Enhancing
Teaching-Learning Environments
in Undergraduate Courses

ETL project

Occasional Report 3, March 2003

Concepts and Conceptual Frameworks Underpinning the ETL Project

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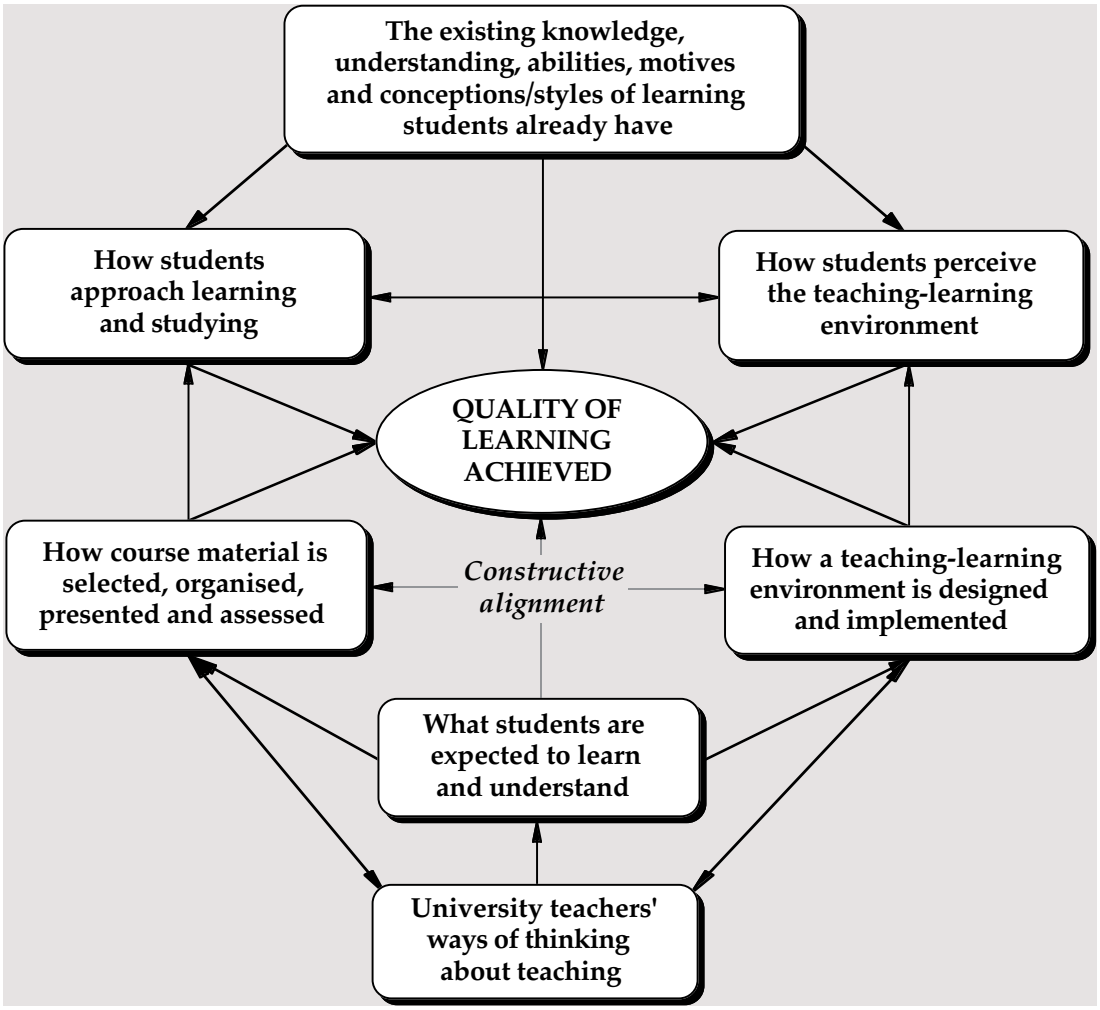
Introduction

One of the ETL project outputs was described as 'conceptual frameworks tailored to specific subject areas'. The idea of these was to provide colleagues with a coherent set of concepts, and supporting descriptions of the underlying research findings, to develop more precise ways of thinking about university teaching and learning. Conceptual frameworks would be designed to complement the other outputs – the questionnaires and case studies of the collaborative initiatives – to encourage reflection on ways of enhancing teaching-learning environments within colleagues' own contexts and situations.

