analysis of this material at a level of detail that would adequately reflect its grounding in particular and specialist areas of the subject, but the pervasive concern to foster various ways of thinking and practising is readily apparent, even in a small selection of extracts such as the following:

I think what I would really like students to develop is a sound understanding of the experimental basis of everything we know and understand about transcriptional and post-transcriptional processes. And that's something that takes a lot of time. And sometimes, given the shape of our modules and the time available, it's not always possible to focus students' attention on experimental bases for their understanding of various events in transcriptional control. And that's where the course work, the guided study, comes in. Where the students have to contend with the literature and take on board a new development in the field, so the course work I set them this time was RNA interference which was just emerging as an important idea for regulating genes, but for experimental purposes. And so that was their course work, where they had to read the original literature, understand an important experimental series of procedures and fit that into the general perspective of gene regulation.

B1L P L1 Lines 88-89

> There's nothing [in the module] which would be key knowledge for someone who wants to be a molecular and cellular biologist because there are various options. So, I suppose what we're trying to do is make them get to grips with a specific topic and analyse the problems associated with that topic, and be able to have a grasp of what's going on, what the research problems are, how you approach finding out more about that topic. [...] I just think it's a way of learning to think in particular ways. I suppose developing their own skills in analysis in that area.
>
> B2L P L1 Lines 90-95

> Well I guess it is, it's the critical appreciation which ideally I would most like them to have. And that is to develop the skills of not merely accepting what the abstract of a paper tells you. It's being able to look at the data in a paper and then to say or to make your own conclusions as to whether that, whether those conclusions are consistent with the data presented or are they the only conclusions etc.
>
> B3L P L1 Line 356

As these and other comments indicate, the range of skills and competencies referred to was wide-ranging, and often clustered around the successive steps of seeking relevant information on a topic, analysing and interpreting it, and communicating what has been found out – which were chiefly pursued and practised, as is evident here and elsewhere, through active learning opportunities such as coursework assignments or, in hte case of B2L, group-based problem-solving.

Interestingly, what also differentiated the staff from the students in their references to WTP was the capacity – presumably stemming from their depth of experience and standing in the subject – to recognise and value the career benefits to students of learning to WTP. These benefits, some of them were keen to point out, could be useful far beyond professions closely linked to the biosciences:

> We're aware that whatever sort of employment they go on to, professional types of employment, so many of them are going to be asked to do presentations of one sort or another. Whether they're going to industry, lecturing, teaching, research, they've got to have the confidence to stand in front of a class and to begin to defend whatever they're presenting.
>
> B3 LP L1 line 328

> It's more a way of thinking and knowing how to approach problems because, for example, if people are employing post-graduates/PhDs, they don't say, "What we need is a student who's got a degree in genetics or a degree in molecular and cellular biology." What you're looking for is someone who's got a good degree and can think in the right ways. So, I suppose we're trying in these degrees to give them a certain degree of knowledge. But it's mainly getting someone who can think and solve problems. [..] Once you've grasped [that]you can actually apply what you've learned to a Phin any subject or even going to industry and apply what you've learned because it's like anything, if you are looking at a new problem you just go to the library and get some reviews and read it up. But you need to have those basic skills in place of knowing how to read the literature, how to assess what you're reading, evaluate it, bring it together.
>
> B2LP L.1, lines 98-99

> Well it is the same with all of these seminar units. They reflect the interests of staff members at the ... supposedly the highest level of non-experimental work that is available to undergraduates. The encouragement is to go out and look at the original literature. And so it leads an undergraduate into the type of scholarship that they will have to do if they go into science as a career. Certainly if they go into it for a higher degree. Which most of our students do. But even if they go into it in industry or even in a related subject like patent law, this is one of the experiences that we hope will be useful to them. The necessity, the absolute necessity to consult the scientific literature outside of mainstream textbooks. The secondary, well not secondary, the second but just as important is the ability to present these results to their peers.
>
> B3L P L2 Lines 44--45

Congruence of teaching-learning activities

The teaching-learning strategies pursued in the three final-year course units were strikingly different from one another, as was noted earlier in section 4a and summarised in Figure 4.2. Yet despite these

differences, and the contrasting student experiences associated with them, the students' perceptions of the teaching provision were positive across the three settings:

S1: It is a really good module [...]. It all interlinks.

S2: Yeah, with the lectures you're able to see it coming together … because of the relevance regarding how the science is applied, and how the basis of the science can be used to understand new concepts, so that helps bring that sort of process together.

S3: Same here.

B1 L P JN3

What I enjoyed most about it is that we've had a lecturer for each different topic [...] so it's been someone whose really keen on the topic and who really knows everything about it and is working on it [...] Because we get the half-hour break or twenty-minutes' break between each section, we always find ourselves just sitting and talking over the problems, because we get them beforehand [...] So we are just looking at them and just kind of talking through the stuff that we've learned in the first half, so that you learn it a lot better if you discuss it with other people.

B2 L P V1

I think it's actually quite useful too, that you're given a topic which you don't know anything about usually, and you have to actually research it. And also when other people present it, it's quite nice because it's different to lectures and you learn about the usefulness of certain applications or yeah certain techniques.

B3 L P V1

Congruence of assessment and feedback

Assessment regimes in the three course units also differed considerably, ranging from an approach based wholly on exams in B2L to one based entirely on coursework in B3L, and a mixed economy in B1L. And once again, despite these differences, the questionnaire findings, as we saw earlier, had appeared to show a reasonably high degree of congruence in the perceptions of the students. However, closer examination of the B3L questionnaire item scores on the 'guidance and feedback on assessment' sub-scale revealed much lower mean scores for two of the items, as Figure 5.9 shows. None of the B3L students agreed or strongly agreed with the statement 'The feedback on my work helped me to improve my ways of learning and studying' (fdbk for learning, mean = 2.3), while only one student agreed with the statement 'The feedback given on my set work helped to clarify things I hadn't fully understood' (fdbk to clarify, mean = 2.6).

Figure 5.9: Students' ETLQ scores on 'Feedback' subscale (Means +- 1 SD)

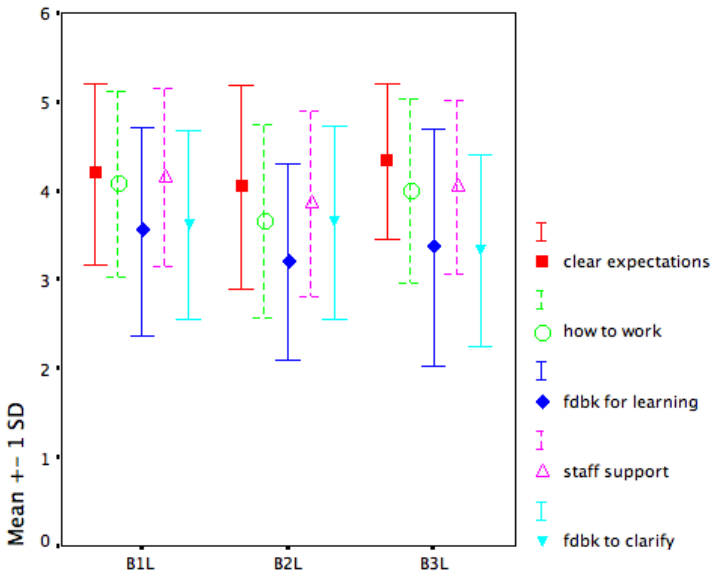


Table 5.2: Feedback items from the ETLQ

- It was clear to me what was expected in the assessed work for this course unit.
- I was encouraged to think about how best to tackle the set work.
- The feedback given on my work helped me to improve my ways of learning and studying.
- Staff gave me the support I needed to help me complete the set work for this course unit.
- The feedback given on my set work helped to clarify things I hadn't fully understood.

