when writing ILOs and deriving the criteria for assessing assessment tasks. A hardline approach to accountability may not, however, consider this rigorous enough.

One problem with being too rigorous is that attributes, particularly in the social/value domain, have varying degrees of relevance to different programmes. Empathy, say, is highly appropriate in a social work degree, rather less so in, say, computer programming. A social worker lacking empathy clearly should not be awarded a degree in social work, but one would be inviting big trouble withholding a degree from a computer scientist on the basis of lack of empathy. To insist that inappropriate or irrelevant attribute/outcomes are forced into all programmes irrespective of suitability is to invite resistance and cynicism from students.

Reconciling specific programme ILOs with the requirements of the university's graduate attributes policy is a question specific to each institution and there are various ways of handling it (Bath et al. 2004; Sumsion and Goodfellow 2004).

The important question, as far as teaching itself is concerned, is deriving the course ILOs from programme ILOs and graduate attributes, however that is done.

Intended learning outcomes at the course level

In previous editions of this book, we used the term 'curriculum objectives' or just 'objectives' for the intended outcomes of a course. We now think the term 'intended learning outcome' (ILO) is better because it emphasizes more than does 'objective' that we are referring to what the student has to learn rather than what the teacher has to teach. 'Intended learning outcome' clarifies what the student should be able to perform after teaching that couldn't be performed previously – and there may well be outcomes that are a positive outcome of teaching that weren't intended. 'Objective' was intended to have the latter, student-centred, meaning but ILO makes it absolutely clear that the outcomes are from the student's perspective. The term 'objective' also may recall in older readers the problems associated with 'behavioural objectives'.

'The student will understand expectancy-value theory' might be a teaching objective, but it is not an ILO. Likewise the following example, taken from the objectives for an occupational therapy unit: 'At the end of this unit, students will be able to understand the concept of muscle tone and its relation to functional activity.' What does it mean 'to understand the concept of muscle tone'? What learning activities are involved? What level of understanding are the students to achieve? Here is an objective that is not an ILO.

With an ILO we need to make a statement about what students' learning would look like after they have learned expectancy-value theory to the acceptable standard. Defining that standard of the outcome of

learning is important. Verbs like 'understand', 'comprehend', 'be aware of' are unhelpful in ILOs because they do not convey the *level* of performance we require if the ILO is to be met. Even the quite common 'demonstrate an understanding of' leave important questions unanswered: what does the student have to do to demonstrate 'an' understanding? What level of understanding does the teacher have in mind – simple acquaintance? Able to point to an instance of? Apply in a real-life situation? One of the key criteria of a good ILO is that the student, when seeing a written ILO, would know what to do and how well to do it in order to meet the ILO. Box 5.1 presents the conventional objectives of a course in engineering, then the same course expressed in ILOs.

Box 5.1 From objectives to intended learning outcomes in an engineering course

Objectives (old)	ILOs (new)
1 To provide an understanding of the kinematics and kinetics of machines and the fundamental concepts of stress and strain analysis	**1** To *describe* the basic principles of kinematics and kinetics of machines and the fundamental concepts of stress and strain analysis
2 To develop an analytical understanding of the kinematics and kinetics and elastic behaviours of machine elements under loading	**2** Using given principles, to *solve* a mechanical problem that involves loading and motion
	3 To *select* relevant principles to obtain the solutions for mechanical problems
	4 To *present* analyses and results of experiments in a proper format of a written report such that a technically qualified person can follow and obtain similar findings

Source: Patrick Wong and Lawrence Li, Department of Mechanical and Electrical Engineering, City University of Hong Kong

The main reasons for teaching a course – as with a programme – usually amount to no more than five or six. Each ILO might be regarded as one of these reasons. The more ILOs, the more difficult it becomes to align teaching/learning activities and assessment tasks to each. Trying to impose a knowledge, skill, value and attitude template, with all their sub-domains, is as inappropriate at the course level as we saw it was at the programme level.

When writing course ILOs, we need specifically to:

1. decide what kind of knowledge is to be involved
2. select the topics to teach and decide the level of understanding desirable for students to achieve and how it is to be displayed.

We now turn to these important issues. This will enable us to start writing the course ILOs themselves. Finally, we address the question of alignment itself, involving all three levels of institution, programme, and course outcomes.

Kinds of knowledge and levels of understanding

Kinds of knowledge

Knowledge, as the object of understanding at whatever level, comes in two main kinds. *Declarative*, or propositional, knowledge refers to *knowing about* things, or 'knowing-what': knowing what Freud said, knowing what the terms of an equation refer to, knowing what kinds of cloud formation can be distinguished, knowing what were the important events in Shakespeare's life. Such content knowledge accrues from research, not from personal experience. It is public knowledge, subject to rules of evidence that make it verifiable, replicable and logically consistent. It is what is in libraries and textbooks and is what teachers 'declare' in lectures. Students' understanding of it can be tested by getting them to declare it back, in their own words and using their own examples. Such knowledge is basic to applications and creations, but is separate from them.

Functioning knowledge is based on the idea of performances of various kinds underpinned by understanding. This knowledge is within the experience of the learner, who can now put declarative knowledge to work by solving problems, designing buildings, planning teaching or performing surgery. Functioning knowledge requires a solid foundation of declarative knowledge.

These distinctions tell us what our curricula might address. Curricula in many universities are overwhelmingly declarative with teaching methods correspondingly expository. One study from the University of Texas found that university teachers spent 88% of their teaching time in lecturing students (cited by Bok 2006), yet students are supposed to be educated so that they can interact thoughtfully with professional problems; to use functioning knowledge, in other words. Unfortunately, often it is only the foundation declarative knowledge that is taught, leaving it to the students when they graduate to put it to work.

The traditional way of teaching psychology to education students illustrates this problem. The reason for teaching psychology is that teachers should know something about such topics as human learning and motivation, child development, the nature of intelligence, and so on and on, not

for the good of their souls, but so they may *teach better*. However, until recently, these topics were taught and the students assessed on how well they had learned them – on their declarative knowledge of the topics – not on how well they applied their topic knowledge to their teaching. With the exception of courses using problem-based learning, the *application* of the theoretical content to teaching or to any other professional practice was left up to the student, when 'out there, in the real world'. When this happens, the most important intended outcome of the course and of the whole programme – that students would teach more effectively by virtue of having learned all that theory – has been ignored in both the teaching and the assessment of the theory courses. It was this realization that prompted the use of portfolio assessment as reported in the last chapter (Box 4.1, p. 51).

This is a problem not only of teacher education. The theory component in professional programmes in general is often treated as an end in itself, not as a means to performing in a more informed and effective way. While some courses in a degree programme, and some topics in probably all courses, need to be taught and assessed in their own right, the higher levels of 'understanding', involving reflection and application, need to be assessed in terms of how students' learning is manifested in better professional practice as their functioning knowledge.

Leinhardt et al. (1995) make a similar distinction between 'professional' knowledge and 'university' knowledge:

- *Professional knowledge* is functioning, specific and pragmatic. It deals with executing, applying and making priorities.
- *University knowledge* is declarative, abstract, and conceptual. It deals with labelling, differentiating, elaborating and justifying.

In other words, would-be professionals are trained in universities to label, differentiate, elaborate and justify, when what they need out in the field is to execute, apply and prioritize!

Entwistle and Entwistle (1997) found that the forms of understanding encouraged by university accreditation and assessment procedures are not those that are professionally relevant (see later). The rhetoric is right, but, in practice, universities tend to focus on declarative knowledge, which students often see as irrelevant and hence worthy of only a surface approach.

The problem is lack of alignment between intended learning outcomes and the means of teaching and assessing them. Graduates need to face new problems and to interact with them, reflectively and thoughtfully. Predicting, diagnosing, explaining, and solving non-textbook problems are what professionals have to do, so this is what university teachers should aim to get their students to do, particularly in senior years. Building such performances of understanding into the course ILOs, aligning teaching to them and designing assessment tasks that confirm that students can or cannot carry out those performances, is a good way to start.

But first, the question of understanding 'understanding'.

Performances of understanding

Ask any teacher what they want of their students and they will say they don't want their students just to memorize, they want them to *understand*. Consequently, that verb is the first they think of when designing the intended learning outcome statements. The trouble is that 'understand' can mean very different things, from the trivial to the complex.

Does the previously mentioned teaching objective, 'The student will understand expectancy-value theory', mean that the student is able to:

1 write a textbook definition of expectancy-value theory
2 explain how it works in the student's own words
3 watch a video of a teacher–student interaction and be able to predict what is likely to happen to the student's motivation afterwards
4 reflect on the student's own teaching to illustrate that a problem that had occurred could be accounted for and rectified in terms of expectancy-value theory?

All these are examples of 'understanding' at some level or other. Clearly, we need to pin down the level of understanding we want when stating the ILO. The ILO needs to make a statement as to that standard, which is done by selecting a suitable verb.

Entwistle and Entwistle (1997) conducted a series of studies on what students meant by 'understanding' and then asked them how they attempt to understand when preparing for examinations. The students described the experience of understanding as *satisfying*; it was good to have the feeling that you understood at last. It also felt *complete*, a whole, as previously unrelated things were suddenly integrated. The experience was irreversible; what is now understood cannot be 'de-understood'. Students thought a good practical test of understanding was being able to explain to someone else or to be able to adapt and to use what had been understood. These are pretty good definitions of sound understandings that probably fit most teachers' requirements: you want students to interrelate topics, to adapt and use the knowledge so understood, to explain it to others and to feel satisfied and good about it.

Unfortunately, when it came to the examinations, these indicators of understanding evaporated. Students attempted instead to understand in ways that they thought would meet assessment requirements. Understanding then took on much less desirable forms. The Entwistles distinguished five:

1 Reproduces content from lecture notes without any clear structure.
2 Reproduces the content within the structure used by the lecturer.
3 Develops own structure, but only to generate answers to anticipated examination questions.
4 Adjusts structures from strategic reading of different sources to represent personal understanding, but also to control examination requirements.

5 Develops an individual conception of the discipline from wide reading and reflection.

Only the last form of understanding, described by a small minority of students, is anything like the students' own definitions. All other forms focused on meeting examination requirements. The examinations actually prevented students from achieving their own personal understandings of the content, which the Entwistles understandably found 'worrying'. Many of these students were in their final year, just prior to professional practice, yet the assessment system pre-empted the very level of understanding that would be professionally relevant. Worrying indeed.

To use our learning in order to negotiate with the world and to see it differently involves understanding of a high order. It is the kind of understanding that is referred to in the rhetoric of university teaching, yet seems hard to impart. If students 'really' understood a concept they would *act differently* in contexts involving that concept and would use the concept in unfamiliar or novel contexts: these are called *performances of understanding* (Gardner 1993; Wiske 1998).

The challenge is to conceive our intended learning outcomes in terms of these performances of understanding, rather than in verbal declarations of understanding. The difference between meeting the requirements of institutional learning and 'real' understanding is illustrated in Gunstone and White's (1981) demonstrations with Physics I students. In one demonstration, two balls, one heavy and one light, were held in the air in front of the students. They were asked to predict, if the balls were released simultaneously, which one would hit the ground first and why. Many predicted that the heavy one would 'because heavy things have a bigger force' or 'gravity is stronger nearer the earth' (both are true but irrelevant). These students had 'understood' gravity well enough to pass HSC (A Level) physics, but few understood well enough to answer a simple real-life question about gravity. They could correctly solve problems using the formula for g – which does not contain a term for the mass of the object falling – while still reacting in the belief that heavy objects fall faster. They didn't *really* understand gravity in the performative sense – and why should they if their teaching and assessment didn't require them to? These physics students hadn't changed their commonsense conceptions of gravity, but had placed alongside them a set of statements and formulae about physical phenomena that would see them through the exams. To really understand physics or mathematics, history or accountancy is to *think like* a physicist, a mathematician, a historian or an accountant; and that shows in how you behave. Once you really understand a sector of knowledge, it changes that part of the world; you don't behave towards that domain in the same way again.