In the research proposal, a generic conceptual framework was used to illustrate our starting point. For the purposes of describing key developments in conceptualising the project, a revised version of that diagram has been produced, showing the main concepts being used in our project.

In *Figure 1* the focal concept is the *quality of learning achieved*, with the remaining concepts describing some of the variety of influences affecting the outcomes of learning. The top half includes concepts used to indicate some of the many variations shown by students in their

Figure 1 Conceptual framework indicating influences on student learning



attitudes and behaviour, while the bottom half covers influences attributable to the teachers and the teaching-learning environment they design and implement. Each of these main concepts will now be discussed, with greater attention to those being the focus of current developments.

Students' existing knowledge and characteristics

This construct covers a whole variety of concepts that indicate past influences on the approaches to learning and perceptions of the teaching-learning environment that are central to our current research. Above all, the quality of learning achieved depends on the knowledge and understanding with which the student enters a course, along with the associated abilities, motives, conceptions and styles of learning. These aspects are, however, not being assessed directly within our project, with the exception of students' reasons for being in higher education and for taking the particular course unit. These reasons are covered in the questionnaire given out at the beginning of the course unit (*Learning and Studying* or *LSQ)* which relates to prior attitudes and studying.

How students approach their learning and studying

In the project, approaches to learning and studying have been measured by scores from our two inventories, one looking at general approaches (within the first questionnaire - *LSQ)* and the other focusing on the approaches specifically adopted on our target course unit (in the questionnaire given out towards the end of the unit – *Experiences of Teaching and Learning* or *ETLQ).* Factor analysis in our pilot work suggested the existence of five separable aspects (Entwistle, McCune & Hounsell, in press). These were:

- *deep approach* indicating the intention to understand for oneself, backed up by processes of learning that involve relating ideas and use of evidence;
- *surface approach* indicating the intention to cope minimally with course requirements, relying mainly on routine memorisation and procedural working;
- *monitoring studying* being an aspect of metacognition, the ability to stand back from one's learning and studying and reflect on how it is affecting academic progress;
- *organised studying* indicating how well students systematise their work on required tasks and manage their time effectively;
- *effort management* covering the extent to which effort is well directed and concentration is maintained.

The main focus within our research proposal was on approaches to learning and studying which are known to be related to student attainment. The categories describing these approaches can be used as a proxy for the quality of learning achieved, to provide one way of investigating changes attributable to our collaborative initiatives within our target course units. Our main focus will be on possible increases in deep approaches and monitoring studying (related to engagement in learning), and decreases in the surface approach (related to achievement). Improved effort (related to motivation and achievement) and study organisation (related to achievement) will also be of interest.

How students perceive the teaching-learning environment

Perceptions of the teaching-learning environment are being described, in part, from inventory scores from the *ETLQ*, but also from group and individual interviews with students. The ETLQ inventory was developed from an analysis of earlier instruments, and also from an extensive

review of the literature which led to a concept map (introduced in a subsequent section). Initial factor analysis of the inventory suggested five or possibly six factors (Entwistle, McCune & Hounsell, in press). The factors were described as follows:

- *aims, organisation and alignment*;
- *encouraging learning* (with an emphasis on ways of thinking and practising in the subject (see below));
- *assessment, assignments and feedback*;
- *supportive climate* (with staff support being separable from peer support and more influential on perceived progress);
- *evoking interest* and showing relevance

Additional aspects of the students' perceptions of the teaching-learning environment are being found through qualitative analysis of group and individual interviews with students.

Quality of learning achieved

A developing set of concepts is being used to consider the quality of learning. In the student learning literature, there has been an emphasis on conceptual understanding to represent high quality learning, but this had to be broadened to cover additional skills and ways of thinking, both academic and professional. This combination we now refer to as *WTPs* (*ways of thinking and practising in the subject*) which can then be expressed in specific terms within each of our subject areas, and also in relation to colleagues' pedagogical thinking. Within biology, for example, the WTPs have been have been provisionally categorised as follows (Hounsell & McCune, 2002):

- *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, inter-connective 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.