Analysis of the interviews also proved illuminating, suggesting that while students in all three units had commented positively on the guidance they had received about what staff expected of them in their assessed work, this was not the case for the essays which the students in B3L had to submit by the end of the semester:

> Various factors seemed to have fuelled their uncertainty: a lack of past experience of (and present practice in) writing essays; unfamiliarity with the kind of essay assigned in this module, which had been designed to foster sustained critical reflection that drew on what they already knew and understood rather than called for new reading around the topic; and a perceived paucity of feedback on those essays which had been submitted for other modules.
>
> (McCune and Hounsell, in press)

These students also expressed uncertainty about what the ground-rules were for buttonholing their lecturers in search of further guidance, and disappointment with the paucity of feedback they had received on their semester presentations:

> S1: They were encouraging. We were the first up and they did say, "Well done, that was a good start".
>
> S2: They don't hold you back after, though, do they, and tell you where you went wrong? 'Cos like in my biochemical ethics [module] the people that did the presentation stay behind with the two lecturers and they tell you how they think you performed. So you get a very clear instant reaction, whereas this one you don't at all. So you've no idea how well [you've done].
>
> B3LP J01

In sharp contrast, the students in B2L had shown much more positive perceptions of feedback, both in their questionnaires responses and in their interview comments. At first sight, this might seem puzzling, since these students had no set coursework, and thus no opportunity to receive feedback of the conventional extrinsic kind, i.e on assignments which were completed and submitted outwith timetabled class time. But this seemed amply compensated by the rich advance guidance the students were given on exam requirements, together with the intrinsic feedback – to use a distinction put forward by Laurillard (2002) – which they derived from the problem-solving sessions which formed a centrepiece in the module. These had evidently enabled them to gain repeated practice in tackling problems grounded in authentic data, and to check out answers with one another and with the guest lecturers and the module coordinator:

> S1: You've got your [unit handbook] that tells you all your references and learning objectives for each lecture.
>
> S2: And the lecture actually itself, and then afterwards it's like discussions been done and then you've got the reference and I think there is objectives as well in this.
>
> S3: And even answers to the problems that we've done. And the discussions afterwards. If you miss anything during the lesson you have it. [...]
>
> S4: It's really demanding because you have to think and you have to do a lot of work for it, but in the end, they also give you the basis for you to succeed, I think.
>
> B2LP V02, lines 379-387

c. Enhancing Learning and Teaching – Collaborative Initiatives

As explained in the introduction to this report, the research design of the main part of the ETL project involved a two stage process. In the first year of our work with a particular course unit we focused on developing an understanding of the teaching-learning environment of that unit, as perceived by the students and staff. One of the main aims of the ETL project was to investigate the effectiveness of changes to teaching-learning environments, which had been informed by perspectives from the research literature and by evidence systematically collected in each setting. Therefore the second stage of our work with a given course unit involved building on the findings from this first round of data collection to negotiate collaborative initiatives with the course teams. The four initiatives taken forward, which are summarised in Table 5.3, involved evidence-informed changes to the course units intended to enhance the quality of the students' learning. In settings B1F and B2L the decision was taken not to pursue an initiative. In setting B1F scheduling interviews with students proved impracticable following the leave of absence of the module co-ordinator, while in setting B2L it was felt that the course unit was functioning so well in its current format that it would be unwise to introduce any changes.

Looking firstly at the impact of the qualitative data collected in each setting, summarised in Table 5.3, almost every aspect of each collaborative initiative was guided by the findings from the student interviews. While the interviews provided a generally positive impression of each of the four course units in focus here, they also gave rich insights into how the course units might be further enhanced. The analysis of the student interview data focused on drawing out key themes to illustrate which aspects of the course units as teaching-learning environments were best supporting the students' learning and where there might be scope for change. In taking forward this analysis we took into account the aims of the course unit, as expressed in the course documentation and interviews with members of staff. We were also alert, however, to the students' perspectives on how well the course units were meeting their aims and needs. In reporting our analyses to the course teams, we took care to indicate the frequency with which particular themes were expressed across the interviews and to draw attention to counter-examples. One limitation of the interview data in some instances was that we were only able to interview a small proportion of the students from the larger course units.

The overall picture from the ETLQ items relating to students' perceptions of their course units as teaching-learning environments, was very favourable in all four course units. In three of the four settings, data from the ETLQ also contributed to an understanding of how the units might be enhanced. As ETLQ data had been collected from between 42% and 100% of the students in the settings in which initiatives were subsequently taken forward, this data provided more information as to how common certain concerns were among the students on each course unit. Typically it was necessary to look at the data at the level of individual questions in order to identify potential problems, as the scale scores sometimes masked lower scores on single items. One difficulty with using a generic questionnaire in all of the settings was that it was not possible to have enough items to capture all of the aspects of the teaching-learning environments which subsequently proved to be relevant. In some instances, for example, items which related to teaching or assessment in general could not illuminate difficulties which arose with some parts of the teaching, or only with certain assessments. As the students sometimes completed the questionnaire before they had received feedback on aspects of their work, the feedback items did not always pick up issues which students raised when looking ahead during the interviews.

As discussed earlier (see section 5b above) many of the difficulties mentioned by the students related to feeling the need for greater guidance and feedback about their assessed work in a context where managing the transition to University-level study (for many first year students) and adjusting to the demands of honours-level study (for many final year students) had contributed to uncertainties about expectations. This being the case, all of the collaborative initiatives included efforts to enhance students' understanding of what was expected of them in their assessed work and of what they might do to improve for future assessments. In B1L part of the concern was that masters students, who were new to the institution, might not have had sufficient guidance and feedback on their

Table 5.3: Collaborative initiatives in the biosciences

Unit	Collaborative Initiative	Key Student Interview Findings Leading to Initiative	Key Quantitative Findings Leading to Initiative	Evidence of Impact of Initiative
B1L Genomes	Enhanced guidance about course structure and 'throughlines'. Additional guidance about criteria/ expectations for assessed work. Feedback on course work prior to exam.	Several interviews – difficulty following the sequence of parts of the course unit. Several interviews - concern that feedback may not be received before exam. Some uncertainty about level/expectations for assessments.	Little clear evidence in quantitative data.	No evidence of relevant improvement in the quantitative data. Several interviews – positive comments about additional guidance provided about assessed work. Impact of attempt to clarify throughlines unclear.
B2F Foundation Biology	Making clear to students the relevance of the skills elements of the course unit to the work of practising biologists. Enhancing guidance to demonstrators about advising students on assessments and skills elements. Enhanced guidance and feedback proforma for one assignment.	Several interviews – some students expressing narrow 'exam focused' view and difficulties seeing relevance of skills elements. Several interviews – concern about the adequacy of guidance/feedback on certain assignments.	No directly relevant questionnaires items. Substantial minority - low scores on items in 'clarity and feedback about assessment' scale.	In all but one interview the students expressed positive views about the skills element of the unit. All interviews - more positive comments about the guidance and feedback on the assignment that was the focus of the initiative. No improvement in quantitative data.
B3F Foundation Biochemistry	Formative assessment via MCQs given in some lecture slots. Guidance to tutors to enhance the consistency of tutorial support. 'Orientation' lecture at start of module to enhance students' understanding of how to approach the course unit.	All interviews - lack of feedback, delayed feedback and lack of opportunities to practise examination questions. Two of three interviews - tutorial support varied markedly between tutors.	Over 50% - low scores on items relating to being given useful feedback. Not possible to relate items specifically to tutorials. Over 50% - disagreed with item about being prompted to reflect on how they were learning.	Positive comments in two out of three interviews that the MCQs provided students with useful feedback. No improvement in quantitative data. All three interviews - indications of little success in achieving consistency of tutorial support. Improvement on item about being prompted to reflect on how they were learning*. Higher scores on items relating to organisation/ alignment may have been related to this initiative.
B3L Enzymology	Additional guidance about criteria/ expectations for essays and presentations. Staff met students to give feedback on their presentations. Anonymous peer feedback on presentations.	Two of three interviews – uncertainty expressed about criteria/ expectations particularly for essay assessments. All interviews – lack of feedback an issue generally in the department. Little feedback given on presentations. Students unclear what feedback to expect on essays.	Unclear - items did not distinguish between presentation and essay assignments. Mean scores on two feedback items below the midpoint of the scale.	All interviews - indications of greater clarity about essays. Higher scores on items relating to guidance about assessment. Positive responses to the additional feedback across all interviews. Higher scores on items relating to feedback.

progress before their examinations. The additional guidance, provided as part of the collaborative initiative, seemed to be appreciated by the students when they commented in their interviews. The lack of any apparent impact of the initiative on the questionnaire items and scale scores may perhaps be explained by the fact that the sample brought together two rather distinct groups of students taking a course unit in which different parts of the unit were taught somewhat differently. Splitting the data for the students into the two groups was not helpful as this made some of the sample sizes rather low.