Gunstone and White's physics students were good at verbally declaring their knowledge, for example, explaining what gravity, or the three laws of motion, are about. But is this why we are teaching these topics? Is it for

acquaintance, so that students know something about the topic and can answer the sorts of stock questions that typify examination papers? In that case, declarative understanding will suffice. Or is it to change the way (sooner or later) students can understand and control reality? If that is the case, then a performative level of understanding is implicated.

Levels of understanding

So far we have been talking about the end point, 'real' understanding. However, understanding develops gradually, becoming more structured and articulated as it develops. Undergraduates will not attain the level of precision and complexity of the subject expert, but we want none to retain the plausible misunderstandings that marked Gunstone and White's physics students' understanding of gravity.

We thus need to define understanding in ways that do justice to the topics and content we teach, as appropriate to the year level taught. The task is to define what is acceptable for each stage of the degree programme, given a student's specialization and degree pattern. That is a highly specific matter that only the teacher and subject expert can decide, but a general framework for structuring levels of understanding helps teachers to make those decisions and it also provides a basis for discussing levels across different years and subject areas. Once a sound understanding of the basic structural framework is achieved, adapting it to particular course ILOs is straightforward.

The SOLO taxonomy is based on the study of outcomes in a variety of academic content areas (Biggs and Collis 1982). As students learn, the outcomes of their learning display similar stages of increasing structural complexity. There are two main changes: *quantitative*, as the amount of detail in the student's response increases; and *qualitative*, as that detail becomes integrated into a structural pattern. The quantitative stages of learning occur first, then learning changes qualitatively.

SOLO, which stands for **s**tructure of the **o**bserved **l**earning **o**utcome, provides a systematic way of describing how a learner's performance grows in complexity when mastering many academic tasks. It can be used to define course ILOs, which describe where students *should* be operating and for evaluating learning outcomes so that we can know at what level individual students actually *are* operating.

To illustrate, let us take some content with which you are all now familiar and see where you stand on your level of understanding of it.

What are approaches to learning? How can knowledge of approaches to learning enhance university teaching?

In a few sentences, outline your answer to these questions. **Stop reading any further until you have completed the task.** Then turn to Task 5.1 and try to evaluate your own response and against the model responses.

Task 5.1 SOLO levels in approaches to learning question and why

The following levels of response could be observed (but, it is to be hoped, the first three responses were not):

1 *Prestructural*

'Teaching is a matter of getting students to approach their learning.'

This response could have been written by somebody with understanding at the individual word level, but little understanding of what was discussed in the previous chapter. Prestructural responses simply miss the point or, like this one, use tautology to cover lack of understanding. These responses can be quite sophisticated, such as the kind of elaborate tautology that politicians use to avoid answering questions, but, academically, they show little evidence of relevant learning.

2 *Unistructural*

'Approaches to learning are of two kinds: surface, which is inappropriate for the task at hand, and deep, which is appropriate. Teachers need to take this into account.'

This is unistructural because it meets only one part of the task, defining what approaches to learning are in terms of just one aspect, appropriateness. It misses other important attributes, for example that they are ways of describing students' learning activities and what might influence them, while the reference to teaching adds nothing. Unistructural responses deal with terminology, getting on track but little more.

3 *Multistructural*

'Approaches to learning are of two kinds: surface, which is inappropriate for the task at hand, and deep, which is appropriate. Students using a surface approach try to fool us into believing that they understand by rote learning and quoting back to us, sometimes in great detail. Students using a deep approach try to get at the underlying meaning of their learning tasks. Teaching is about getting students to learn appropriately, not getting by with shortcuts. We should therefore teach for meaning and understanding, which means encouraging them to adopt a deep approach.'

We couldn't agree more. The first part is quite detailed (but could be more so); the second part is also what good teaching is about. So what is the problem with this answer? The problem is that this response does not address the key issue: *how* can knowledge of approaches enhance teaching? not *that* they can enhance teaching. This is what Bereiter and Scardamalia (1987) call 'knowledge-telling': snowing the reader with a bunch of facts, but not structuring them as required – and don't be misled by the odd connective like 'therefore'. Here, the students

see the trees but not the wood. Seeing trees is a necessary preliminary to adequate understanding, but it should not be interpreted as comprehending the wood.

4 *Relational*

'Approaches to learning are of two kinds: . . . (etc.) The approaches come about partly because of student characteristics, but also because students react differently to their teaching environment in ways that lead them into surface or deep learning. The teaching environment is a system, a resolution of all the factors present, such as curriculum, assessment, teaching methods and students' own characteristics. If there is imbalance in the environment, for example a test that allows students to respond in a way that does not do justice to the curriculum, or a classroom climate that scares the hell out of them, the resolution is in favour of a surface approach. What this means is that we should be consistent.'

And so on. Here we have an explanation. Both concepts, approaches and teaching, have been integrated by the concept of a system; examples have been given, and the structure could easily be used to generate practical steps. The trees have become the wood, a qualitative change in learning and understanding has occurred. It is no longer a matter of listing facts and details, they address a point, making sense in light of their contribution to the topic as a whole. This is the first level at which 'understanding' in an academically relevant sense may appropriately be used.

5 *Extended abstract*

We won't give a lengthy example here. The essence of the extended abstract response is that it goes beyond what has been given, whereas the relational response stays with it. The coherent whole is conceptualized at a higher level of abstraction and is applied to new and broader domains. An extended abstract response on approaches to learning would be a 'breakthrough' response, giving a perspective that changes what we think about them and their relationship to teaching. The trouble is that today's extended abstract is tomorrow's relational. Marton and Säljö's original study was such a breakthrough; linking approaches to learning to systems theory was another, but now both are conventional wisdom.

The examples illustrate the five levels of the taxonomy. Uni- and multistructural levels see understanding as a quantitative increase in what is grasped. These responses were deliberately constructed to show that the higher level contains the lower level, plus a bit more. The 'bit more' in the case of multistructural incorporates the unistructural, then more of much the same – a purely quantitative increase. The 'bit more' in the case of

relational over multistructural involves a qualitative change, a conceptual restructuring of the components, the recognition of the systems property as integrating the components, while the next shift to extended abstract takes the argument into a new dimension. SOLO describes a hierarchy, where each partial construction becomes the foundation on which further learning is built.

This distinction between knowing more and restructuring parallels two major curriculum aims: to *increase knowledge* (quantitative: unistructural becoming increasingly multistructural); and to *deepen understanding* (qualitative: relational, then extended abstract). Teaching and assessment that focus only on the quantitative aspects of learning will miss the more important higher level aspects. Quantitative, Level 1, theories of teaching and learning address the first aim only, so that the deepening of understanding is left to Susan's predilections for spontaneous deep learning activities. The challenge for us is to highlight the qualitative aim in the ILOs and support it by both teaching and assessment methods. Then Robert's understanding is likely to be deepened too.

Using SOLO to design particular intended learning outcome statements is helped considerably by using verbs that parallel the SOLO taxonomy. A visual representation is given in Figure 5.2, with some verbs typical of each level.

The verbs in the staircase are general, indicating what the students need to be able to do to indicate achievement at the level in question. Table 5.1 provides many more verbs from SOLO.

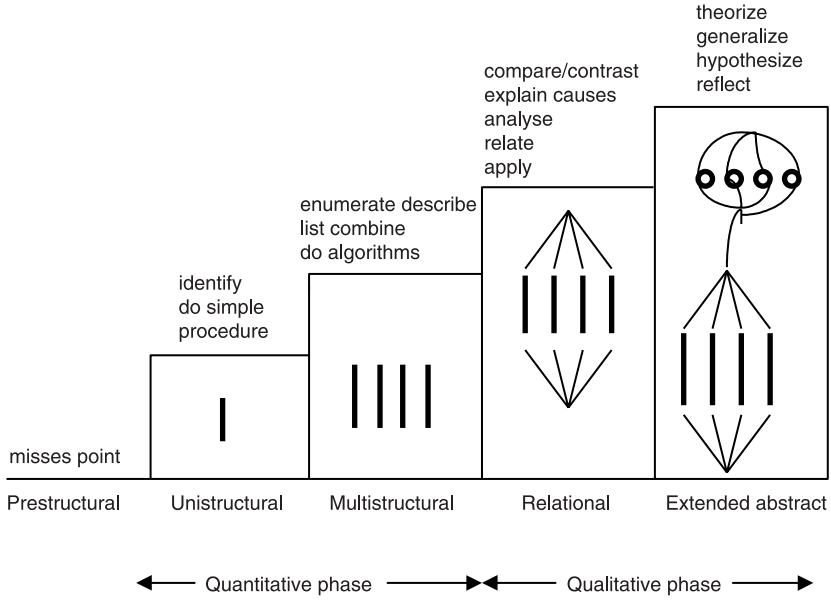

Figure 5.2 A hierarchy of verbs that may be used to form intended learning outcomes

Table 5.1 Some verbs for ILOs from the SOLO taxonomy

Unistructural	Memorize, identify, recognize, count, define, draw, find, label, match, name, quote, recall, recite, order, tell, write, imitate
Multistructural	Classify, describe, list, report, discuss, illustrate, select, narrate, compute, sequence, outline, separate
Relational	Apply, integrate, analyse, explain, predict, conclude, summarize (précis), review, argue, transfer, make a plan, characterize, compare, contrast, differentiate, organize, debate, make a case, construct, review and rewrite, examine, translate, paraphrase, solve a problem
Extended abstract	Theorize, hypothesize, generalize, reflect, generate, create, compose, invent, originate, prove from first principles, make an original case, solve from first principles

This gives us a wide range of levels that can be adapted to the levels appropriate to particular courses, from first to senior years. Particular content areas and topics would have their own specific verbs as well, which you would need to specify to suit your own course. Some verbs could be either extended abstract or relational, depending on, for example, the degree of originality or the context in which the verb was deployed: 'solve a problem', for example. And whether 'paraphrase' is relational or multistructural depends on how the student goes about paraphrasing: replacing with like-meaning phrases or rethinking the meaning of the whole text and rewriting it. Writing ILOs is one thing but when it comes to assessing them it needs to be done in a context so that these ambiguous verbs can be pinned down: to 'show your working', as maths teachers are wont to say.

For another set of verbs, based on Bloom's revised taxonomy (Anderson and Krathwohl 2001), see Table 5.2.

The original Bloom taxonomy was not based on research on student learning itself, as is SOLO, but on the judgments of educational administrators, neither is it hierarchical, as is SOLO. Anderson and Krathwohl's revision is an improvement, but even then under 'understanding' you can find 'identify', 'discuss' and 'explain', which represent three different SOLO levels. This is exactly why 'understand' and 'comprehend' are not helpful terms to use in writing ILOs. However, the Bloom taxonomy is a useful adjunct for suggesting a wider list of verbs, especially for a range of learning activities.

Designing and writing course ILOs

In designing outcomes, there are several points to consider.