If teaching is to be aligned to high-level learning objectives, then, moving beyond distinctive WTPs, we need to establish any crucial topics or concepts that affect how the teaching is carried out and how understanding develops within that subject area. We are currently looking at three pedagogical concepts that may prove helpful in discussions with both staff and students - *troublesome knowledge, threshold concepts,* and *delayed understanding*. In our research proposal, we had used the notion of *marker outcomes* as a way of highlighting (and hopefully measuring) key aspects of each course unit, with the idea that we might identify outcomes that were common across course units in each subject area at a particular level. It soon became clear that there was much less commonality across courses than we had anticipated, and that colleagues and students were under far too much pressure to allow us to explore marker outcomes in the ways we had envisaged. As an alternative, we have been asking colleagues about topics or concepts that students find particularly difficult, what Perkins (1999) calls troublesome knowledge.

We have also explored specific forms of difficulty. In economics, for example, there appear to be certain concepts that are not only difficult for students to grasp, but are also serve as 'portals' to

a developing understanding of the subject, "opening up a new and previously inaccessible way of thinking about something" (Meyer & Land, 2002, p. 1). There are indications that such concepts are also found in other subject areas, although probably not in the same form.

> Where threshold concepts exist within curricula, there is a likelihood, owing to their powerful transformative effects, that they may prove troublesome for students. Difficulty in understanding threshold concepts may leave the learner in … a suspended state in which understanding approximates to a kind of mimicry or lack of authenticity.
>
> (op. cit. p. 13)

An example of a threshold concept in economics is 'opportunity cost', but even 'price' itself seems to act in the same way for some students. In history, there may not be specific threshold concepts, but there is a specific way of thinking that students are expected to acquire – to evaluate the significance of evidence within its specific social context and historical period. And in the early stages of analogue electronics, failure fully to grasp the different functions of key components of circuits, even of resistors, can affect subsequent learning. Later on it seems to be the ability to shift readily between physical, diagrammatic and algebraic circuit representations that is more important.

The final pedagogical concept related to content has emerged in considering students' experiences of learning electronics. Scheja (2002) found that electronics students in his study experienced what he called 'delayed understanding', where achieving a full grasp of a topic has to be postponed, pending further study. This has also been mentioned, and endorsed as important, by students recently interviewed within the project. For example, when considering the concept of 'feedback' in operational amplifiers, typically four different forms of feedback are introduced sequentially. Each circuit design has specific features which need to be grasped in turn before an understanding of the underlying concept becomes possible. In addition, Scheja suggested that material is presented to students at a rate, and in a way, that makes concurrent understanding difficult for many of them. He also found that topics within theory and practical work could become seriously out of phase for some students, again delaying the possibility of a full understanding.