In B2F there were two assignments that seemed particularly problematic in terms of the students understanding of what was expected of them and of the rationale for their grades. It was therefore decided, as part of the collaborative initiative, to provide additional written guidance to the students about one of these tasks and to provide a structured proforma for feedback on it. The guidance notes given to the lab demonstrators about advising students on assessments were also strengthened. In the subsequent iteration of the course unit the interview comments relating to this assignment were much more favourable. There was no evidence of discernible change in the quantitative data, perhaps because the effect of changes to the guidance and feedback on this one assignment had not been sufficient to show up against the students' perceptions of the feedback on their assessed work as a whole.

> Yeah. [...] I thought [the feedback on the assignment in question] was good because it had written comments and how you'd done in each bit. So it wasn't just a mark out of nowhere, you knew where you'd let yourself down, whether it was the presentation, or whether it was the content, or what.
>
> B2 FC JN02, lines 65-73; 113

Looking at the impact of the use of multiple-choice questions to provide formative feedback, in site B3F, a similar picture emerges of positive commentary on the changes in the student interviews which were not reflected in the questionnaire data.

> S2: But [the module co-ordinator's] been giving questions at the end of his lectures but none of the others had. Which is a shame […].
>
> I: Does it help when they do?
>
> S1: [It does?] because at the start of the lecture when he's preparing it and you are sat down talking or whatever, if you look at the question and then think about it, the last lecture does kind of flood back a little [...]
>
> S3: And if you don't know, then you just write it down and you will look back at the lecture, or you will do the reading or something, so . . .
>
> S4: It's useful, it was useful.
>
> B3 FC V01, lines 174-179

This difficulty in demonstrating an effect of the collaborative initiatives in the questionnaire data may be related to the more general problem of achieving across-the-board changes in large first year courses where there are many members of staff involved and they are working under considerable pressure. It is perhaps therefore unsurprising that the strongest evidence of change in our biosciences settings comes from the small final year course unit B3L. Again the focus was on guidance and feedback on assessments and in this setting clear changes were apparent in both the qualitative and quantitative findings. As indicated earlier, the assessments for the B3L setting comprised two course work essays, which were rather different in their demands to previous essays written by the students, and 40 minute oral presentations given by pairs of students. Prior to the collaborative initiative the students had indicated some uncertainty about what was expected of them in their essays and were concerned about lack of feedback (the latter was of concern in the department more generally, rather than being specific to this course unit).

The collaborative initiative in B3L involved additional guidance to students about how tackle the presentations and essays and about how they would be marked. This was given during the first meeting of the class and reinforced with a handout, in the case of the presentations, and through

further class discussion, in the case of the essays. Feedback to students on their presentations was given in a private meeting with the members of staff teaching the course unit, directly after the students' presentations. Peer feedback was also given on each presentation using anonymous slips on which each student recorded one excellent feature of the presentation and one aspect on which there was room for improvement.

Figure 5.6 and Table 5.4 show the mean scores on each of the scales relating to the students' perceptions of the teaching-learning environment on B3L pre and post the collaborative initiative. The scores suggest that the students had even more positive perceptions of the course unit in the post collaborative initiative year, across all of the scales. The biggest improvement was on the 'clarity and feedback about assessment' scale, as would be expected given the nature of the collaborative initiative. The next largest improvements were on the 'alignment' and 'support from other students' scales. The latter effect may be due to the element of peer feedback in the collaborative initiative. The alignment scale measures students' perceptions of the integration between how they were taught, how they were assessed and what they were supposed to learn. It might be that the additional guidance given about the assessments contributed to the increase on this scale.

Table 5.4: Comparison of perceptions of the module in 2002/3 and 2003/4

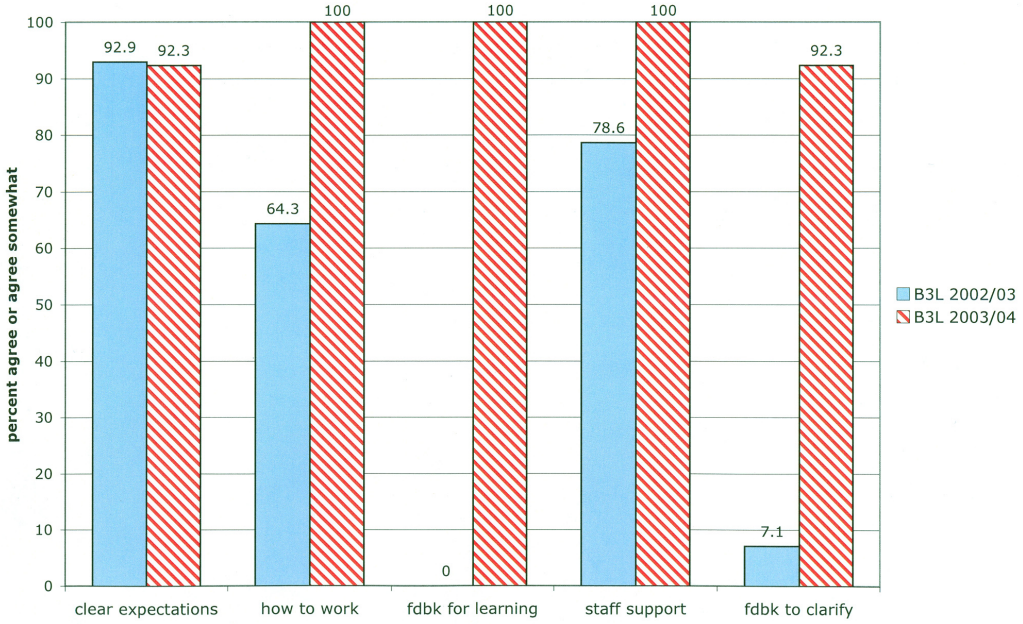
	Pre-collaborative stage			Collaborative stage		
	Mean	*SD*	*N*	*Mean*	*SD*	*N*
Clarity and coherence	3.51	.45	14	4.26	.53	13
Choice allowed	4.36	.69	14	4.62	.62	13
Encouraging learning	3.67	.65	14	4.23	.42	13
Set work and feedback	3.31	.80	14	4.36	.38	13
Assessing understanding	3.75	.94	14	4.54	.52	13
Staff enthusiasm and support	4.18	.64	14	4.54	.63	13
Student support	3.61	1.11	14	4.73	.33	13
Interest and enjoyment	3.75	1.12	14	4.65	.32	13

Figure 5.10 summarises the students' responses to the individual items in the 'clarity and feedback about assessment' scale. The improvement is really quite striking, particularly on items 35, 'The feedback given on my work helped me to improve my ways of learning and studying' and 40, 'The feedback given on my set work helped to clarify things I hadn't fully understood'.

In addition to these changes in the way the course unit was perceived, differences between the students' typical approaches to studying for the subject area (as measured by the LSQ) and the approaches they reported taking to the course unit (as measured by the ETLQ) were more marked in the post collaborative initiative year. The 2003/04 group showed a slightly greater improvement in the deep approach and a slightly greater decrease in the surface approach, as compared with the 2002/03 group.