Table 5.2 Some more ILO verbs from Bloom's revised taxonomy

Remembering	Define, describe, draw, find, identify, label, list, match, name, quote, recall, recite, tell, write
Understanding	Classify, compare, exemplify, conclude, demonstrate, discuss, explain, identify, illustrate, interpret, paraphrase, predict, report
Applying	Apply, change, choose, compute, dramatize, implement, interview, prepare, produce, role play, select, show, transfer, use
Analysing	Analyse, characterize, classify, compare, contrast, debate, deconstruct, deduce, differentiate, discriminate, distinguish, examine, organize, outline, relate, research, separate, structure
Evaluating	Appraise, argue, assess, choose, conclude, critique, decide, evaluate, judge, justify, predict, prioritize, prove, rank, rate, select, monitor
Creating	Construct, design, develop, generate, hypothesise, invent, plan, produce, compose, create, make, perform, plan, produce

Source: Anderson and Krathwohl (2001)

Decide what kind of knowledge is to be involved

Is the ILO in question about declarative knowledge only: knowing about phenomena, theories, disciplines? Or functioning knowledge: requiring the student to exercise active control over problems and decisions in the appropriate content domains? The ILO should be clear as to what kind of knowledge you want and why. Declarative knowledge in a professional education programme may be taught for various reasons:

- As general 'cultural' content, as in the liberal arts notion of an educated person; e.g. a business management student must take an arts subject for 'broadening'. There is no functioning knowledge involved here.
- As content specifically related to the profession: e.g. the history of western architecture in an architecture degree. This is important background for architects to have, but again there may be little direct bearing on functioning knowledge.
- As content that does bear on functioning knowledge, but is not a key priority. In this case, students might be taught the basic outlines and where to go for more details as and when the need arises.
- As content that definitely bears on everyday decision making. The ILO should be written specifically for seeking the functioning knowledge concerned.

All these different purposes for teaching a topic or course require careful thought as to the balance between coverage and depth. The curriculum is not

a plateau of topics, all 'covered' to the same extent, but a series of hills and valleys. In an international phone call, you don't just chat about the weather. We need similarly to prioritize our classroom communications by deciding the depth, or level of understanding required, for each topic, as discussed later.

Select the topics to teach

Selecting the actual topics to teach is obviously a matter of specific content expertise and judgment. You, as the content expert, are best able to decide on this, but when doing so note the tension between coverage and depth of understanding.

There is almost always strong pressure to include more and more content, particularly when teachers share the teaching of a course and in professional faculties where outside bodies validate courses. All concerned see their own special topic or interest as the most important. Over-teaching is the inevitable result:

> The greatest enemy of understanding is coverage – I can't repeat that often enough. If you're determined to cover a lot of things, you are guaranteeing that most kids will not understand, because they haven't had time enough to go into things in depth, to figure out what the requisite understanding is, and be able to perform that understanding in different situations.
>
> (Gardner 1993: 24)

If we conceive the curriculum as a rectangle, the area (breadth *x* depth) remains constant. Take your pick. Breadth: wide coverage and surface learning giving disjointed multistructural outcomes. Depth: fewer topics and deep learning giving relational and extended abstract outcomes. Do you want a curriculum 'a mile wide and half an inch deep', as US educators described the school mathematics curriculum following the abysmal performance of US senior high school students in the Third International Mathematics and Science Study (quoted in Stedman 1997)? Or do you want your students to *really* understand and be able to use what you have taught them?

Actually, the area of the curriculum needn't be entirely constant. Good teaching increases the area, maintaining depth. But there are limits, and there is little doubt that most courses in all universities contain more content than students can handle at little more than the level of acquaintance – which, it is to be hoped, is not an intended outcome. However, when modes of assessment go no deeper than acquaintance, as is likely with multiple-choice tests, the problem remains invisible.

Level of understanding intended

Is it an introductory or an advanced course? In first year, an extended abstract or theoretical level of understanding of a topic may be too high for even an A grade. The answer also varies according to why students are enrolled in a common first year subject. Anatomy 101, for example, might contain students enrolled in first-year medicine and students enrolled in a diploma in occupational therapy. The ILOs, the required levels of understanding and the assessment tasks should be different for each group.

Next, it is necessary to ask why you are teaching this particular topic:

- to delineate boundaries, giving students a broad picture of what's 'there'
- to inform on a current state of play, to bring students up to date on the state of the topic or discipline
- to stockpile knowledge, of no perceived use for the present, but likely to be needed later
- to inform decisions that need making in the near future, as in problem-based learning?

Each of these purposes implies a different level and kind of understanding; each can be nominated by identifying the appropriate outcome action verbs.

One way of addressing the importance of a topic is to spend more or less time on it. A better way is that important topics should be *understood at a higher level* than less important topics. An important topic might be understood so that students can use it or solve problems with it; a less important topic, just that it is recognized. We can signal importance by choosing a verb at the appropriate level of understanding for each topic.

Writing the course ILOs

We are now in a position to start writing course ILOs. These need to be stated in such a way that they stipulate:

- the *verb* at the appropriate *level* of understanding or performance intended
- the topic *content* the verb is meant to address, the object of the verb in other words
- the *context* of the content discipline in which the verb is to be deployed.

The ILOs for the course *The Nature of Teaching and Learning* illustrate these points:

1 *Explain in depth* why a particular course topic is important to teaching.
2 *Explain* how the component course topics interrelate.
3 *Reflect* on your teaching in terms of a working theory you have gained from the course.
4 *Evaluate* a situation that has gone wrong and *apply* a solution.

The first two refer to declarative knowledge: the students have to reach a level of understanding that requires them to *explain* something, not just describe or list it: the latter only display multistructural levels of understanding. In one, explanation is in depth (1), requiring students to relate the topic to the context of teaching and is at a relational level of understanding, as is the form of explanation in (2), requiring students to integrate the topics in the context of the course itself.

The second two are about functioning knowledge and should be at the relational to extended abstract level of understanding, depending on the originality of the student's response. The content in (3) is the student's own working theory and the context the student's own teaching, and in (4), the content is the theory used in evaluating and the context the problematic situation in teaching.

You should now be in a position to design and write your own ILOs for a course you are teaching (Task 5.2).

Task 5.2 Writing course ILOs

Take a course that you are teaching. Consider the course aim and write the course ILOs by identifying:

a the kind of knowledge to be learned (declarative or functioning)
b the content or topic to be learned
c the level of understanding or performance to be achieved.

The following grid may be a useful framework to help you think.

Kind of knowledge	*Content or topic*	*Level of understanding or performance (outcome verb)*

Now go across the rows and write out the course ILOs by stating the intended level of understanding or performance (outcome verb) and the content or topic in which the verb is to be enacted. You do not need to include the kind of knowledge in the course ILOs as they are only meant to help you clarify your thinking and decision making.

To recap an example of a course ILO from our course *The Nature of Teaching and Learning*:

Students should be able to:
Reflect (*level of understanding and performance*) on your teaching in terms of a working theory you have gained from the course *(content).*

Now write your course ILOs.
Students should be able to:
ILO1:_____
ILO2:_____
ILO3:_____
ILO4:_____
ILO5:_____
ILO6:_____

Review the ILOs to see if:
a the kind of knowledge, content and level of understanding or performance are relevant to achieve the course aim
b they cover all the main reasons for teaching the course
c they are clearly written, especially in identifying the level of understanding or performance to be achieved by the students
d the number is manageable for designing aligned teaching/learning activities and assessment tasks.

You may now wish to review your existing course 'objectives'. Do they need to be rewritten as course ILOs?

Aligning intended learning outcomes at three levels

Now that we have written the course ILOs, we have the task of checking to see that all these levels of intended outcomes, starting with the programme ILOs and the graduate attributes, are aligned.

Graduate attributes and programme ILOs

Table 5.3 shows a simply way of checking the alignment between graduate attributes and programme ILOs.

The table is a device to ensure that the match between programme ILOs and graduate attributes has at least been considered. Our view is that programme ILOs should not be forced to match attributes that don't belong in the programme. Because of the different natures of different disciplines or professions, different programmes may have different emphases in addressing the graduate attributes. It is not necessary that every programme should address all graduate attributes because some graduate attributes may not be relevant to the programme. Programme ILOs are simply the reasons that

the programme is being taught, which is a matter of professional and academic judgment. However, university policy will prevail on this.

Table 5.3 Aligning programme ILOs with graduate attributes

Graduate attribute	*Programme ILO*
Competent professional practice	Apply principles to real-life accounting situations
Communicate effectively	Communicate as a professional with clients and colleagues in real-life accounting situations
Teamwork	Operate effectively and ethically as a team member in real-life accounting situations
Ethical professional	As above

Task 5.3 Aligning programme ILOs with graduate attributes

1 Take a programme in which you are teaching and *either* list the programme ILOs if they are already articulated *or*, if they are not, sit down with the programme coordinator or programme committee chairperson and first write the aims of the programme and a list of programme ILOs that meet those aims.

2 What are the graduate attributes of your university? List them in the left-hand column in the grid.

3 Now list the programme ILOs that would address the attributes.

Are all attributes addressed somewhere? What are not? Does it matter?

Graduate attribute	*Programme ILO*
1	
2	
etc.	

Task 5.3 parallels Table 5.3: it asks you to align programme ILOs with the graduate attributes of your university, if it has any. List them in the left-hand column, as in Table 5.3. If the intended outcomes of a programme you are teaching have already been articulated, go to the right-hand column and match them with any graduate attributes each might address. If the

programme ILOs haven't yet been articulated, discuss them with the programme coordinator and derive a set, then match them with the graduate attributes. This should give you a clearer idea of how graduate attributes can suitably be addressed in your teaching. How does your attempt gel with your university's policy on this?

Programme ILOs and course ILOs

The next level of alignment is between the programme and the course ILOs. As each programme is served by its constituent courses, it is important that, when aligning course ILOs to the programme ILOs, the course ILOs in total address all aspects of the programme ILOs. Often a programme ILO will be addressed by several courses, from different and increasingly more complex angles. You may attempt this in Task 5.4.

The great advantage of this level of alignment is that it guards against complaints:

- from students that through sloppy programme design the same issue is addressed in different courses
- from employers or professional bodies that some important issues aren't addressed at all by any course.

Course ILOs, teaching/learning activities and assessment tasks

The final alignments are between the course ILOs and (a) the teaching/learning activities (TLAs); and (b) the assessment tasks (ATs). These are the critically important tasks for the design of a constructively aligned curriculum. They are dealt with in the next few chapters.

Summary and conclusions

Intended learning outcomes at different levels

ILOs exist at three levels: as graduate attributes, as programme outcomes and as course outcomes. Graduate attributes are conceived mainly in two ways: as generic skills or abilities that are to be displayed in all circumstances or as attributes embedded in the content area of a discipline. Reconciling these interpretations and dealing with them in an accountable way is a complex issue. Programme ILOs need to address the graduate attributes in an accountable way and to reconcile this with the reasons that the degree is being offered in a substantive sense. They are expressed as the central outcomes intended for the programme and that are to be met by

Task 5.4 Aligning course ILOs with programme ILOs

For individual teachers

1 List the programme ILOs of the programme.

2 List the course ILOs of the courses that you are teaching in a given programme. It may be one or more.

3 Consider what programme ILO(s) each of the course ILOs addresses.

Programme ILOs	*Course 1 ILOs*	*Course 2 ILOs*	*Course 3 ILOs*
1			
2			
3			
4			

Do your course ILOs address the programme ILO(s)?

For the programme coordinator

After all the courses of the programme have been considered, the programme coordinator needs to consider the following:

a Are all the programme ILOs being addressed by the courses?
b Is the alignment between the programme ILOs and the course ILOs balanced? In other words, are any of the programme ILOs being overemphasized or vice versa?
c Are there any gaps in the programme ILOs that are not being addressed?

the particular courses in a balanced way. Course ILOs determine the teaching and assessment that takes place in the classroom and consequently need to be designed and written with a view to the kind of knowledge and the level of understanding intended.

Kinds of knowledge and levels of understanding

Declarative (propositional) knowledge refers to knowing about things and is 'declared' in the spoken and written word. Functioning knowledge is knowledge based on the academic declarative knowledge base that is put to work. These distinctions are important in sorting out whether

students need to understand, as in 'know about', or, as in 'put to empowered use'.