University teachers' ways of thinking about teaching

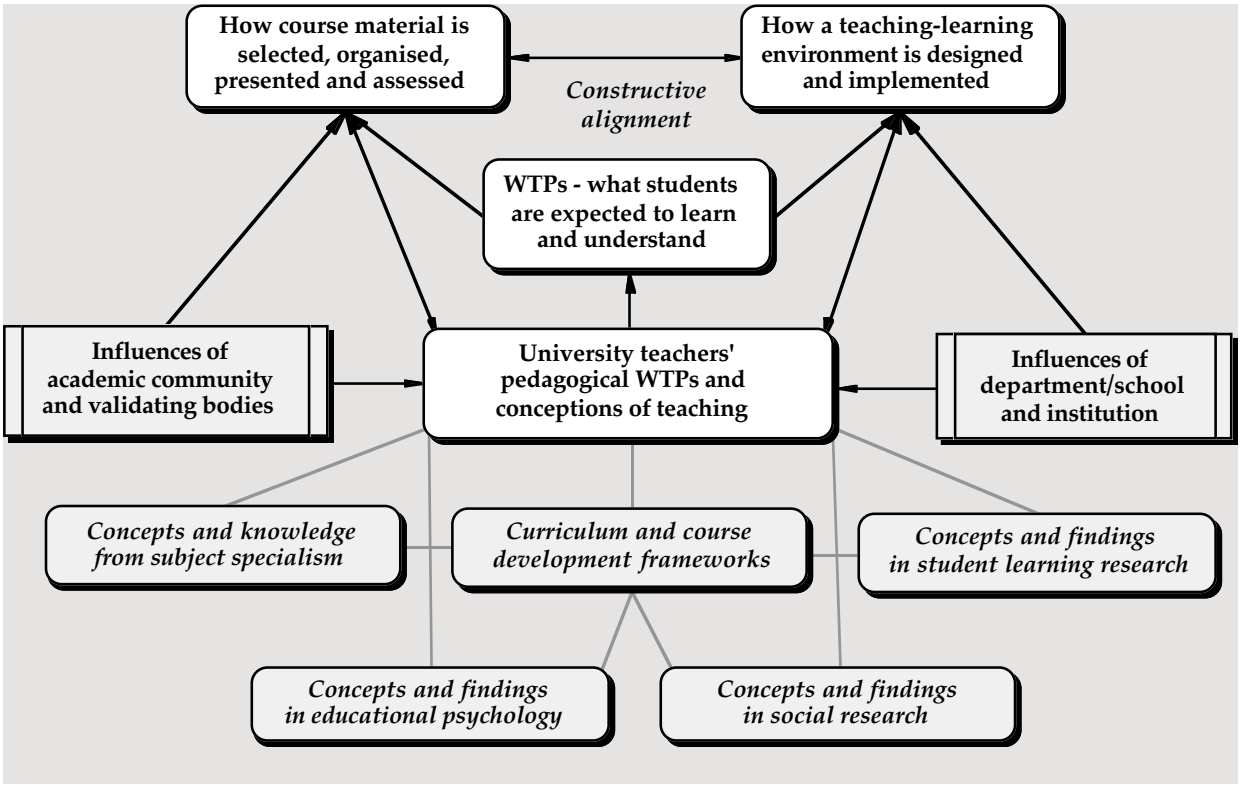
Within the literature there are continuing debates about the differences that exist in the ways in which university teachers think about pedagogical matters. One formulation parallels the description of conceptions of, and approaches to, learning. It outlines contrasting conceptions of teaching, with a main contrast between a teacher-focused conception (with a content orientation) and a conception that is student-focused (with a conceptual development orientation) (Prosser & Trigwell, 1999). Some of the research suggests that these are nested categories, with the less sophisticated conception being overtaken and incorporated (probably in an altered form) within the more sophisticated one. The two-way arrow above the teaching conceptions box in *Figure 1* has been used to suggest that the ways in which course materials are selected, organised, presented and assessed, reflect (and also actually form) the particular teaching conception held (Eley, 2002). This two-way effect would also be found in designing a teaching-learning environment.

It is, however, unlikely that a sophisticated conception of teaching would have any straightforward relationship to the teaching methods and strategies adopted. Rather, there could be many possible ways of translating that type of thinking about teaching and learning into practice, as the university teacher took account of the nature of the intake and stage the students had reached. It would also develop in close conjunction with thinking about the nature of the subject being taught (Entwistle, McCune & Walker, 2002). Moreover, the influences on the choice of teaching approaches adopted are clearly more complex than any simple analytic model can convey, depending, as it does, on, for example, the departmental

ethos, the resources and time available, and university policies relating to funding and assessment procedures.

University teachers' conceptions of teaching are built up mostly through their experiences of designing and teaching courses, and from strategies and procedures established within the department. In addition, there are influences from quality assurance procedures within the institution and from external agencies such as the Learning and Teaching Support Network, the Institute for Learning and Teaching in Higher Education, and the Quality Assurance Agency for Higher Education. But these conceptions are increasingly being affected by the various research literatures, particularly through the strengthened induction and continuing professional development activities in universities. *Figure 2* suggests not only some of these influences, but also where their influence is likely to be greatest. Those on the left more directly affect the development of course material, and those on the right influence the design of the teaching-learning environments, although there are, of course, many cross-linkages as well.