There is evidence to suggest that these differences between the pre and post collaborative initiative cohorts' perceptions of the course unit were unlikely to be due to existing differences between the groups of students when they began the course unit. At the beginning of the course unit the two cohorts had similar scores on items relating to: what they were expecting to gain from the experience of higher education; their reasons for taking the course unit; their typical approaches to learning and studying and their self rating of academic progress before starting the course unit. There was also evidence in the student interviews which supported and developed on these questionnaire findings. The students in the post collaborative initiative group typically indicated greater confidence in their

Figure 5.10: The students' responses to individual feedback items



understanding of what was expected of them in their assessed work. The students seemed to value both the staff and peer feedback, although they differed in their views about how honest they felt their peers would be. The students generally felt that the staff and student feedback focused mainly on their presenting skills, whereas the class discussion helped to develop their understanding of the scientific content.

I And they, how much have they told you about the essays? […]

S4 They have given us good guidance -

S3 Yeah,

S2 Yeah, they did didn't they? […]

S3 Yeah, one of them particularly, it's not really anything we can find references for […] So, it's something we've really got to kind of think about, and draw on our knowledge of what we already know. So rather than just go away and find a paper to start with, we've sort of got to think about it first, and work out which direction we want to go in with it. […]

I And what sort of things do you think it's going to be marked on?

S1 I think they'll look in your writing to try and see what level of understanding in general, of Biochemistry you have [..]

S2 You can probably try and put some of your own original ideas into it as well, cause they're quite, you can, as you said, interpret it, interpret it differently so it's probably quite a lot of that as well.

S1 Yeah, and you come to realise that they're looking for, the people who sort of, maybe come up with a novel idea, or you know [..] like an original, sort of technique or way of learning or something. [...]

B3L, CJ 01 TEXT UNITS 265-313

I So do you think this thing with having feedback from the other students, is that a worthwhile thing? […]

S1 I think it is, cause then you realise, you realise what you did wrong and how you can improve it. It is actually really useful.

S2 Especially from people that [...] you know, that if we do something blatantly stupid they'll tell us. It's quite good to get opinions from people who've been listening to you but not marking […]

B3L, CV 01 TEXT UNITS 79-101

The other theme which links the collaborative initiatives in the biosciences settings is attempts to 'frame' the course units for students so that they had a clearer understanding of either the purpose of the unit, its structure, or how they were expected to approach the unit. This issue was relevant for B1L and B3F but was particularly salient in the B2F course unit. A number of the students in the pre collaborative initiative cohort in B2F expressed rather narrow 'exam-focused' views of the course unit and a lack of understanding of the relevance of some of the skills elements of the unit. They seemed to focus on what was covered in the lectures and final examination, rather than taking a broader view of what they might learn from the module. This then seemed to lead these students to evaluate the other components of the module in terms of whether they served the purpose of helping them learn the 'syllabus' as defined by the lectures and examination.

I: Do you have a sense then at all of what it is they're trying to get you to learn from these assessments? Cos it sounds like folk are a bit confused. Are you getting some sense at all of what sorts of things they're hoping you get out of it?

S: Not really from these ones. Like the whole poster and debate I mean that's [..] that was working together [….] but I'd have probably preferred it if it was working together like while learning something you were going to be examined on, something that was going to be useful for you. [….]

B2F PV 03

What is puzzling about this 'exam-focused' view is that it seems to be at odds both with the assessment weightings for B2F (in which 50% of the marks on the module come from the coursework), and with considerable research evidence that undergraduate students are strongly influenced by their perceptions of assessment requirements (Marton, Hounsell and Entwistle, 1997; Wilson, Lizzio & Ramsden 1997). It is possible that this narrow view might perhaps have carried over from students' prior assessment experiences, in Highers or at A level, where exams were externally marked and might thus have been seen as much more of a decisive benchmark than coursework. It might also be that, prior to coming to university, students were given much greater direction in how to focus their effort equitably across all aspects of their work, and were now having trouble doing this for themselves. In the extract below, some students discuss how they had not realised the importance of coursework for an earlier course unit, but had now begun to appreciate just how much it counted in first-year biology:

I: Do you have a sense at all of what would be most important to do well in the subject area? Maybe if you know someone was going to come and study this next year, what would you say were the important things to do well in that?

S2: Get your coursework sorted out and don't mess about with it cos you don't get told the kind of real emphasis [..] put on coursework. I didn't do that brilliantly [last semester] and it made my mark go well down [...] It catches up with you if you don't expect it. It ended up that to get 'A' I would have had to get 96% in the exam […] the coursework is a lot larger emphasis than you realise.

S1: [..] They tell you it's 5% [..] and you're like, 'huh, 5 percent' [..]

S2: But it all adds up.

S1: It does all add up, uh huh.

B2F PV 04

As part of the collaborative initiative the course team were encouraged: to making greater use of introductions to practicals to convey the importance of these skills; to give greater emphasis to subject relevance (e.g. by referring to 'the skills of the practising biologist' or 'the contemporary biologist's toolkit' rather than simply to 'transferable skills'); and to encourage staff and post-graduates teaching on the laboratory classes to talk with students about their own research, and to display in the labs examples of posters they had created to communicate research findings at bioscences conferences. In the subsequent collaborative initiative year the disintegrated views of skills expressed by the prior cohort were rarely expressed in the interviews.

I Did you understand the point of doing a poster as opposed to just standing up and talking?

S1 Yeah, because it was like to [the student then describes the topic of the poster]. So even if the research didn't relate much to what you were doing in the lab it actually got you going out there and the whole point of researching does relate to everything because it got you on the internet and in the libraries and looking at your books and getting, 'cos you had nothing, you had to start from scratch so you were responsible for going out there and getting all this information and data to put on the poster. So that does relate to what you would have to go and do.

B2 FC J01, lines 134-142

All of the collaborative initiatives described here can be understood in relation to the notion of congruence introduced earlier in this report. In each setting we worked from the starting point that the different elements of a teaching-learning environment need to work together to support the kinds of high-quality learning sought. Our choices about which aspects of these environments to address in our questionnaires and interviews was guided by findings from more than thirty years of research focusing on student learning in higher education from the student's perspective (for more information about how this literature forms the basis of the work of the ETL project see Entwistle, 2003; Entwistle, McCune and Hounsell, 2003; McCune and Hounsell, 2004). In some of our settings, particular questionnaire items or scales stood out from the broadly positive picture presented by the rest of the scores and this provided evidence of possible lack of congruence between some aspects of the teaching-learning environment and the aims of the course units. In each setting the students' concerns, as expressed in their interviews, provided rich perspectives on aspects of the course units which seemed to them to be out-of-kilter.

What is apparent from our findings is that there is no single correct formula for achieving high degrees of congruence within a given setting, even when many of the broad aims are the same, as was the case particularly in the final year courses considered. Each of the course units described here, and earlier in this report, showed many aspects of congruence before the collaborative initiatives were begun, even though there were marked differences in how they were taught and assessed. In our attempts to increase the congruence in four of the settings, through collaborative initiatives, it was necessary to consider each setting individually and in-depth to identify possible courses of action. While guidance and feedback on assessments was a fairly common theme across the settings, the actions taken had to fit the particular setting and the needs and stages of development of particular groups of students. It was also important to take into account the different contextual constraints on congruence such as differing levels of resource and variations in institutional practices.

Those aspects of the initiatives which focused on 'framing' the course units for students signal the need for students to be able to perceive the congruence of the teaching-learning environment in a particular setting and to have an understanding of how they might approach their learning within this context. This was particularly striking in B2F where aspects of the teaching-learning environment which seemed, on the face of it, to be well aligned to the aims of the course unit were perceived negatively by the students because they did not understand the purpose of these activities.