But whether declarative or functioning knowledge is in question, we need to specify the *level* of understanding intended. This can be done by selecting a verb and a context for demonstrating the desired level. The SOLO taxonomy can be helpful in specifying those levels.

Designing and writing course ILOs

Before designing particular ILOs it is necessary to:

1 Decide what kind of knowledge is to be involved.
2 Select the topics to teach. But beware: 'The greatest enemy of understanding is coverage.'
3 Decide the purpose for teaching the topic, and hence the level of understanding or performance desirable for students to achieve. We need to prioritize, by requiring that important topics are understood at a higher level than less important topics.

Prioritizing ILOs is done in terms of the verbs related to each level of understanding: important topics are assigned a higher level of understanding than less important. The SOLO taxonomy is useful for providing a 'staircase of verbs' that can be used selectively to define the ranges of understanding needed. Using verbs to structure the ILOs emphasizes that learning and understanding come from student activity and they are used to align ILOs, teaching/learning activities and assessment tasks.

Aligning ILOs at three levels

Once ILOs have been finalized, they need aligning: programme ILOs with graduate attributes, course ILOs with programme ILOs and teaching/learning activities and assessment tasks with course ILOs. These last alignments with course ILOs are dealt with in following chapters.

Further reading

Biggs, J.B. and Collis, K.F. (1982) *Evaluating the Quality of Learning: The SOLO Taxonomy*. New York: Academic Press.

Boulton-Lewis, G.M. (1998) Applying the SOLO taxonomy to learning in higher education, in B. Dart and G. Boulton-Lewis (eds) *Teaching and Learning in Higher Education*. Camberwell, Victoria: Australian Council for Educational Research.

Toohey, S. (2002) *Designing Courses for Universities*. Buckingham: Open University Press.

The first goes into the derivation of SOLO in detail, Boulton-Lewis with several applications of SOLO in higher education. Toohey focuses more on programme (which she calls 'course') design than on course ('unit') design, which usefully complements the present chapter, which concentrates more on writing ILOs for courses.

Graduate attributes

Higher Education Research & Development, 23, 3: August 2004. This whole issue is devoted to graduate attributes.

The graduate attributes site at University of Sydney: http://www.usyd.edu.au/ab/policies/Generic_Attributes_Grads.pdf

The Graduate Attributes Project, Institute for Teaching and Learning, University of Sydney: http://www.nettl.usyd.edu.au/GraduateAttributes/ and how each faculty has developed its own statement of graduate attributes based on the university's framework: http://www.nettl.usyd.edu.au/GraduateAttributes/interpretations.cfm

How the Faculty of Commerce and Economics contextualizes the UNSW graduate attributes: http://wwwdocs.fce.unsw.edu.au/fce/EDU/part3.pdf

Writing course ILOs

The following guides to writing ILOs elaborates the above:

University of Glasgow: http://senate.gla.ac.uk/academic/ilo/guide.pdf

Oxford Brookes University: http://www.brookes.ac.uk/services/ocsd/2_learntch/writing_learning_outcomes.html

On the SOLO taxonomy

A rather nice diagrammatic presentation of SOLO by James Atherton: http://www.learningandteaching.info/learning/solo.htm

As SOLO might apply to children's ethics and to zoology from the University of Queensland's TEDI: http://www.tedi.uq.edu.au/downloads/Biggs_Solo.pdf

A paper by Hargreaves and Grenfell on SOLO and 'The use of assessment strategies to develop critical thinking skills in science': http://www.unisa.edu.au/evaluations/Full-papers/HargreavesFull.doc

And Google 'SOLO taxonomy' for 20,000 more results.

6

Contexts for effective teaching and learning

While particular teaching/learning activities (TLAs) need to be aligned to the target verbs in the ILOs they are to facilitate, there are also general criteria all TLAs should meet, whatever verbs they address. We look at these general criteria in this chapter. All teaching/learning activities set for students should be seen as having value and to be readily performable; students should be required to build on what they already know, to be relevantly active, to receive formative feedback and to be engaged in monitoring and reflecting on their own learning. A potential teaching/learning activity should meet these general criteria before it is aligned to the particular ILOs it is to facilitate.

Characteristics of rich teaching/learning contexts

In Chapter 1, good teaching was defined as 'getting most students to use the level of cognitive processes needed to achieve the intended outcomes that the more academic students use spontaneously'. Traditional teaching methods – lecture, tutorial, and private study – do not in themselves require students to use these high-level cognitive processes; Susan uses them but she does anyway, no thanks to the teaching. These teaching methods do not intrinsically provide support for appropriate levels of learning; they leave Robert floundering with a pile of lecture notes, a lot of trees but no wood. The challenge for teaching, then, is to select teaching activities that will encourage Robert to use learning activities that Susan uses and that will achieve the ILOs.

There is no such thing as one 'best' all-purpose teaching method: what is 'best' depends on what ILO is being addressed and, at the practical level, on what are the available resources. However, some general characteristics of good teaching/learning contexts emerge from the literature, and that are common to the achievement of a range of ILOs. These are:

1 an appropriate motivational context
2 a well-structured knowledge base
3 relevant learner activity
4 formative feedback
5 reflective practice and self-monitoring.

Appropriate motivational context

When we discussed motivation in Chapter 3, three major points emerged:

1 A Theory Y climate is best for quality learning. Learners learn best when they feel free to move, are trusted and are able to make decisions and take responsibility for their own learning – *consistent with* clear policies and procedures and with an organized environment for learning. 'Consistent with' is the rub. Different teachers, and especially administrators, will disagree about the right balance between a Theory Y climate and an organized environment. Many teaching/learning activities and assessment tasks that address higher level outcomes require an extent of student involvement and a lack of constraints on space and time, such that colleagues, heads of department or boards of examiners may well regard as unacceptably messy: not in the interests of running a tight ship.
2 The task provided – the teaching/learning activity itself – must be *valued* by the student and not seen as busy-work or trivial. In outcomes-based teaching and learning, where the TLA is aligned to the ILO, this is much easier to achieve than in unaligned teaching, because what the student is asked to do is patently in service of achieving the intended outcomes of the course.
3 The student must have a reasonable *probability of success* in achieving the task. Again, this is patently the case in constructive alignment – if an outcome is *intended*, then presumably the teacher has set a task that is achievable. Nevertheless, in their informal interactions with students and in their comments on student performances, teachers may convey messages to students that they have little hope of succeeding; for example, by attributing a poor performance to lack of ability rather than to lack of persistence.

Constructing a base of interconnected knowledge

The teaching context could be regarded as a construction site on which students build on what they already know. Sound knowledge is based on *interconnections*. Everything that has been written so far in this book about understanding, deep learning, the growth and development of knowledge and intrinsic motivation reiterates this. Sound understanding is itself the realization that what is separated in ignorance is connected in knowing.

Cognitive growth lies not just in knowing more, but in *restructuring* what is already known in order to connect with new knowledge.

Building on the known

The physics professor is greeting the new intake of freshers, still glowing from their A level successes:

> 'Now, do you remember the physics you were taught in sixth form?'
> Two hundred heads nod enthusiastically.
> 'Well forget it. You're here to learn *real* physics, not the simplicities you were taught in school!'

This true exchange is a good example of how not to teach. Teaching builds on the known, it must not reject it: proceed from the known to the unknown, as the old saying has it. In deep learning, new learning connects with old, so teaching should emphasize the interconnectedness of topics. It helps to make the connections explicit ('Last week we. . . . Today, I am taking that further'), to choose familiar examples first, to ask students to build on their own experiences when discussing a principle or topic, to draw and explain parallels while teaching, to use cross-references in presenting material, to present topics by showing where they connect to other topics.

This is easier in an outcomes-based rather than in a topic-based curriculum. With only five or six ILOs, instead of a dozen or so topics, dealing with an ILO will inevitably draw on a wider range of relevant material than teaching topic by topic.

Maximizing structure

The connections we were talking about above are drawn horizontally, but the most powerful connections are drawn vertically or hierarchically. That is, we should help students to *reconceptualize*, so that what are seen as differences at a subordinate level become related at a superordinate level. Take the concept of motivation (Chapter 3). Extrinsic and intrinsic motivation have different effects on learning; one is associated with poor learning, the other with high-quality learning. Two different phenomena? Not so: each is incorporated within expectancy-value theory. The different effects are not because they are different forms of motivation, but because the student reads the value component differently: in one case the task itself is valued, in the other the task is only a means of acquiring something else that is valued.

Specific concepts that seem irreconcilably different to students may frequently be interpreted as different instances of the same higher order principle, the differences the students see are because they are focusing at a lower order node. In teaching, we should see that the students understand what the nodes in the structure are. Teaching using bullet lists, for example, is useful only when the points listed are at the same level or node in the structure. If they are not, the bullet list hides the real conceptual structure. In SOLO terms, they are describing in a multistructural way what is a relational or extended abstract structure.

New information should not be just dumped on the learner, in rambling lessons, in poorly constructed texts or as bullet lists. Good teaching always contains a structure, hidden away, but there to be found. Teaching from lists is like sawing the branches off a tree, stacking them in a neat pile, and saying: 'There! See the tree?'

The chances of students coming to grasp the structure can be maximized in many ways. In some circumstances, it is appropriate to present the structure upfront. An 'advance organizer' is a preview of a lecture that mentions the main topics to be dealt with and the overriding conceptual structure to which they may be related (Ausubel 1968). The student then has a conceptual framework from the start: as material is introduced, it can be fitted into place. For example, a diagram based on expectancy-value theory could be used as such an organizer to a lesson on motivation.

A 'grabber', by the same token, doesn't rely on structure for its effect but on its emotional impact. Starting a class with a cartoon, an interesting slide or video clip elicits interest in the topics to follow. Whereas the advance organizer is *conceptual*, the grabber is *affective*, appealing to shock or to humour. Both have their place but work on different principles – our interest here is in the structure of the material, not in its shock value.

Some teachers fall into the trap of talking down to students with an in-your-face conceptual structure, all answers and no questions. Lessons that are too well structured encourage students simply to take on board the given structure and memorize that, thereby establishing one of the lowest of the forms of understanding mentioned by Entwistle and Entwistle (1997; see pp. 74–5). In the end, the student must *always* do the structuring – it's what the student does that is important. The challenge for teachers is to strike the right balance between presenting students with chaos, on the one hand, and with cut-and-dried conclusions, on the other, where all the interesting conceptual work has been done. The question of how much structure to present, given your students and their existing knowledge base, may be gauged from using formative feedback while they are learning – questions, trial runs, even the inter-ocular test (look them in the eyes for signs of life) – as discussed later.

Relevant learner activity

Being active while learning is better than being inactive. Activity is good in itself: it heightens physiological arousal in the brain, which makes performance more efficient. Physical exertion has quite dramatic effects on mental performance. Typically, four minutes of brisk exercise, such as running or pedalling on a bicycle, improves performance in such tasks as mental arithmetic. Longer periods, however, see performance worsen in the unfit, but continuing to improve in the fit (e.g. Tomporowski and Ellis 1986). Getting the adrenalin to flow increases alertness. This is one very good reason for breaking up long periods of lecturing with interspersed activities. Even just

stopping the class and doing stretching exercises does more for students' learning than droning on.

In one study, students were required to learn from text in increasingly active ways: reading silently, underlining important words, writing out the key sentences containing those words, rewriting sentences in one's own words, to the most active, teaching somebody else the material. There was a strong correlation between extent of activity and efficiency of learning (Wittrock 1977).

Better still is when the activity addresses specific intended learning outcomes. Excursions are generally regarded as useful extensions to in-class learning, but their best use is when the activities in the excursion are aligned to the intended outcomes of the excursion. MacKenzie and White (1982) devised an excursion on coastal geography in which each of the intended outcomes was linked to quite dramatic actions, such as chewing mangrove leaves, wading through a muddy swamp, jumping across rock platforms and so on. Performance on a written test on what they had observed and learned three months later was near perfect. Spiegel describes a similar approach of 'adventure learning' to legal studies (see Box 6.1).