Figure 2 Influences on teaching and pedagogical WTPs



Some of our initial interviews with staff have already drawn attention to major differences between subject areas in how teaching and learning are conceptualised that seem to be a reflection of *pedagogical WTPs* within the discipline (McCune & Reimann, 2001). Combining knowledge of their subject with ideas and experience about teaching, creates what Shulman (1987) called *pedagogical content knowledge.* The concepts, models and analytic procedures with which colleagues are most familiar also colour their thinking about teaching, affecting the metaphors they use, the evidence they find convincing, and the nature of the relationship they see between teaching and learning. Economists, for example, seem to use cost-benefit analysis in deciding what teaching methods to adopt, while staff involved in media and communication studies mention concern about the nature of their relationships with students and the underlying values those imply. It is also clear that the nature of the concepts within each

discipline will affect the ways in which the ideas are organised and presented, what forms of assessment are considered to be appropriate, and how assignments are assessed. And this subject specificity is central to our project.

How course material is selected, organised, presented and assessed

The ways in which teaching is carried out in a course unit clearly depend on the collective pedagogical WTPs of teachers providing that unit. But they are also strongly influenced by institutional priorities, policies and requirements, and on the teaching ethos of the school, department or course team (right side of *Figure 2*). There are also strong outside pressures coming from the academic community in that subject area and from validating bodies, where these are involved (left side of *Figure 2*). Some disciplines and professional areas have developed an impressive literature on pedagogical WTPs, whereas others are still conceptually undeveloped. Earlier, it was noted that various literatures are playing a stronger part in forming and elaborating conceptions of teaching

Teaching for understanding

From these areas, we have taken special note of the *Teaching for Understanding* framework (Wiske, 1998) described to us by one of our international consultants, David Perkins. The main components of that framework suggest a way of developing a curriculum so as to focus directly on the development of understanding. Although it was developed through work with school teachers, it translates easily into a university setting.

The starting point for the teacher is to identify *overarching goals* for the course which guide the identification of generative topics. These goals are repeatedly presented to the students in the form of *throughlines* which help them to see how the topics and themes within the course hang together. The next step is for the teacher is to identify a set of *generative topics* which are "issues, themes, concepts, ideas, and so on that provide enough depth, significance, connections, and variety of perspective to support students' development of powerful understandings" (Blythe *et al*., 1998, p. 18). From these generative topics follow the identification, first, of a series of *understanding aims*, and then of a range of tasks which will demand *understanding performances.* These performances focus on rather different aspects of the target understanding and so cumulatively help students to understand in ways accepted by the teacher. Finally, the framework insists that assessment should be *ongoing* or formative, providing students with feedback about their work and also allowing both teacher and students to assess how well students' understanding is developing.

So far, we have found the notion of *throughlines* particularly helpful in stressing the importance of helping students to keep the overarching aims of the course and course unit firmly in mind as they are studying.

Constructive alignment

Drawing on the student learning research, our other international consultant, John Biggs, has developed the notion of *constructive alignment* (Biggs, 1999), which was used in our proposal as an overarching concept designed to inform our thinking about the influence of teaching-learning environments. The Quality Assurance Agency (QAA, 2000) framework made clear the importance of aligning teaching and assessment procedures with the intended learning outcomes, but Biggs added the term 'constructive', based on constructivist theories of learning, to argue that the main aims of any course should be oriented towards conceptual understanding and high level learning outcomes. In *Figure 1*, constructive alignment is shown centrally between the WTPs that students are expected to learn (aims), the presentation of course material, and the teaching-learning environment provided. In discussing possible collaborative initiatives with departmental partners, any discerned misalignment will be highlighted.