One aspect of our findings which was disappointing was that it was rarely possible, in our questionnaire data, to demonstrate any clear effects when comparing the pre and post collaborative initiative cohorts in terms of the differences between their typical approaches to learning and their approaches to the course unit. There are a number of possible reasons why this was the case. In the two first year settings it was difficult to achieve widespread and consistent changes to the course units when working with large course teams. In all of the settings the students would also have been influenced by the wider pressures of their overall degree programmes, of which the course units in question formed only one part. Wider workload pressures, or perceptions of typical assessment expectations, may have limited the extent to which students felt able to alter their approaches.

Given that there was typically less than one semester between the first and second questionnaires, this may not have been sufficient time for marked changes in approach to develop. For a student to change their approach to learning they may not only need to perceive that this is supported

and rewarded by their teaching-learning environment they may also need to reflect on their own learning processes and consider how they might adapt. Such change processes take time and would be more likely to be apparent where systematic changes were made across several years of a degree programme. It is possible, however, that the questionnaires were simply not sufficiently sensitive to pick up any changes in the students' learning which did occur. It should also be borne in mind that we were working with generally successful courses to begin with, in which the students were already displaying approaches to learning which seemed generally consonant with successful higher education study.

Overall, the picture presented here is one which illustrates how successful course units can be further enhanced in ways which notably improve students' perceptions of the settings as teaching-learning environments. These changes were also achieved, on the whole, without large additional demands on the staff teaching the units. This is an important point as it has been apparent, across the ETL project, that academic staff often struggle considerably to juggle multiple demands on their time. Further, we have often found that the course units under study are shifting and changing, due to pressures outwith the control of the course teams, such as institution wide changes to programme structures. The pressures on staff and students mean that the ETL team have also had to make considerable efforts to collect adequate data. Providing sufficiently rigorous, rich, and clearly explained accounts of our findings to support collaborative initiatives has also been a time-consuming process. This being the case, course teams or educational developers seeking to build on the findings presented here, and in other ETL publications, may find it more profitable to draw on aspects of the key findings, core concepts and tools developed during the project, than to attempt to replicate the research process described here.

6. CONCLUSIONS AND IMPLICATIONS

In this closing section of the report, we review the main findings emerging from our work in the biosciences and explore their implications for teaching-learning practices. The sequence followed is thematic, considering in turn ways of thinking and practising, engaging with student diversity, feedback and formative assessment, and course organisation and management. We also re-examine congruence itself, as a framework for monitoring, appraising and 'trouble-shooting' teaching-learning environments, and conclude with the theme of evidence-informed development.

a. Ways of Thinking and Practising in a Subject (WTP)

As reported earlier, WTP was devised by the ETL project team in an attempt to capture the richness, depth and breadth of what students can learn through engagement with a given discipline or subject area in a specific context. For the students, this entails learning to think like an established subject specialist and to undertake activities and tasks in a manner akin to an experienced subject practitioner. The concept can also encompass developing a sense of how knowledge is generated in the subject, and a critical appreciation of the limits of evidence and the contestability of findings, as well as communicating the subject for varied purposes and to differing audiences.

The main findings included:

- Learning to think and practise as a bioscientist was embedded within the experience of coming to know the subject at an advanced level. As students' grasp of a subject area developed, so too did their appreciation of what might be entailed in thinking liking a bioscientist and practising as an established practitioner.
- Although it was possible to distinguish aspects of WTP concerned with, inter alia, conceptual understanding, skills, or attitudes and values, these various aspects were generally closely intertwined and symbiotic in the practice of the subject.

- WTP was most readily apparent in (and evidently most clearly promoted through) active learning opportunities of a variety of kinds: for example, through working through problems alongside practitioners in B2L, or through placements and through giving presentations in B3L.
- Although WTP was most visible in final-year course units, first-year courses could nevertheless provide opportunities to begin to acquaint students with the 'toolkit' of the practising academic or professional bioscientist as in B2F where students were asked to prepare posters and write letters to GPs.

The use of WTP as a framework to aid in curriculum design and development might have benefits in helping to pinpoint higher-order learning outcomes. It would also have implications for how degree programmes might develop students' grasp of the subject over the successive years of undergraduate study. A third use of the framework could be in reviewing the congruence of teaching-learning and assessment activities with the pursuit of WTP.

b. Engaging with Student Diversity

An important finding from the present study has to do with the extent to which the course units surveyed engaged effectively with the growing diversity of the students being admitted. While it was evident that each of the units had mechanisms in place to offer learning support – a tutorial system, interactive practical tasks, supplementary learning resources – there was nonetheless a perception among the students from non-standard backgrounds whom we had interviewed that their needs had not been adequately acknowledged by at least some staff. Put another way, there were indications of insufficient awareness of just what was entailed for at least some of the students in making up the lost ground between themselves and their better-prepared peers. This finding is an especially important one given the evidence cited earlier that students with weaker background knowledge at the start of a biology course were less likely to take a deep approach to their learning (Crawford et. al., 1998; Hazel and Prosser, 1991).

As far as possible implications for practice are concerned, perhaps the most important of these would be to ensure that there are monitoring strategies in place which can check to what extent existing support mechanisms are meeting the needs of non-traditional entrants in particular. This may not be easy to achieve through conventional devices such as evaluation questionnaires and staff-student liaison committees where such students are in the minority, and where the needs of particular sub-groups (mature or overseas students, for instance) may be quite different. It may also be necessary to recognise that while supplementary resources (textbooks, computer-based self-study materials, revision tests) can help in 'making up ground', they may at the same time add considerably to students' day-to-day workloads in ways that have knock-on effects.

c. Feedback and Formative Assessment

In the majority of the settings surveyed, at both first and final-year levels, the provision of feedback emerged as a pervasive source of student dissatisfaction, echoing similar findings in other settings and subject areas (see for example Hyland, 2000; Ivanic et al., 2000; Higgins et al. 2001; Hounsell, 2002). The students' concerns were not simply with the quantity and quality of tutors' comments on their work, but could be closely interwoven with other aspects of formative assessment: the provision of guidance about expectations and criteria, opportunities to practise unfamiliar but formally assessed tasks, clarity about ground-rules for buttonholing tutors with queries, and/or the incidence of intrinsic feedback.

Addressing these concerns is important, on two grounds. First, there is extensive empirical evidence from all levels of education that effective formative assessment can facilitate and enhance the quality of learning (Black and Wiliam, 1998; Black et al., 2003; Askew 2000). Second, it may be indispensable in attaining a firm grasp of ways of thinking and practising in the biosciences. As Sadler has argued, "students have to be able to judge the quality of what they are producing and be able to regulate

what they are doing during the doing of it" (Sadler, 1989, p. 121). Thus effective formative assessment involves not simply providing constructive and timely feedback comments: it also entails assisting students to come to hold a conception of what counts as good-quality work in the subject area which broadly matches that held by staff as practising bioscientists.

What then, practically speaking, could biosciences lecturers and tutors do about formative feedback? An overriding priority would be to ensure that they are in touch with students' perceptions and experiences, and promptly enough to take remedial action where this is necessary. And if there are indications of a need to improve the provision of feedback, what options might be considered? This would depend on the circumstances, but might include one or more of the following:

- optimising opportunities for intrinsic feedback, as in B2L
- developing students' capacity to engage with and make use of tutors' feedback (see for example, Merry et al., 2000; c.f. Sadler, 1998, p. 78)
- developing marking and commenting pro formas (as in the B2F collaborative initiative) to link tutors' feedback more explicitly to assessment criteria
- identifying low-risk but constructive ways of involving students in formative assessment, e.g. in evaluating one another's work and in giving one another worthwhile feedback, as in B3L and B2F (c.f. Langan, 2003; Orsmond, 2004) . As Cohen, Boud and Sampson (2001) have observed:

  > The giver of feedback has to identify what constitutes good work in a given subject area and express these ideas in a coherent form, while also communicating effectively with the prospective receivers about their feedback needs. The recipient of feedback benefits from identifying and articulating these needs, from receiving detailed comments from a peer who has faced a similar challenge and from responding appropriately to the feedback.