Box 6.1 Adventure learning in the School of Law

Nadja Siegel, lecturer in law at Queensland University, is the winner of the law section of the Australian University Teaching Awards. Through adventure learning she tries to develop in students the skills they will need to apply professionally. . . . She creates activities with an element of risk – physical, social or emotional – so that the experience is more real. Crossing a river using blocks as rafts, with one team missing equipment, forces them into deciding whether to adopt a competitive or cooperative approach. But she says adventure learning is not just games. '. . . [Y]ou really need to be aware of how you're using the activity and be able to direct the students' experiences to the focus of their learning . . .'

Source: *The Australian Higher Education*, 26 November 1997

Such activities need to be energetic and memorable in themselves, as well as being aligned to an academic outcome. If discovering the role of salt in the ecology of mangrove swamps is an intended learning outcome, chewing mangrove leaves for their salt content is a teaching/learning activity directly addressing that outcome. If managing a team is an ILO, showing initiative in obtaining cooperation in building a raft is a relevant TLA.

We learn through activating different sense modalities: hearing, touch, sight, speech, smell and taste. The more one modality reinforces another, the more effective the learning. It is like trying to access a book in a library. If all you know is the author, or the title, or the publisher or the year of publication, you could be in for a long search, but the more those 'ors'

become 'ands', the faster and more precise the search becomes. Just so in accessing or remembering what has been learned. The more TLAs tie down the topic to be learned to multiple sensory modes, the better the learning.

Table 6.1 puts this very neatly. Don't take the percentages mentioned there too literally, but the messages are clear, simple, and basically right. Some sensory modalities are more effective for learning than others; the more they overlap, the better; and best of all, you learn through teaching, which requires all the previous activities.

Table 6.1 Most people learn . . .

10%	of what they read
20%	of what they hear
30%	of what they see
50%	of what they see and hear
70%	of what they talk over with others
80%	of what they use and do in real life
95%	of what they teach someone else

Source: Attributed to William Glasser; quoted by *Association for Supervision & Curriculum Development Guide 1988*

Table 6.1 is well worth remembering when designing TLAs – peer teaching being a particularly powerful way of learning for the teacher.

It may help to conceptualize this by realizing that the outcomes of learning are stored in three memory systems (Tulving 1985):

- *Procedural* memory: remembering how to do things. Actions are learned.
- *Episodic* memory: remembering where you learned things. Images are learned.
- *Semantic* memory: remembering meanings, frequently from statements about things. Declarative knowledge is learned.

When we learn something, each system is involved; we learn what we *did, where* it was and how to *describe* what it was. However, they are not equally easily accessed. Actions are easiest to remember (do we ever forget how to ride a bicycle?) and semantics, what was actually said, are hardest. That sequence probably reflects the sequence of psychological development: first actions, then images, then semantics. Be that as it may, recalling the context or the actions can often bring back the semantics. If you can *picture* where you learned it and what you were doing, you are more likely to recall what it was that you learned. It's like accessing the book in the library. Thus even learning straight declarative knowledge, the stuff of academia, is best done in association with a rich store of images and actions. The adventure learning studies do exactly that.

Lecture theatres admittedly offer less scope for activity than wilderness areas, but as we see in the following chapter, students can be kept relevantly active in the classroom and rather more so than they usually are.

Formative feedback

Arguably the most powerful enhancement to learning is feedback during learning. This is also called formative assessment – not to be confused with summative assessment. The purposes and effects of these two forms of assessment are so different it is a pity the word 'assessment' is used for both. It tends to confuse issues – and sometimes teachers. Formative assessment is provided *during* learning, telling students how well they are doing and what might need improving; summative *after* learning, informing how well students have learned what they were supposed to have learned. In one project we were involved in, teachers regarded the comments they wrote on final assessment tasks as 'formative', despite the fact that the course was over, let alone that students rarely pay attention to comments given at the end of a course so that they may generalize them to how they learn in future courses.

There have been numerous studies of the effects of feedback (for example, Black and Wiliam 1998; Hattie 2003) and it tops the list of those factors leading to good learning. Running close is whole-class interactive teaching, followed by self- and peer-assessment and cooperative learning, with class size way down the list: all of which we come to in the next chapter.

So important is formative feedback that the effectiveness of any particular teaching/learning activity can be judged by how well it provides feedback to students as they learn. In a large lecture, students may receive little or no feedback, while one reason that interactive class teaching works so well is because it more readily provides students with contemporary information about how well they are going along the road to learning.

Effective feedback requires that students have a baseline knowledge of where they are and knowledge of where they are supposed to be heading – what the ILOs are, in fact – and the feedback is meant to slot into that gap in their self-knowledge. Feedback can be provided by the teacher, by other students and by the students themselves, each such source giving a different aspect to the feedback.

Using error constructively

Errors are important learning opportunities, but formative feedback is essential in learning from error. In the course of learning, students inevitably create misconceptions that need to be corrected so that any misunderstandings can be set right, literally in the formative stage. To do this requires a Theory Y climate, where students will feel free to admit error. If they think that the information will be used summatively or that they will be judged on the result, they will be defensive about admitting to any error. In that case, an opportunity for learning has been lost. This must make one cautious about using formative test results in the final grade.

In a tutorial or group session where the tutor is censorious or sarcastic students will keep quiet, preferring not to make themselves vulnerable. This is independent of any particular teaching method. In an otherwise fine problem-based learning (PBL) course at a particular university, one tutor

completely wrecked the process. The aim in PBL is for students to pose questions and to follow through with plausible answers to a given problem. This they do by reference to theory, past experience, similar cases, etc., asking questions and testing possible answers in discussion. But in this particular case, the tutor replied to every question put to her with an all-knowing sneer: 'That's for me to know and for you to find out!' So the students in this group gave up asking questions and problem-based learning acquired a bad name. So did the tutor.

Some teachers feel awkward about drawing attention to students' errors. In wanting to create a Theory Y climate, where students can feel free to explore possibilities and ask far-out questions, these teachers are reluctant to publicly correct students' errors.

This is the dilemma teachers have to face: Do I correct mistakes and risk discouraging students from expressing their understandings in public? Or do I let them go uncorrected in the interests of maintaining a productive working atmosphere? Not to correct seems to be abdicating from an important teaching function: misconceptions are allowed to pass unquestioned and uncorrected. One technique is to smile encouragingly, with 'Yes, not bad. Can anyone else elaborate on that?' This signals that there is a problem, that we are part-way there, that it is a collective job to achieve a better outcome and that individuals are not to be blamed for not having a perfect answer first time round. It's a matter of the interpersonal chemistry, the rapport, that a teacher can create. With good rapport, public correction is cheerfully accepted and appreciated.

Japanese teachers do exactly this in what Hess and Azuma (1991) call 'sticky probing', which westerners might see it as a little drastic. A single problem is discussed for hours by students, with teacher adjudicating, until a consensus acceptable to teacher and students is reached. The focus of the probing is a particular student's error, with the student the focus of public correction. Japanese students, however, don't appear to see this as a punishment for making a mistake; they understand that learning is a collective activity and that learning from mistakes is part and parcel of learning.

Using error constructively thus involves two challenges:

- requiring students to expose their erroneous thinking without risk of ridicule, loss of face or low grades
- correcting them nicely so that they feel positive about being corrected and not ashamed or resentful.

This is a personal matter that every teacher needs to resolve in a way that each can feel comfortable with.

Reflective practice and self-monitoring

In Chapter 3 we discussed reflective practice and transformative reflection, whereby teachers monitored their own practice and used their theory of

teaching to see how they could teach better. The same thing applies to learning itself. When self-monitoring, learners keep a watching brief over their learning: How am I doing? Am I making mistakes here? Any pattern in my errors? If so, what is it and how can I avoid it in future? Is there any way I can approach this more effectively than I am now?

These are the sorts of questions that good learners ask themselves, like good practitioners of any sort. Formal, top-down ways of teaching discourage self-questioning. If the teacher always assesses how well the student is doing and never allows the student to self-assess, the student lets it go at that and consequently doesn't see the need for or acquire the skills of reflection. Indeed, the longer many undergraduate students stay at university – the Susans excepted – the less deep and the more surface oriented they tend to become. This has been observed in several countries: Australia (Biggs 1987a; Watkins and Hattie 1985), the UK (Entwistle and Ramsden 1983), and Hong Kong (Gow and Kember 1990). It seems that Robert's learning as it becomes institutionalized becomes unreflective, performed by rule of thumb and with minimum effort. All the decisions, especially about assessment, have been made for him in formal top-down teaching.

Where the teacher expounds the material and assesses it at the end, the teacher is in effect the masterbuilder for constructing the student's knowledge base, the student an apprentice bricklayer only. The student is left in a passive role both in receiving information and in monitoring what has been learned. They come to believe – or rather, they have the belief they acquired in school confirmed – that keeping track of their learning is the teacher's job, not their own. They are unlikely to become very good independent or lifelong learners.

Learning to 'monitor the construction site' is another name for those study skills that involve self-management, including self-assessment, dealt with in Chapter 8 under the heading of self-directed TLAs that are so important for addressing an attribute such as lifelong learning (see also Figure 5.1, p. 68).

A checklist for designing teaching/learning activities

Any TLA should meet the following criteria for a good learning context (see Table 6.2).

When you have decided what would be the most suitable TLAs for a particular course, given the ILOs and the practical considerations of resources and class size, Table 6.2 suggests the TLA be screened to meet the following criteria:

- Is the general climate in which it is deployed Theory Y?
- Do the students see the task as relevant and important; do they see themselves as likely to succeed at it?

- Does the task build on previous relevant knowledge?
- Does it require the learner to be relevantly active?
- Does it allow for the learner to be reflective as learning progresses?

If the task falls short on any of these criteria, it should be redesigned.

Table 6.2 Some important general criteria for any TLA: a checklist

	Motivational climate	*Does it build on or require*
	Theory X/Y Value Success	Prior knowledge? Learner activity? Reflection?
TLA1 TLA2 TLA3 etc.		

Task 6.1 is a reflective exercise to help you see what type of teaching/learning context you have created for your students.

In the next two chapters we turn to the central issue: what learning outcomes are the TLAs intended to achieve?

Summary and conclusions

If we are to devise and implement effective teaching/learning activities (TLAs), we need first to ask if there are any general criteria they should meet. There are. They need to be grounded in an appropriate motivational context, to work from a base of interconnected knowledge, to require relevant learner activity and to encourage reflective practice and self-monitoring. The power of a teaching method or TLA depends on the extent to which it embodies these characteristics.

Establishing an appropriate motivational context

The general context needs to be Theory Y so that students can take more responsibility for their learning, but some colleagues and more administrators will see this differently. Specifically, tasks need to be valued by students and to be attainable.

Constructing a base of interconnected knowledge

A powerful knowledge base is complex in structure and error free, built on accessible interconnections. Creating such a base involves: building on the

Task 6.1 The teaching/learning context you have created

Select one of the teaching methods that you commonly use and evaluate it in light of its effectiveness in relation to the characteristics of a good teaching/learning context. Provide evidence to substantiate your evaluation.

a Establishing an appropriate motivational Theory Y context for your students.

b Creating an interconnected knowledge base for your students.

c Providing learning activities relevant to engage your students with the ILOs.

d Providing formative feedback on your students' learning progress.

e Encouraging your students to self-monitor and reflect on their learning.

What changes would you like to make in the future to further enhance the effectiveness of your teaching/learning context?

known, making use of students' existing knowledge and emphasizing structural interconnections between topics. These points should infuse teaching whatever the particular teaching activity.