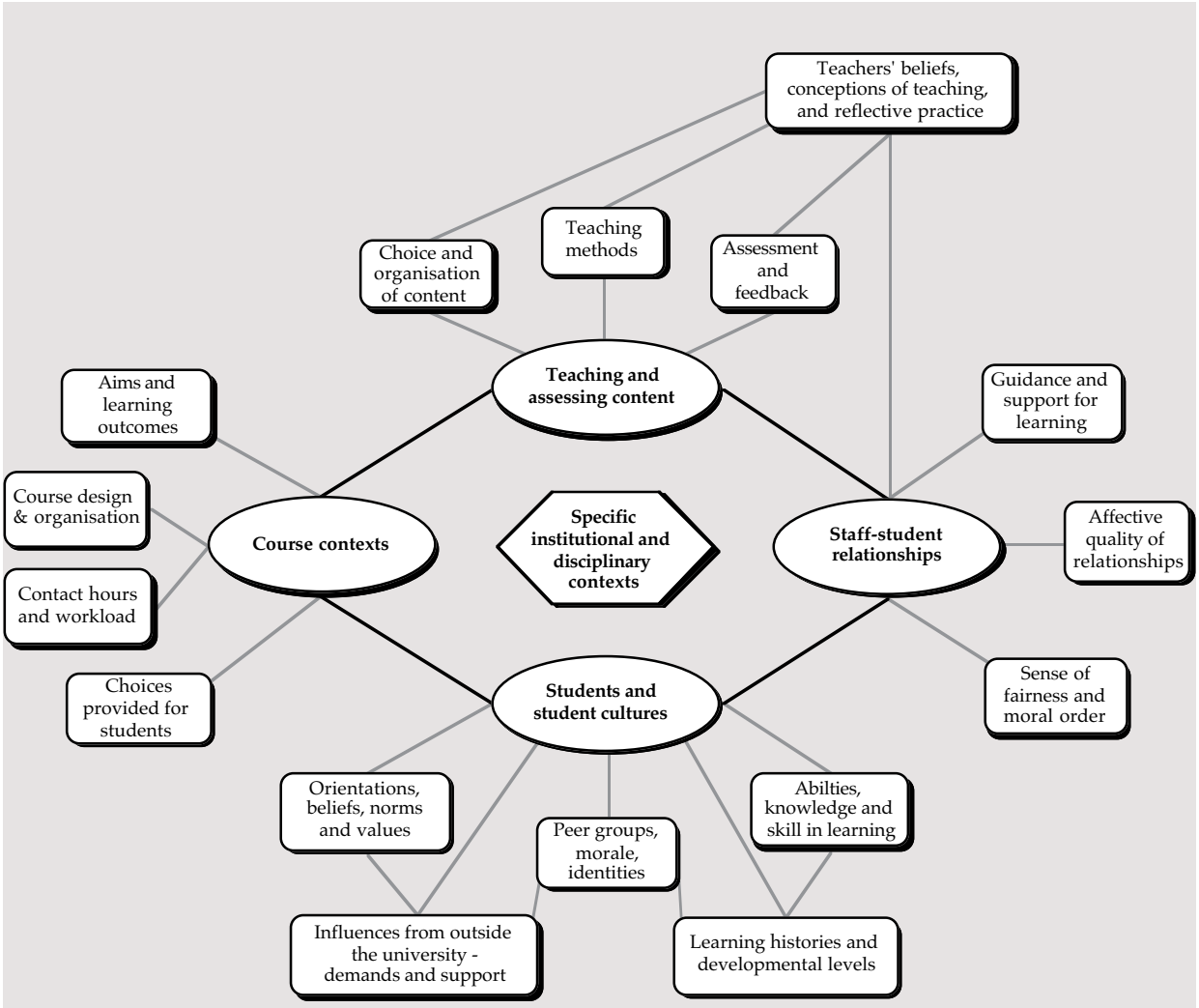
The analyses we have carried out so far have already suggested that there are additional aspects of constructive alignment that will also need to be kept in mind. In biology, for example, three other forms of alignment have been identified – to the students taking the course unit, of the learning support provided, and of the course organisation and management (Hounsell & McCune, 2002). It is becoming clear already that issues of course organisation and management become central in large first-year courses, as students are distributed among many different tutors who are responsible for providing feedback on coursework. Alignment of assessment in such situations becomes inextricably bound up with the course organisation and management.

Biggs uses his framework to show how particular *teaching-learning activities* (TLAs) can be selected that, on the basis of previous research, are likely to encourage and support deep approaches to learning. Some of these, along with others we have identified, have been listed as an Appendix, although these are still just indicative, needing further elaboration and refinement.

How a teaching-learning environment is designed and implemented

Our definition of a teaching-learning environment includes all the aspects already mentioned above in relation to the presentation of course material, but that aspect was discussed

Figure 3 Conceptual map of the 'inner' teaching-learning environment



separately so as to focus more strongly on the academic and professional content at the heart of university teachers' work.