- involving students in activities where they work collaboratively on problems, or in which the work produced is openly displayed – as in oral and poster presentations – rather than privately submitted. Either or both kinds of activities (examples of which could be found in several of the course settings surveyed here) can furnish students with opportunities to acquaint themselves with one another's work at first hand, and so help to develop a common understanding of what has – and can be – achieved (Hounsell, 2003).

Possibilities such as these can help to create feedback-rich teaching-learning environments in which there is the recognition that regular interaction and dialogue are needed about what high-quality work in the biosciences entails.

d. Course Organisation and Management

Our findings brought course organisation and management to the fore as a dimension of teaching-learning environments which had hitherto held Cinderella status. It is a salient and potentially quite influential dimension, particularly in large and diverse first-year courses where course teams may also be large and diverse and where there is quite high role differentiation between the roles of various team members. The data from both staff and students highlighted particularly issues relating to a sense of impersonality and distance, the challenges of communicating effectively within and across course teams, and inconsistency in practices or difficulties in spreading good practices. For example, in B2F students spoke of not remembering which staff member had given a particular lecture because there were so many different lecturers, and in B3F the variability of tutorial practices led to a sense of unfairness amongst students.

The implications of these findings for course teams and more widely include:

- a need for greater recognition of the demanding nature of effective course organisation and management, with possible implications in turn for the size of workloads, the briefing and

induction of course convenors, and the resources allocated to introductory first-year courses as compared to honours-level courses

- a need for reviews of communication structures within course teams and consideration of what a minimum threshold commitment to a course team might involve for each team member
- a need for course monitoring and evaluation strategies which are 'in time to make a difference' and which are better attuned to the complexities of contemporary undergraduate courses as teaching-learning environments.

e. Congruence Itself

As reported earlier, the construct of congruence was developed by the ETL project team, building on Biggs' model of constructive alignment, as an overarching conceptual model within which various key influences on undergraduate teaching-learning environments can be understood. This study shows the conceptual and analytical potential of congruence in pinpointing and illuminating key contextual influences that could facilitate or constrain the quality of students' learning.

For example, one important dimension of congruence which emerged from the findings was the provision of guidance and feedback to students, the perceived adequacy of which varied greatly. While the feedback given during the seminars in B2L was perceived to contribute high quality learning and WTP, the feedback given on the students' presentations in B3L was seen less positively in spite of it being more obviously in place.

Two other dimensions of congruence - congruence with students' backgrounds and aspirations, and congruence of course organisation and management - were found to be applicable mainly to the first-year course settings, where there were large and diverse intakes of students which were taught and assessed by course teams whose make-up could also be large and diverse and whose roles could be distributed. These two features can set daunting pedagogical challenges, especially in an era of reduced resources per student, as was evident in the experiences of the students interviewed in the present study, and was also acknowledged by many of the teaching staff interviewed. The cohort size and diversity also posed challenges in establishing what the collective experience of such a teaching-learning environment might be, given the variations in perceptions and experiences across classes within any given course unit.

f. Evidence-informed Development

Finally, one further and important implication for practitioners is the role of systematic empirical evidence in informing pedagogical change and development. The data collected during the first phase of the collaborative initiative in each of the departments involved in the project (student questionnaires, staff and student interviews, course documentation), together with further discussions with staff teaching the programme, were used to pinpoint areas where change might be beneficial.

Of course, other factors may also be compelling drivers of change in undergraduate courses, including, for example, the need to respond to new national or institutional policies, alterations in staffing or a rise or decline in other resources, advances in subject-matter knowledge which need to be integrated into or reflected in the curricula, and technological developments which open up new teaching-learning or assessment opportunities. However, our findings suggest that there is a case for a bigger role for evidence-informed change than has been the case hitherto: an approach which is securely grounded in in-depth understanding of how undergraduate courses function as 'teaching-learning environments' and where their respective strengths and weaknesses may lie in facilitating WTP and other high-quality learning processes and outcomes.

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Economic and Social Research Council
Teaching and Learning Research Programme
Enhancing Teaching-Learning Environments
in Undergraduate Courses

Learning and Studying Questionnaire

Introduction to the Project

The ESRC Teaching and Learning Research Programme is a nation-wide initiative designed to provide a more effective research base to help staff to enhance the teaching they provide for students. Our project is the only one at university level, and we are investigating how students learn with differing kinds of teaching and support. We shall be looking at students' approaches to learning and studying in five contrasting subject areas in some 30 course settings across Britain. We shall also be asking students about their experiences on a particular course unit and about the kinds of knowledge and skills they feel they have developed. Staff will also be working with us on the project, and the overall results for the class (not for individuals) will be fed back to the staff to allow them to develop the course unit further. Bringing together findings from all the different course unit settings is intended to produce a general picture of the ways in which research can inform teaching. We hope that you will be prepared to join in this important study by completing this questionnaire and another one later on in the course unit, and that some of you will also be ready to talk to us about your experiences in higher education. If you want to find out more about the study, you can look at the web site at http://www.ed.ac.uk/etl

Data Protection Act

In accordance with the Data Protection Act, we have to ask you to sign the following declaration. You can be quite sure that all the information we collect will be used only for the purposes of research and kept confidential to the research team itself: it will not be released to anybody else.

I agree to allow the university to provide the research team with my name, contact details, grades and other information about my course of study. I also agree that this information, and the data collected from me, may be held and processed by the team for the purposes of research.

Sign

Print name

Date D D M M Y Y

Background information

Institution

Overall programme of study

This course unit or module

FOR OFFICE USE

Identity number

Please complete from the right, e.g. 1 2 3 4 5 6 7

Age

Year of study

Male

Female

1 What do you expect to get from the experience of higher education?

Put a cross in the appropriate box to indicate how strongly you agree with **each** of the following statements.

	Very strongly	*Fairly strongly*	*Somewhat/ not sure*	*Rather weakly*	*Very weakly/ not at all*
a. I want to develop knowledge and skills I can use in a career.	☐	☐	☐	☐	☐
b. I hope the things I learn will help me to develop as a person and broaden my horizons.	☐	☐	☐	☐	☐
c. I'm focused on the opportunities here for an active social life and/or sport.	☐	☐	☐	☐	☐
d. I hope the whole experience here will make me more independent and self-confident.	☐	☐	☐	☐	☐
e. I'm mainly here because it seemed the natural thing: I'd done well academically in the past.	☐	☐	☐	☐	☐
f. I want to learn things which might let me help people, and/or make a difference in the world.	☐	☐	☐	☐	☐
g. I want to study the subject in depth by taking interesting and stimulating courses.	☐	☐	☐	☐	☐
h. I mainly need the qualification to enable me to get a good job when I finish.	☐	☐	☐	☐	☐
i. I want an opportunity to prove to myself or to other people what I can do.	☐	☐	☐	☐	☐
j. When I look back, I sometimes wonder why I ever decided to come here.	☐	☐	☐	☐	☐

2 Reasons for taking this particular course unit or module

Put a cross in the appropriate box to indicate how strongly you agree with **each** of the following statements.

	Very strongly	*Fairly strongly*	*Somewhat/ not sure*	*Rather weakly*	*Very weakly/ not at all*
a. It's something I expect to find interesting.	☐	☐	☐	☐	☐
b. It's supposed to be a fairly easy course unit.	☐	☐	☐	☐	☐
c. It should look good on my CV.	☐	☐	☐	☐	☐
d. It should help me to understand the subject better.	☐	☐	☐	☐	☐
e. It's an area I will need to know about for my career.	☐	☐	☐	☐	☐
f. It's not what I would have chosen but it's compulsory.	☐	☐	☐	☐	☐
g. I understand it's a course unit that's particularly well taught.	☐	☐	☐	☐	☐
h. People I know and like are also taking this unit.	☐	☐	☐	☐	☐
i. It fits in well with the rest of my timetable.	☐	☐	☐	☐	☐

Other reasons .....