Relevant learner activity

Knowledge is constructed through learner activity and interaction. Activity has two main roles. The fact of being generally active in and of itself provides general alertness and efficiency. Second, and more specifically, activity specifically keyed to the intended learning outcomes, using different sensory modes of learning to provide multiple access to what has been learned, is a very powerful way of learning.

Formative feedback

If there is any single factor that supports good learning it is formative feedback: teaching is good or poor depending on how readily students receive feedback on how they are doing. For feedback to be effective students need to be clearly aware of what they are supposed to be learning and as they are unlikely to be perfect first time, they need information as to where their deficiencies lie and misconceptions students may have need to be confronted and corrected. Teachers, other students and students themselves can be useful sources of feedback, depending on the intended learning outcome.

Reflective practice and self-monitoring

Whatever the TLA, it should encourage students' awareness of their own knowledge construction, largely by placing them in situations that require them to self-monitor and self-direct their own learning. This is the way to achieve lifelong learning.

Further reading

On good teaching/learning contexts and principles of good teaching

Biggs, J. and Moore, P. (1993) *The Process of Learning*. Sydney: Prentice-Hall Australia.
Fuller, R. (1998) Encouraging active learning at university, *HERDSA News*, 20, 3: 1–5.
Gibbs, G. (2006) On giving feedback to students. http://www.brookes.ac.uk/services/ocsd/firstwords/fw21.html
Hattie, J.A. (2003) Teachers make a difference. http://www.arts.auckland.ac.nz/faculty/index.cfm?P=8650

Petty, G. (2006) *Evidence-based Teaching*. Cheltenham: Nelson Thomas.
Ramsden, P. (2003) *Learning to Teach in Higher Education*. London: Routledge.

Biggs and Moore describe rich learning contexts and the conditions for good learning and summarize research on expert teaching. Ramsden deals with six key principles of effective teaching. Fuller's article is rich with practical suggestions for active learning. Hattie's paper is a summary of meta-analyses on a huge scale: this is a technique that combines research results from hundreds of studies enabling stable generalizations over a variety of contexts about what factors are most important in enhancing student learning. By far the most important are giving proper feedback, as discussed in this chapter, and active teaching, as discussed in the next. Petty's book shows how to put into practice the teaching methods with the biggest 'effect sizes' in Hattie's work: feedback, interactive teaching, graphic organizers and various examples of group work are among the best. We elaborate on all of these in following chapters.

Gibbs's paper describes how feedback is best provided.

Links to educational development centres worldwide

http://learningandteaching.dal.ca/ids.html. This URL provides very useful links to centres in most western countries. You can navigate to most topics dealt with here and in other chapters on university teaching that will discuss the topic in the context and vocabulary of your own country.

7

Teaching/learning activities for declarative knowledge

We discuss aligning teaching/learning activities (TLAs) to ILOs relating to declarative knowledge in this chapter, and to functioning knowledge in the following one. Teaching declarative knowledge by lecture, followed by tutorial, has become so established that 'lecturing' has become the generic term for university teaching, to be carried out in 'lecture theatres', particularly for dealing with large classes. We suggest that the term 'lecture' describes a situation, not a teaching/learning activity, and that within the situation of the large class there are far more effective ways of achieving course ILOs than talking at students. In this chapter, we show how interactive teaching, which is a highly effective mode of teaching, can be used in even large classes. We also deal with interactive learning, and teacher questioning, in smaller classes. We end with a discussion of some of the teaching/learning activities that can be supported by educational technology.

Three changes needed in the way we usually think about teaching

When we turn to the matter of designing teaching/learning activities, we find that to implement constructive alignment requires changing the ways we have previously thought about teaching. First, we, as teachers, need to stop thinking about the next lecture that we have to give or the tutorial we have to design. These are only situations for student learning. It is only when we have clarified our intended learning outcomes that we should start thinking about the teaching/learning activities we might most appropriately use, within our resources. This will probably not mean giving lectures. Many academics start from the assumption that their major activity is to give a 'lecture', which is after all what the timetable says they should be doing. University planners and architects accordingly designate these rooms 'lecture

theatres', equipping them with stage and spotlight, as if skilled performers are to provide some pleasant entertainment there. What goes on is only rarely carried out by people skilled in the performing arts and only sometimes is it entertaining.

The assumption that the lecture method, and its satellite the tutorial, should be the defaults that academics use in discharging their teaching duties needs examining. The lecture and tutorial do have their uses, but they are limited in what they can effectively achieve. There are more effective ways of using the space in those large 'lecture' theatres. It helps to think of lectures and tutorials as *situations*, in which a range of teaching/learning activities can take place, rather than as prescriptions for a manner of teaching.

The second change in thinking is to shift the focus from what the teacher does to what the student should best be doing. Teaching is, if you like, a service activity, we teach so that students may learn and what they learn depends on how they go about learning. That sounds obvious, but all too frequently the messages from administration downwards are that teaching is only about what teachers do. We actually have a two-sided ledger sheet: (a) what the teacher is doing and (b) what at the same time the students are doing. Attaining the intended outcomes depends rather more on (b), than on (a). It's a pity that in English we have two separate words for 'teaching' and 'learning'. Some languages, such as Russian, have one word for both so that you can't then say: 'I taught them but they didn't learn.' One feature of constructive alignment is that it brings teaching and learning closer together, even if in English we don't have a single word for it.

The third change is that we need to stop assuming that learning is only taking place when it is located inside a teacher-directed classroom. If you want your students to be the lifelong learners that the mission statement of your institution almost certainly requires, some learning should certainly be taking place outside a formal teacher-directed environment.

In sum, designating teaching sessions as 'lectures' and 'tutorials' should not be seen as prescribing what teachers have to do, but as situations in which a variety of teaching/learning activities can take place. And it must not be forgotten that there will be some intended learning outcomes, often the most important ones, where the best situation for relevant student learning activity is *outside* the classroom, not inside.

We need to make a clear distinction between appropriate teacher activity and appropriate student activity.

What teachers do: What students do

Let us say teaching takes place in a typical lecture situation, where the intended outcome contains that very common verb 'explain'. What are teacher and student most likely to be doing (see Table 7.1)?

The teacher talks to the usual structure of the lecture: introduces the topic, explains, elaborates, takes questions and winds up. The students are

engaged in receiving the content, listening, taking notes, perhaps asking a question – but not necessarily 'explaining'. Although this is what the students are intended to be able to do, here the teacher is doing all the explaining. The students are usually only required to explain the theory or topic in question when it comes to exam time – but by then it's too late. The students haven't been given the opportunities to learn to explain before they are assessed on their ability to explain. There's a distinct lack of alignment between the ILO and the students' learning-related activities.

Table 7.1 What teachers and students do in a lecture leading to an ILO containing 'explain'

Teacher activity	*Student activity*
Introduce	Listen
Explain	Take notes
Elaborate	Understand (but correctly? deeply enough?)
Show some PPT slides	Watch, note points
Questions on slides	Write answers to questions
Wind up	Possibly ask a question

What does it mean to 'explain', as opposed, say, to 'describe'? In order to 'explain' something, the student must understand how the components of the topic/theory are related to each other, which is a relational level of understanding, whereas to 'describe' requires only that the components of the topic can be listed, which is a multistructural level of understanding. The teacher's task is therefore both to present the information itself and how it is structured; the student's is to receive the information and to structure it. In our example, neither teacher nor Robert monitors that double task. Susan would structure her understanding enough for her to be able to explain the topic but only because that's what she usually does, explaining to another student what she thought the teacher meant or reflectively explaining to herself while reviewing and revising. Susan's learning-related activities are aligned to the ILO, if only by default, whereas Robert's are not. In constructively aligned teaching, the teacher might use teaching/learning activities such as peer teaching or buzz groups within the class to ensure that everyone does some explaining; the TLAs are then aligned to the ILO containing that verb 'explain'. Box 7.1 (p. 113) gives another example of 'explain'.

We should now consider teaching/learning activities that relate to constructing the declarative knowledge base.

Constructing the declarative knowledge base

Building a well-structured knowledge base involves what Ausubel (1968) calls 'reception learning', that is, the reception of declarative knowledge and structuring it meaningfully. As we have seen in the 'explain' example, lecturing

by the teacher leaves that structuring activity up to the student – Susan does it, Robert usually does not. It is important to use TLAs that help all students, particularly the Roberts.

Teaching/learning activities for reception learning can be managed by the teacher, by groups of students or by the individual student:

- *Teacher managed*: lecturing, tutorials, setting assigned readings or textbooks, laboratories, concept mapping, one-minute essays, teaching study skills in context.
- *Teacher managed but with active student participation*: peer teaching, peer-assisted study sessions (PASS), interactive work in class, bulletin boards, various group work.
- *Student managed*: collaborative learning groups, chat rooms.
- *Individually managed*: reading, searching the web, soliciting advice, listening to a lecture.

Many of these are not teaching/learning *activities* so much as teaching/learning *situations*, in which the appropriate student learning-related activities may or may not occur. The situation – be it lecture, tutorial, laboratory or excursion – simply defines the broad parameters within which learning takes place. It would be a poor physiotherapist who told a patient with a problematic knee joint: 'Go to the gym and do some work with weights.' The proper response would be to find out what the problem was: that, say, one of the muscles supporting the kneecap was weak so the kneecap 'wandered'. Working the whole of the knee in the gym would exacerbate the problem because the other muscles would do the work for the weak one, thus worsening the imbalance. The weak muscle needs to be singled out and exercised.

Just so, hitting all the ILOs with one method, lecturing, is likely to call out the learning activity of memorizing to do the work meant for genuine understanding – especially is this so if the assessment is by examination. In short, the learning activity most appropriate to each ILO needs to be singled out and 'exercised'. Dumping the student in an overall teaching/learning situation will in many cases result in over-exercising inappropriate learning 'muscles'.

Let us illustrate with that very common situation, the large class lecture followed by a tutorial, as a means of constructing a base of well-structured declarative knowledge.

Teaching declarative knowledge in large classes

The lecture/tutorial

A lecture is where the subject matter expert tells the students about the major topics that make up the discipline or professional area, and what the latest thinking is on a topic or discipline. The flow of information is one way,

the students' contributions usually being limited to questions and requests for clarification. Elaborating the material, removing misconceptions, applying to specific examples, comparing different interpretations, are left to the complement of the lecture, the tutorial. This seems like a good combination for effective reception learning: the lecture is like the Tasmanian tiger making the kill, the tutorial like the Tasmanian devil doing the mopping up. But sadly, for our simile, the tiger is already extinct, and the devil is heading that way.

Probably because it conveniently accommodates large fluctuations in student numbers, the lecture has become the method for all seasons. It is assumed that if you know your subject, and do not have any speech defects, you can deliver a passable lecture. But take the case of Dr Fox, who did a circuit of several US university medical faculties. He was hugely successful; the student ratings were highly positive and he was praised as an inspirational teacher in total command of his subject matter. It turns out that Dr Fox was a professional actor, whose only knowledge of the field was supplied by a *Reader's Digest* article (Ware and Williams 1975). Dr Fox's escapade has been used to support several conflicting positions:

- Good teaching isn't a matter of how much you know but of how well you put it across. (Wrong on both counts. 'Putting it across' is not what good teaching is.)
- It just goes to show how unreliable student ratings are: they only want to be entertained. (It doesn't show this: these students were rating a one-off presentation, not a complete semester of teaching.)
- Lecturers should be trained in thespian skills or at least in public speaking, as in Box 7.3 (p. 124). (Helpful, no doubt, but could the majority of academics perform centre stage, day after day, inspiring students every time?)
- We should subcontract large class lecturing to professional actors. (Why not, if an academic writes the script?)
- Lectures may motivate and inspire students – if they have the appropriate thespian skills. (Partly correct.)
- There must be better ways of teaching large classes than lecturing. (Correct.)