In the early stages of the project, considerable effort was put into establishing the ways in which the term 'environment' had been used in the literature. From a bewildering array of concepts and theories that were identified and used to create a concept map, the central core of concepts describing the 'inner' teaching-learning environment shown as *Figure 3* (and described more fully in Entwistle, McCune & Hounsell (in press). The 'outer' array included concepts that are part of the teaching-learning environment, but which either have less direct impact on learning, or are less easy for students to perceive. This more focused concept map was one source of items for the inventory within the *ETLQ* designed to assess students' perceptions of the teaching-learning environment, which produced the five factors already mentioned. *Figure 3* concentrates specifically on describing the environment, but also includes concepts already introduced. It is used here to draw attention to additional social-psychological aspects, such as those relating to staff-student relationships and student cultures.

The set of concepts shown here comes from different sources. Some concepts are derived from the research literature, including sociology and social psychology (such as student identity and moral order), while others are terms used in everyday teaching (such as course design and contact hours). The latter set of concepts is discussed more in the educational development literature than in research on student learning. But our project needs to integrate ways of thinking coming from both research and educational development, and also to indicate which features of learning environments have been shown to encourage student engagement, a deep approach, and high quality learning outcomes related to subject-specific WTPs.

Fortunately, there is a growing, but still implicit, consensus in the diverse literature advocating improved ways of designing teaching-learning environments. We have been exploring it not just through our own project, but also through our links with a European research network on *powerful learning environments,* based in Leuven. The network's first workshop provided detailed reviews of various ways of defining and implementing such contexts. Looking at innovations in Belgian school education, De Corte (2000; De Corte *et al.,* in press) has outlined some of the common features of what is currently seen as a powerful learning environment. It should:

- include group discussions of both the content and the process of learning and studying;
- provide authentic tasks and realistic problems that have personal meaning and future use;
- inititate and support active and constructive learning processes (conceptual understanding);
- enhance students' awareness of their own cognitive processes and their ability to control their motives and feelings (cognitive and volitional self-regulation).

Two other contributions to the workshop made use of computer-based learning of different kinds. Bereiter and Scardamalia (in press) describe an environment using a computer system to encourage knowledge building at both school and university level, while Lehtinen (in press) reviewed *computer supported collaborative learning,* drawing on both the theoretical and the empirical literature. All these authors have been substantially influenced by current thinking on both *distributed cognition* (Salomon, 1993) and *communities of practice* (Wenger, 1998). As the project progresses, not only will we need to find ways of relating these various contributions to the general context of university education, but also to the specific subject areas and departmental contexts within which our collaborative initiatives are being developed.

Combining the student learning literature with some of the other literature and our own analyses, more specific suggestions can be obtained for teaching-learning activities likely to support high quality learning (extending the list in the Appendix and relating it to specific research reports). Our collaborative initiatives are intended to have a clear conceptual basis in

the research literature and to be guided by the evidence we have collected from the staff and students within a specific institutional and disciplinary context. The issues that staff raise about their course units inevitably tend to be pragmatic, and so there is a potential tension between that focus and one which is informed by research. It is still far from clear the extent to which staff can be introduced to general findings and the conceptual frameworks derived from them, as well as considering the specific analyses carried out on the data derived from that course unit. And yet that was part of our original intention, and will be attempted wherever possible.

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Appendix

Illustrative research-based teaching-learning activities believed to promote active, deep learning