3 Approaches to learning and studying

This next part of the questionnaire has been designed to allow you to describe, in a systematic way, how you go about learning and studying. The technique involves asking you a substantial number of questions which overlap to some extent to provide good overall coverage of different ways of studying. Most of the items are based on comments made previously by other students. Please give your **immediate** reaction to **every** comment, indicating how you **really do** study.

We want to know about your **typical** ways of studying in **the subject area** of which this module or course unit forms a part. If you have not yet encountered a particular situation, try to imagine how you would react.

Put a cross in the appropriate box to indicate how strongly you agree with each of the following statements.

✓ = *agree* ✓? = *agree somewhat* ✗? = *disagree somewhat* ✗ = *disagree*

Try not to use ?? = *unsure* unless you really have to, or unless the item cannot apply to you.

	✓	✓?	??	✗?	✗
1. I usually set out to understand for myself the meaning of what we have to learn.	☐	☐	☐	☐	☐
2. When I'm communicating ideas, I think over how well I've got my points across.	☐	☐	☐	☐	☐
3. I'm pretty good at getting down to work whenever I need to.	☐	☐	☐	☐	☐
4. Topics are presented in such complicated ways I often can't see what is meant.	☐	☐	☐	☐	☐
5. When I've finished a piece of work, I check to see it really meets the requirements.	☐	☐	☐	☐	☐
6. I try to make sense of things by linking them to what I know already.	☐	☐	☐	☐	☐
7. I try really hard to do just as well as I possibly can.	☐	☐	☐	☐	☐
8. On the whole, I'm quite systematic and organised in my studying.	☐	☐	☐	☐	☐
9. Often I have to learn over and over things that don't really make much sense to me.	☐	☐	☐	☐	☐
10. I'm quite good at preparing for classes in advance.	☐	☐	☐	☐	☐
11. I tend to take what we are taught at face value without questioning it much.	☐	☐	☐	☐	☐
12. For an essay or report, I don't just focus on the topic, I try to improve my writing skill.	☐	☐	☐	☐	☐
13. Ideas I come across in my academic reading often set me off on long chains of thought.	☐	☐	☐	☐	☐
14. If I'm not understanding things well enough when I'm studying, I try a different approach.	☐	☐	☐	☐	☐
15. I try to relate ideas I come across to other topics or other courses whenever possible.	☐	☐	☐	☐	☐
16. I carefully prioritise my time to make sure I can fit everything in.	☐	☐	☐	☐	☐
17. I often have trouble in making sense of the things I have to remember.	☐	☐	☐	☐	☐
18. I generally keep working hard even when things aren't going all that well.	☐	☐	☐	☐	☐

PLEASE TURN OVER

3 continued

	✓	✓?	??	✗?	✗
19. I'm just going through the motions of studying without seeing where I'm going.	☐	☐	☐	☐	☐
20. Concentration is not usually a problem for me, unless I'm really tired.	☐	☐	☐	☐	☐
21. Much of what I've learned seems no more than lots of unrelated bits and pieces in my mind.	☐	☐	☐	☐	☐
22. I generally put a lot of effort into my studying.	☐	☐	☐	☐	☐
23. I think about what I want to get out of my studies so as to keep my work well focused.	☐	☐	☐	☐	☐
24. It's important for me to follow the argument, or to see the reason behind things.	☐	☐	☐	☐	☐
25. I organise my study time carefully to make the best use of it.	☐	☐	☐	☐	☐
26. I go over the work I've done to check my reasoning and see that it makes sense.	☐	☐	☐	☐	☐
27. In making sense of new ideas, I often relate them to practical or real-life contexts.	☐	☐	☐	☐	☐
28. Whatever I'm working on, I generally push myself to make a good job of it.	☐	☐	☐	☐	☐
29. I don't think through topics for myself, I just rely on what we're taught.	☐	☐	☐	☐	☐
30. When I find something boring, I can usually force myself to keep focused.	☐	☐	☐	☐	☐
31. I tend to just learn things without thinking about the best way to work.	☐	☐	☐	☐	☐
32. I work steadily during the course, rather than just leaving things until the last minute.	☐	☐	☐	☐	☐
33. When I'm reading for a course, I try to find out for myself exactly what the author means.	☐	☐	☐	☐	☐
34. I try to find better ways of tracking down relevant information in my subject.	☐	☐	☐	☐	☐
35. I look at evidence carefully to reach my own conclusion about what I'm studying.	☐	☐	☐	☐	☐
36. I pay careful attention to any advice or feedback I'm given, and try to improve my understanding.	☐	☐	☐	☐	☐

Finally, how well do you think you're doing in this subject area, based on your performance and comments you have received on your work? *Please try to rate yourself **objectively**, based on the grades you have been obtaining.*

very well		well		quite well		about average		not so well				rather badly
9	8		7		6	5		4		3	2	1
☐	☐		☐		☐	☐		☐		☐	☐	☐

In case we would like to talk to you or send you an email about the project, would you be prepared to give us contact details?

e-mail address ..... mobile/tel. no. .....

Have you answered every question? Please check.

We are very grateful to you for spending time completing this questionnaire.

Economic and Social Research Council

Teaching and Learning Research Programme

Enhancing Teaching-Learning Environments in Undergraduate Courses

Experiences of Teaching & Learning Questionnaire

Introduction to the Project

The ESRC Teaching and Learning Research Programme is a nationwide initiative designed to provide a more effective research base to help staff to enhance the teaching they provide for students. Our project is the only one at university level, and we are investigating how students learn with differing kinds of teaching and support. We are looking at students' experiences in five contrasting subject areas in some 30 course settings across Britain. This is the last questionnaire that we are asking you to complete and it brings together your approaches to studying with your experiences of teaching and learning in this particular course unit or module.

Our overall findings (but none of your individual answers) will be fed back to staff to allow them to develop this course unit further. We are grateful for your involvement in this project. If you are interested in the progress of our work, our web site is http://www.ed.ac.uk/etl

Data Protection Act

If you have not already done this, please complete the following declaration. If you have, start with the Background Information section.

In accordance with the Data Protection Act, we have to ask you to sign the following declaration. You can be quite sure that all the information we collect will be used only for the purposes of research and kept confidential to the research team itself: it will not be released to anybody else.

I agree to allow the university to provide the research team with my name, contact details, grades and other information about my course of study. I also agree that this information, and the data collected from me, may be held and processed by the team for the purposes of research.

Sign

Date D D M M Y Y

Background Information

Print name

Institution

Overall programme of study

This course unit or module

Identity number

Please complete from the right, e.g. 1 2 3 4 5 6 7

Age

Year of study

Male

Female

FOR OFFICE USE

1 Approaches to learning and studying

You may have already filled out a longer questionnaire about your *general* approaches to studying, but this time we want you to relate your answers directly to **this particular course unit or module**. Please give your immediate reaction to **every** comment, indicating how you really have been studying.

Put a cross in the box to indicate how strongly you agree with **each** of the following statements.

✓ = *agree* ✓? = *agree somewhat* ✗? = *disagree somewhat* ✗ = *disagree*

Try not to use ?? = *unsure* unless you really have to, or if it cannot apply to you or your course unit.