Years ago Donald Bligh (1972) reviewed nearly 100 studies comparing lecturing with other methods, mostly group discussions or reading. He found the following:

1 Lectures are relatively effective for *presenting information*, but unsupervised reading is more effective. Since Bligh's time, accessing information has been hugely facilitated by search engines.
2 Lectures are quite ineffective for stimulating *higher order thinking*.
3 Lectures cannot be relied on to inspire or to change students' attitudes favourably, although many lecturers believe their own do.
4 Students like *really good* lectures; otherwise they prefer well-conducted group work.

Psychological constraints on learning

Why are lectures so ineffective? Here are some pointers from the nature of human learning:

1. Sustained and unchanging low level activity lowers concentration. Sitting listening to a lecture is such an activity yet it requires concentrated effort to follow lecture content.
2. The attention of students is typically maintained for about 10 to 15 minutes, after which learning drops off rapidly (see Figure 7.1).
3. A short rest, or a change in activity, every 15 minutes or so restores performance almost to the original level (see Figure 7.1).
4. A period of consolidation after prolonged learning greatly enhances retention. Getting students to review at the end of the lecture what has been learned leads to much better and lasting retention than simply finishing and dismissing the students (see Figure 7.2).

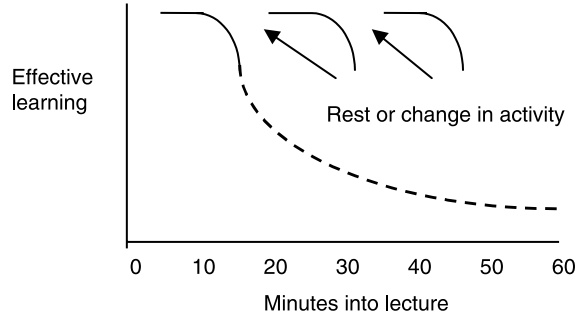

Figure 7.1 Effect of rest or change of activity on learning
Source: After Bligh (1972)

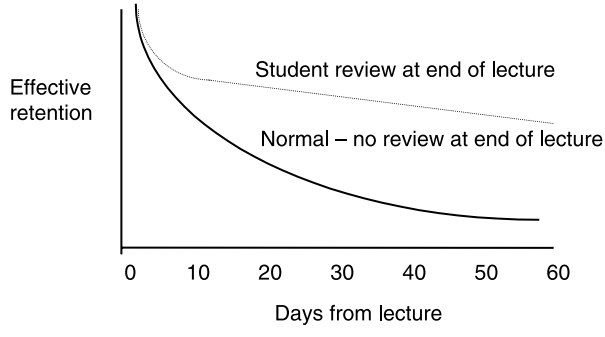

Figure 7.2 Effect of testing at end of lecture on retention
Source: After Bligh (1972)

The time periods in Figure 7.1 depend on the students, the skill of the lecturer, the pace of the lecture, the difficulty of the material, the use of

educational technology involving a change of activity, the time of day and so on. But the basic point remains: Do not talk for longer than 15 or 20 minutes without a pause unless you are *certain* you still have their attention. When you pause, get the students to change their activity.

The effect of consolidation in Figure 7.2 may be achieved by asking students to *actively review* what they had just learned. That does not mean that you tell them what you've just told them, as in the conventional summary: that's you being active. *They* are the ones who should do the reviewing: get them to tell you or a neighbour what you have just told them. The problem is that both teacher and students see the lecture as a matter of teacher performance, not of learner performance. It is a perception that has to be reversed. Today, there's a further argument against the lecture: students are so mixed and selective, and so media wise, they far prefer to obtain information from the web at their own pace, rather than at the pace dictated by someone talking at them (Laurillard 2002).

Given all this, what *can* the lecture do that books and the web cannot?

Many university teachers, through their research and scholarship, have developed a perspective on their field of expertise that is not to be found in textbooks. Through publication lag, textbooks are easily two or more years out of date while active researchers are not. In any event, textbooks do not usually have an 'angle', a perspective, but are typically a multistructural list of things that every first-year student might ever need to know. Who better to provide a critical perspective on that bland smorgasbord of knowledge than the teacher at the cutting edge of the topic and in person? The best defence of the lecture, particularly in senior undergraduate years, thus lies not in doing what other media do as well – and usually better – but in exposing students to the most recent developments in the field, and to the ongoing workings of a scholarly mind.

The teacher should be an agent for transforming knowledge, helping students to interpret and to construct their own knowledge, not a passive substation that relays preformed messages to them. Unfortunately, as noted in Chapter 1, the credit transfer system in universities may well result in courses being designed to be equivalent to courses taught in other universities, a consequence that would severely discourage cutting-edge teaching of the kind we are talking about here. The pressure is to teach in style and content that is compatible with what is being taught in other universities, not to build on locally concentrated excellence.

Where does this leave lecturers who *aren't* frontline researchers? Looking for alternatives to the lecture, we hope. Heaven forbid that teachers have reached the demeaning point where all that remains for them to do is to tell students about content that they can read more effectively.

Since practicalities dictate that large numbers of students will be scheduled to meet one teacher in a big room, it is better to see this as a *plenary session* in which – and out of which – excellent learning can take place, using teaching/learning activities that directly address the intended learning outcomes.

So how can we transform the lecture theatre into a learning theatre?

Interactive teaching

The teaching of Eric Mazur

The last question is something Eric Mazur (1998) asked himself. He was lecturing in physics at Harvard and regularly received good student evaluations. Then he read an article saying that when physics students were lectured to, they relied on memory not on understanding. Not in my class they don't, Eric thought, and tested them on basic principles. The result told him that they were, indeed, relying on memory.

He decided to stop lecturing, forcing the students to rely not on memory but on understanding. He set readings that had to be read before the class. He also gave the students two or three simple questions to be answered by email the night before the class: no answers, no admission to class. His email also said: 'Please tell us what you found difficult and confusing. If you found nothing difficult or confusing, please tell us what you found most interesting.' Thus he discovered what might need clarifying in class. He emailed replies to each student, with an appropriate comment from a database of generic comments.

In class the next day, the students were presented every 10 minutes with a multiple-choice question based on the readings. Each student seat in the theatre had a personal digital assistant (PDA) so that students could record their response to each question; responses were automatically tallied for the whole class and projected on a screen. Other questions addressed a 'trick' physical phenomenon, for example: 'A flat plate of cast-iron, two feet square and one inch thick, has a large circular hole, diameter four inches, drilled in the center. The plate is then heated. Does the hole in the center (a) increase in diameter, (b) decrease, or (c) remain the same, as the plate expands with heating?' While all the relevant physical principles were known by this stage, a wide diversity of opinion as to the outcome of the heating occurred. The students were asked to find someone nearby who voted differently and then to convince their neighbour that their own response was the correct one. After discussion, another vote was taken and this time there was usually much more consensus, in the direction of the correct answer. Mazur reports that the learning was powerful and the students enjoyed it. He was consistently voted best teacher of the year.

Two features of Mazur's approach stand out: feedback and good alignment requiring student activity relevant to the course ILOs. He wanted high level understanding, he gave the students teaching/learning activities that required them to think about novel problems and apply the knowledge they had gained from reading – not from listening to his lectures – and he supplied feedback to each student, individually from himself and from other students.

Course preparation assignments

David Yamane (2006), like Mazur, was also bothered by the inefficiencies of lecturing, when the material could be read before class more efficiently than listening to it in class. The problem was that students didn't read when they were told to. His subject was sociology. He posted 'course preparation assignments' (CPAs) on the course web page to be completed before each class, the time in class being spent in discussions on the assignment in groups of about four. The CPA required students to read and think about a chapter in the course textbook and to produce a written response to a question or problem based on the reading. The CPAs had the following general structure:

1 an introductory statement
2 an objective (ILO) for the assignment
3 the background information for the topic
4 the written assignment.

The first 10 minutes of class were spent in small groups, where individual members pooled their assignments and synthesized one for the group, which was then presented to the whole class. Yamane acted as coordinator and produced a large diagram on the whiteboard that drew together all the points raised and led to a conclusion about the problem. This product was frequently used as the starting point for the next CPA.

This is an example, like the concept map, where what is usually an assessment task – the assignment – becomes the teaching/learning activity. However, instead of assessing the assignment, Yamane looks at each one to check that it has been carried out honestly. If it has, he awards a pass and, if not, the student has to repeat it (all repeats pass in his experience).

This technique worked well within classes of 30 to 80, but Yamane does not recommend it in classes larger than this. He compared the CPA method with a lecture course, taught by himself and using the same material, on students' responses to a questionnaire on their level of thinking and their sense of responsibility and involvement and found strong evidence for the effectiveness of the CPA approach.

Box 7.1 gives an example of an adaptation of CPA by Catherine Chiu in her teaching of sociology at City University of Hong Kong.

How the large class lecture can become interactive

Mazur's and Yamane's teaching are examples of getting students relevantly active with teaching/learning activities that facilitate the intended outcomes. Such teaching, along with formative feedback, has the largest effect on student learning (Hattie 2003). We now look at a range of TLAs that are suitable in large class teaching for constructing a declarative knowledge base in different content areas.

Box 7.1 Course preparation assignments in the teaching of sociology

Introduction to sociology

Course preparation asssignment for Week 5

Lecture two: Culture

1 Read Macionis, Chapter 2, and familiarize yourself with these key concepts:

a Culture, symbols, language, values, beliefs, norms, mores, folkways, cultural integration.
b Cultural changes, cultural lag.
c Cultural diversity, subculture, counterculture.
d Ethnocentrism, cultural relativism.

Assignment 1

a Objective (ILO): To define the key values of Hong Kong culture.
b Background: On pp. 43–44, you read that Robin Williams identifies two key values of US culture.
c Assignment: Identify at least five key values of Hong Kong.

Assignment 2

a Objective (ILO): To apply two theoretical approaches to explain why certain key values exist in Hong Kong.
b Background: On pp. 54–56, Macionis presents analysis of culture using two perspectives – structural-functional and social-conflict.
c Assignment: Pick two of the key values of Hong Kong you have identified and explain why they exist in Hong Kong from the structural-functional point of view. Then do the same by using the social-conflict approach.

Source: Catherine Chiu, City University of Hong Kong

Note taking

Note taking is widely misused when students take notes for the purpose of obtaining a record of what the teacher says. Students, especially the Roberts, have a twofold problem: of following what they are hearing and of writing notes for later reference. They can't do both simultaneously so they alternate between listening and writing. But while they are writing the gist down, the lecturer is sentences ahead. Their notes are therefore a random sample of a fraction of what the teacher was saying. And with only a fraction of the trees, they have to reconstruct the whole wood. Difficult. If note taking is primarily intended as a record for later revision, it is both inefficient and wasteful. Why not just hand out readings?

Note taking may, however, be a useful TLA, for example for immediate review and reflection. If students are to take notes, comprehension time should be separated from recording time, and students should be allowed a time slot to check their notes. Students can swap notes with their neighbour, discuss differences and rewrite their own notes. They can thus review the main ideas about what has been said and elaborate their own understanding to their neighbour and reflect on their neighbour's interpretation if it is different from their own.

Note taking should be used as a teaching/learning activity, in other words, not as a horribly inefficient recording device. The sorts of notes students might best take depend on the content area, the use to which they are to be put and any ILOs they are to serve. For these reasons, the skills and purposes of note taking, as with other study skills, are usefully incorporated into the teaching of particular content (Chalmers and Fuller 1996): we discuss this further later.