Aspect of the t-l environment	Teaching-learning activity or provision	Type of learning it supports / encourages	Indication of possible warrant for inclusion
Course/module design	Provide full module information for students	Clarifies procedures and so allows students to organise their studying	TQA analysis
	Include generative/open and relevant topics	Captures and maintains interest	T*f*U framework
	Describe and repeatedly mention understanding aims	Helps students to keep focused on the need for personal understanding	T*f*U framework
	Choose topics to be intellectually challenging, but still within grasp	Stimulates interest and provides a challenge to encourage development	TQA analysis, Vermunt, & educational psychology
General teaching methods	Make explicit the link with aims for each teaching-learning activity	Enables students to relate teaching and learning to purposes	TQA analysis and constructive alignment
	Explain epistemological basis of knowledge and how evidence is used	Inducts students into the academic discourse of the discipline/profession	Telephone interviews
	Encourage active construction of knowledge using authentic tasks	Increases perceived relevance and develops individual understanding	Constructivist literature
	Encourage students to engage with different perspectives & viewpoints	Encourages reflection on reasons for the differences & develops understanding	Constructivist literature & Alverno College
	Provide students with deliberate conceptual conflicts & dilemmas	Encourages students to revisit and develop their understandings	Constructivist literature
	Identify troublesome knowledge and provide additional support	Avoids unnecessary difficulties and consequent anxiety	Developments from T*f*U framework
Supporting student learning	Discuss study approaches and skills explicitly within module	Encourages self-awareness and deep, strategic approaches	Student learning research
	Identify new skills required and provide specific, timely training	Avoids unnecessary difficulties when tackling assignments or labs	Student learning research
	Encourage students to become aware of their own learning engagement	Develops metalearning capacity	Educational psychology and student learning research
	Identify threshold concepts and their consequences for learning.	Improves awareness of the conceptual basis of the subject	ETL project
Lectures and course materials provided	Develop clear logical structure for module and advance organisers	Seeing how knowledge fits together aids understanding	Educational psychology
	Explain new concepts fully and show similarities/ differences from others	Aids concept formation and differentiation	Educational psychology
	Provide relevant examples of the concept in different contexts	Aids concept formation & encourages transfer to future novel contexts	Educational psychology & student learning research
	Thinking out loud to demonstrate logic, use of evidence, argument, etc.	Makes explicit important aspects of the academic discourse	Student learning research
	Show enthusiasm for the subject and explain its relevance	Vicarious experience of relevance encourages a deep approach	Student learning research
	Show concern for students' difficulties and interest in the students	Mutual respect and approachability develops positive feelings	TQA analysis and student learning research
Group work	Use group-based problems and projects	Discussion of problems or working on a project fosters understanding	Constructivist literature
	Use 'time-outs' for groups to discuss their progress and explain it	Makes explicit the collaborative skills involved in group work	Student learning research Alverno College
	Encourage students to discuss theirown values, goals & intentions	Making values and goals explicit emphasises individual reaponsibility	Constructivist literature
	Provide support and intellectual challenge in discussion groups	Allows students to be open in showing their misunderstandings	Anderson
	Regulate balance between support & challenge by stage of course reached	Prevents students becoming anxious about current state of knowledge	Anderson

Practical work and placements	Encourage final year students to establish links with research teams	Provides implicit/explicit messages about culture of professional practice	Ryder & Leach 1999
Assignments	Provide authentic tasks with substantial choice	Relevance and choice encourage interest and engagement with tasks	TQA analysis, and constructivist theory
	Design tasks specifically requiring understanding performances on aims	Understanding develops through experience on such tasks	TfU framework and constructive alignment
	Provide practice in systematically varied contexts and tasks	Develops skills such as problem-solving	New phenomenology
	Require regular completion of tasks with rapid feedback provided	Helps the transition to self-regulation and awareness in 1st year	Student learning research
	Make sure work load is appropriate by monitoring students' experience	Avoids inducing anxiety and surface approaches	1983 Lancaster study
Assessment	Design a varied range of assessment to provide overlapping evidence	Variety avoids boredom & increases reliability of the assessments	Student learning research
	Assess understanding aims & reward understanding	Strongly influences the direction and quality of student effort	Constructive alignment and TfU framework
	Use some open-ended techniques and problems	Encourages a deep approach	Student learning research
	Make sure that students perceive marking procedures to be fair	Avoids negative feelings of resentment	Student learning research
	Develop marking criteria representing different levels of understanding	Ensures credit is given to high level answers to reward a deep approach	Student learning research
	Give students opportunities to assess their own work & explain how to do it	Encourages self-regulation and appreciation of what is 'good work'	Alverno College
Feedback on assessment	Give timely and helpful feedback	Enables students to recognise their strengths and remedy weaknesses	TQA analysis
	Make positive comments, but also formative criticism	Helps students to see what specifically they can do to improve	Student learning research
Professional development of academic staff	Create authentic research settings for teachers to interview students about their ways of studying and analyse the implications	Develops awareness of how students learn in their subject area and creates direct implications for teaching.	Constructivism within professional development