	✓	✓?	??	✗?	✗
1. I've often had trouble in making sense of the things I have to remember.	☐	☐	☐	☐	☐
2. I've been over the work I've done to check my reasoning and see that it makes sense.	☐	☐	☐	☐	☐
3. I have usually set out to understand for myself the meaning of what we had to learn.	☐	☐	☐	☐	☐
4. I have generally put a lot of effort into my studying.	☐	☐	☐	☐	☐
5. Much of what I've learned seems no more than lots of unrelated bits and pieces in my mind.	☐	☐	☐	☐	☐
6. In making sense of new ideas, I have often related them to practical or real life contexts.	☐	☐	☐	☐	☐
7. On the whole, I've been quite systematic and organised in my studying.	☐	☐	☐	☐	☐
8. Ideas I've come across in my academic reading often set me off on long chains of thought.	☐	☐	☐	☐	☐
9. I've looked at evidence carefully to reach my own conclusion about what I'm studying.	☐	☐	☐	☐	☐
10. When I've been communicating ideas, I've thought over how well I've got my points across.	☐	☐	☐	☐	☐
11. I've organised my study time carefully to make the best use of it.	☐	☐	☐	☐	☐
12. It has been important for me to follow the argument, or to see the reasons behind things.	☐	☐	☐	☐	☐
13. I've tended to take what we've been taught at face value without questioning it much.	☐	☐	☐	☐	☐
14. I've tried to find better ways of tracking down relevant information in this subject.	☐	☐	☐	☐	☐
15. Concentration has not usually been a problem for me, unless I've been really tired.	☐	☐	☐	☐	☐
16. In reading for this course unit, I've tried to find out for myself exactly what the author means.	☐	☐	☐	☐	☐
17. I've just been going through the motions of studying without seeing where I'm going.	☐	☐	☐	☐	☐
18. If I've not understood things well enough when studying, I've tried a different approach.	☐	☐	☐	☐	☐

2 Experiences of teaching and learning

We would also like to know about your experiences of teaching and learning in **this particular course unit or module**. Please rate every comment, using the same scale as in the previous section, remembering not to use ?? = *unsure* unless you really have to, or if it cannnot apply to your course unit. Please give a rating for **every** comment.

	✓	✓?	??	✗?	✗
Organisation and structure					
1. It was clear to me what I was supposed to learn in this course unit.	☐	☐	☐	☐	☐
2. The topics seemed to follow each other in a way that made sense to me.	☐	☐	☐	☐	☐
3. We were given a good deal of choice over how we went about learning.	☐	☐	☐	☐	☐
4. The course unit was well organised and ran smoothly.	☐	☐	☐	☐	☐
5. We were allowed some choice over what aspects of the subject to concentrate on.	☐	☐	☐	☐	☐
6. What we were taught seemed to match what we were supposed to learn.	☐	☐	☐	☐	☐

	✓	✓?	??	✗?	✗
Teaching and learning					
7. We were encouraged to look for links between this unit and others.	☐	☐	☐	☐	☐
8. I can imagine myself working in the subject area covered by this unit.	☐	☐	☐	☐	☐
9. The handouts and other materials we were given helped me to understand the unit.	☐	☐	☐	☐	☐
10. On this unit, I was prompted to think about how well I was learning and how I might improve.	☐	☐	☐	☐	☐
11. I could see the relevance of most of what we were taught in this unit.	☐	☐	☐	☐	☐
12. We weren't just given information; staff explained how knowledge is developed in this subject.	☐	☐	☐	☐	☐
13. The teaching encouraged me to rethink my understanding of some aspects of the subject.	☐	☐	☐	☐	☐
14. The different types of teaching (lectures, tutorials, labs, etc.) supported each other well.	☐	☐	☐	☐	☐
15. Plenty of examples and illustrations were given to help us to grasp things better.	☐	☐	☐	☐	☐
16. This unit has given me a sense of what goes on 'behind the scenes' in this subject area.	☐	☐	☐	☐	☐
17. The teaching in this unit helped me to think about the evidence underpinning different views.	☐	☐	☐	☐	☐
18. How this unit was taught fitted in well with what we were supposed to learn.	☐	☐	☐	☐	☐
19. This unit encouraged me to relate what I learned to issues in the wider world.	☐	☐	☐	☐	☐
20. The web pages provided by staff helped me to understand the topics better.	☐	☐	☐	☐	☐
Students and teachers					
21. Students supported each other and tried to give help when it was needed.	☐	☐	☐	☐	☐
22. I found most of what I learned in this course unit really interesting.	☐	☐	☐	☐	☐
23. Staff tried to share their enthusiasm about the subject with us.	☐	☐	☐	☐	☐
24. Talking with other students helped me to develop my understanding.	☐	☐	☐	☐	☐
25. Staff were patient in explaining things which seemed difficult to grasp.	☐	☐	☐	☐	☐
26. I enjoyed being involved in this course unit.	☐	☐	☐	☐	☐
27. Students' views were valued in this course unit.	☐	☐	☐	☐	☐
28. Staff helped us to see how you are supposed to think and reach conclusions in this subject.	☐	☐	☐	☐	☐
29. I found I could generally work comfortably with other students on this unit.	☐	☐	☐	☐	☐
30. This course unit provided plenty of opportunities for me to discuss important ideas.	☐	☐	☐	☐	☐
Assessments and other set work					
31. It was clear to me what was expected in the assessed work for this course unit.	☐	☐	☐	☐	☐
32. I was encouraged to think about how best to tackle the set work.	☐	☐	☐	☐	☐
33. I could see how the set work fitted in with what we were supposed to learn.	☐	☐	☐	☐	☐
34. You had really to understand the subject to get good marks in this course unit.	☐	☐	☐	☐	☐
35. The feedback given on my work helped me to improve my ways of learning and studying.	☐	☐	☐	☐	☐
36. Doing the set work helped me to think about how evidence is used in this subject.	☐	☐	☐	☐	☐
37. Staff gave me the support I needed to help me complete the set work for this course unit.	☐	☐	☐	☐	☐
38. To do well in this course unit, you had to think critically about the topics.	☐	☐	☐	☐	☐
39. The set work helped me to make connections to my existing knowledge or experience.	☐	☐	☐	☐	☐
40. The feedback given on my set work helped to clarify things I hadn't fully understood.	☐	☐	☐	☐	☐

PLEASE TURN OVER

3 Demands made by the course unit

In this section, please tell us how easy or difficult you found different aspects of **this course unit**.

✓ = very easy ✓? = fairly easy ?? = unsure/not applicable ✗? = fairly difficult ✗ = very difficult

	✓	✓?	??	✗?	✗
a. What I was expected to know to begin with.	☐	☐	☐	☐	☐
b. The rate at which new material was introduced.	☐	☐	☐	☐	☐
c. The ideas and problems I had to deal with.	☐	☐	☐	☐	☐
d. The skills or technical procedures needed in this subject.	☐	☐	☐	☐	☐
e. The amount of work I was expected to do.	☐	☐	☐	☐	☐
f. Working with other students.	☐	☐	☐	☐	☐
g. Organising and being responsible for my own learning.	☐	☐	☐	☐	☐
h. Communicating knowledge and ideas effectively.	☐	☐	☐	☐	☐
i. Tracking down information for myself.	☐	☐	☐	☐	☐
j. Information technology/computing skills (e.g. WWW, email, word processing).	☐	☐	☐	☐	☐

Other demands (please specify): .....

4 What you learned from this course unit

Now we would like to know how much you feel you have gained from studying **this course unit**.

✓ = a lot ✓? = quite a lot ?? = unsure/not applicable ✗? = not much ✗ = very little

	✓	✓?	??	✗?	✗
a. Knowledge and understanding about the topics covered.	☐	☐	☐	☐	☐
b. Ability to think about ideas or to solve problems.	☐	☐	☐	☐	☐
c. Skills or technical procedures specific to the subject.	☐	☐	☐	☐	☐
d. Ability to work with other students.	☐	☐	☐	☐	☐
e. Organising and being responsible for my own learning.	☐	☐	☐	☐	☐
f. Ability to communicate knowledge and ideas effectively.	☐	☐	☐	☐	☐
g. Ability to track down information in this subject area.	☐	☐	☐	☐	☐
h. Information technology/computing skills (e.g. WWW, email, word processing).	☐	☐	☐	☐	☐

Other gains (please specify): .....

Finally, how well do you think you're doing in this course unit as a whole? Please try to rate yourself **objectively**, based on any marks, grades or comments you have been given.

very well		well		quite well		about average		not so well		rather badly
9	8	7	6	5	4	3	2	1		
☐	☐	☐	☐	☐	☐	☐	☐	☐		

Please check back to make sure that you have answered every question.

Thank you very much for spending time completing this questionnaire: it is much appreciated.