Changing activities

As for other large class activities, remember that concentration flags after 15 minutes or so, particularly if the ongoing activity is straight listening. You might set a timer to ring every 15 minutes; when it rings, stop whatever is going on and change the activity or consolidate (Gibbs et al. 1992):

- Students reflect on what they think they have just learned, then in pairs tell each other what they saw as the most important point in the preceding 15 minutes of lecturing. Here's a TLA that gets *them* to 'explain'.
- Each student writes down a question or a comment sparked by the previous 15 minutes for their neighbour to respond to. They can hand in their question/comments sheet at the end of the session; it will also be useful feedback to you – and an attendance check.
- You pose questions for them to answer, either individually or discuss with a neighbour.
- You set a problem for them to work on, either individually or in discussion with a neighbour.
- Towards the end of the lecture, allow five minutes for each student to tell their neighbour or learning partner (see later) what they think was the thrust of the session. This achieves the consolidation by active review and also gives them a different perspective to think about, other than their own interpretation of your perspective. Further, they are giving and receiving feedback, and enacting that ubiquitous ILO 'explain'.

Linking diagrams and key points can be achieved by handouts using PowerPoint software, three or so slides per page, with space beside each where the students can write their notes and comments. This gives students accurate basic notes and diagrams, but requires them to actively search for the main idea, and put it in their own words with an example or two.

Work-along exercises

Olivia Leung, of the Department of Accountancy at City University of Hong Kong, links student activity to her lecturing by devising work-along exercises that accompany her discussion of each topic. These exercises help students follow the lecture closely and actively visualize the application of concepts. Box 7.2 shows some examples of work-along exercises used in an Accounting class of over 200 students.

One-/three-minute essay

The one- or three-minute essay is a technique whereby students write brief answers to such questions as:

At the start of the lecture: What do I most want to find out in this class?
Towards the end: What is the main point I learned today?
Also at the end: What was the main point left unanswered in today's session?

Allow a couple of minutes for students to swap and read what their neighbour said. The students' responses may be handed in, with names, and each can be read in a few seconds. The answers can be used as formative assessment both for them and for you – and as an attendance check. The cumulative record gives a very good, and quick, indication of the development of students' thinking through the course.

These ultra-short essays at the beginning of the class forces students, as did Mazur, to actually *do* the pre-reading and to reflect on it. The second question can tell you something about their learning and your teaching: if some quite minor aside is seen as 'the main point', either you or they have a problem. In either case, it will need to be addressed in the next class. The last question also provides fodder for the next class. Students are provided with feedback on how their thinking is in line with other students' and with your own. You can no doubt think of other questions that would better suit your intended outcomes. Some may find it more convenient for students to use personal digital assistants (PDAs) to record and transmit their one-minute essays.

Concept maps

Concept maps were originally designed both to present a structure and to find out how students see the structure (Novak 1979). They can be used by teachers for both teaching and assessment purposes and by students for organizing their ideas, for example for reviewing the semester's work, for planning and writing essays or for clarifying difficult passages. They are useful for ILOs requiring students to see the whole, perceive relationships, integrate and organize and can be demonstrated and used by students inside or outside the classroom.

In creating concept maps, students singly or in groups are presented with a central concept or principle. Either they themselves generate sub-concepts that relate to it, or the sub-concepts are supplied. The students then arrange the sub-concepts, either drawing them or arranging cards on which they

Box 7.2 Some examples of work-along exercises for a class in accounting of over 200 students

Review question: *Debit and credit effects on assets and liabilities*

What accounts below are decreased by debits?

- Inventory
- Accounts payable
- Dividends
- Cash
- Notes payable
- Accounts receivable

Answer: _____

Why? _____

Review question: *Adjusting entry supplies*

The trial balance shows supplies of $2000 and supplies expense of $0. If $750 of supplies are on hand at the end of the period, what is the adjusting entry?

Account	Debit	Credit
	$1250	
		$1250

The balance in supplies after adjustment is $750, the amount remaining unused. The amount used is transferred to expense.

Review question: *Closing entries*

Which of the following accounts will have a zero balance after the closing process?

- Unearned revenue
- Advertising supplies
- Prepaid insurance
- Rent expense
- Income summary

Answer: _____
are temporary accounts. All temporary accounts are closed and thus have a zero balance after the closing process.

Source: Olivia Leung of City University of Hong Kong

have been written, in a way that makes best sense to them, the distance between sub-concepts reflecting their perceived degree of interrelation. Lines are then drawn linking sub- and central concepts with a brief explanation of what the link or relationship is.

Creating concept maps is a learning experience for the students, helping them to explicitly structure their thinking and, at the same time, the resulting maps give an indication of how the student sees the way in which individual concepts relate to each other. They can therefore be used for assessment purposes (p. 235). As concept maps present an overall picture, a holistic representation of a complex conceptual structure, they are best evaluated by judging the complexity of the arrangement and the correctness of the interrelations, rather than by analytic 'marking' (see Chapter 9). They can be used as feedback, to see how teaching might be adjusted, as part of the final assessments of student learning or for students in their own studying.

Santhanam et al. (1998) found that first-year science and agricultural students saw the value of using concept maps but not their relevance. They thought that memorization was the best approach to study in first year and so did not use concept mapping in their own studying; a depressing finding, suggesting that the students had obtained the wrong cues from the way they had been taught and assessed (see also Ramsden et al. 1986).

Think-aloud modelling

When presenting new tasks or problems, it can be very helpful for the teacher to think out loud while handling it, so that the students are clearer about what they are supposed to be doing. The teacher is doing the self-analysis and reflection publicly, letting the students know how an expert does it, so that eventually they do so themselves. Many teachers think aloud for their students automatically, but many others do not. Modelling is handy whenever you get the inevitable: 'But what are we supposed to do?' But then, for it to be an active TLA, they must then be required to do it, not just watch a demonstration.

An overhead projector enables you to face and interact with the class while thinking out loud, showing your notes and revisions and mistakes. For example, you could show how you write an article at the various stages of planning, composing and revising, to demonstrate the various techniques that academic writers use. Students are brought face to face with processes and possibilities that they themselves would not think of and, if the class is not too large, the students can call out contributions to the ongoing composing or problem-solving process. In large classes, you could nominate a particular row or rows of students to call out their suggestions.

The various techniques just mentioned meet many of the objections raised about the lecture and they can take place in the lecture situation and focus on what the *students* are doing, not what the teacher is doing. Students are not confronted with loads of information at too great a rate for many of them to handle, but are required to work with that information, to elaborate, correct and consolidate it.

Peer teaching

What do you perceive when you enter the door of a large crowded lecture theatre: 400 students sitting there waiting to be taught by you or 400 teaching assistants waiting to be brought in on the action? Peer teaching is a very powerful ally when you have large classes to teach. There may be no single best method of teaching 'but the second best is students teaching other students' (McKeachie et al. 1986: 63).

Peer teaching is greatly under-utilized, although both tutor and tutee benefit academically, the tutor more than the tutee (as you would expect on the grounds of active learning), while the tutor is also likely to have increased social skills and attitudes to study and self (Goodlad and Hirst 1990; Topping 1996). The reasons for these benefits are clear:

- The content to be taught has to be viewed not from one's own perspective, but from that of someone whose conceptions of the topic to be taught are different and less satisfactory.
- The teacher reflects on how they learned the topic, which means that peers, being closer to that process and more aware of the traps and difficulties than the expert, can teach more empathically.
- The teacher 'owns' the material, publicly taking responsibility for its validity. There is heavy loss of face if they get it wrong – so they are more careful about getting it right.

Two New Zealand tertiary institutions give course credit for peer tutoring, the practical work being carried out tutoring secondary school students (Jones et al. 1994). No, not education students, destined for a teaching career, but law, science, and business students. The assumption is simply that teaching the subject deepens students' understanding of it. Compared to teacher-led groups, student-led groups range wider in their discussion and produce more complex outcomes (McKeachie et al. 1986; Tang 1998). In cross-year tutoring, the tutor is in a higher year than the tutee. Both tutors and tutees like the process, and the achievement of the tutees is little different from conventionally taught (Topping 1996): a positive and cost-effective finding, when you think about it.

The peer assistance supplementary scheme or peer-assisted study sessions (PASS in either case) is a common scheme for cross-year tutoring, designed to alleviate the problem of large first-year classes. The tutors are second-year or third-year students who passed the first-year subject exceptionally well and are judged to have appropriate personal qualities. They are trained to 'model, advise and facilitate' rather than to address the curriculum directly and are either paid or given course credit. Data involving 295 courses in the USA show improved achievement and higher re-enrolment and graduation rates (National Center for Supplemental Instruction 1994). Outcomes in the UK are likewise encouraging (Topping 1996). At the University of Queensland, over many thousands of student, regular attendees of PASS averaged a whole grade higher than students who did not attend, while of the students

gaining high distinctions, 85% attended PASS, 14% did not (Chalmers and Kelly 1997).

PASS employs two tutors or student leaders per group of 25 first years and they are paid also to attend at least one lecture that the tutees receive (Chalmers and Kelly 1997; Watson 1996, 1997). Leaders receive one full day of training and ongoing weekly meetings with the staff coordinator. Leaders are required to keep a reflective diary, with which they provide feedback to the departmental staff coordinator. This ongoing information was found to be far more useful to lecturers in meeting problems than end-of-semester course evaluations.

Attendance from the first-year classes is voluntary, ranging from 20% of the class to over 80%. The agenda is up to the students, frequently involving a review of what has gone on in class that week. No new material is presented.

Following are some of the benefits that students see (Chalmers and Kelly 1997):

- a friendly environment in which they can comfortably ask 'the dumbest questions'
- weekly study that keeps them up to date
- insight into the range of material other students are covering and the difficulties they have
- a mentor who can give information and who has inside knowledge of how they coped
- international students particularly like the opportunity to discuss without staff present.

PASS is considered particularly useful in subjects having:

- large classes, particularly when unsupported by other group work
- highly technical content
- a failure rate of more than 10%
- high international student enrolments
- a service role as a core subject for a number of degree courses.

To sum up, then, if two major principles are adopted, that lecture theatre can indeed become a learning theatre:

1 Keep the students active with relevant teaching/learning activities.
2 Supply them regularly with feedback from yourself, from other students, and from reflective self-assessment.

Where does this leave the tutorial?

Active learning of this kind meets many if not all of the outcomes the tutorial is intended to achieve – elaboration and clarification of what the students had understood from the preceding lecture. And given that 'tutorials' of 30 and 40 students, as sometimes occurs, can't possibly do what they are

supposed to do, and that tutors are frequently the least experienced staff members, one begins to question why we should have tutorials at all. Essentially, the tutorial is a relic of an older academic ecosystem, when the Susans outnumbered the Roberts and when classwork needed only to be held in big or small rooms.

If we replace the lecture with more flexible teaching/learning activities involving interactive learning, as suggested earlier, the conventional tutorial may follow the Tasmanian tiger into extinction unless it is rethought. In the School of Experimental Psychology at the University of Sussex, for example, tutorials are mainly student-led tutorials. Students give a brief 15-minute presentation that has been assessed by the teacher beforehand, each tutorial has assigned questions for discussion and each student must put to the group at least one point in the lectures they didn't understand. Beyond that, the students run the main proceedings themselves, except that the teacher turns up for the last 10 minutes, which has a good effect on morale and allows unresolved issues to be put to the teacher (Dienes 1997).

Interactivity in smaller classes

In classes under 30, sometimes the formal lecture becomes the formal lecture with a looser, more conversational script. Some inspirational lecturers like students to interrupt with comments or ask unplanned questions. They can think up answers on their feet: the lightning riposte, *that's* the stuff of good teaching! Maybe, but there could be a role confusion here between stand-up comic and teacher; the attention in this case is on the teacher, not on what the students are supposed to be doing. The students are simply the means for showing how brilliant the teacher is.

Good interactive teaching nevertheless requires on-the-spot improvisation in response to events as they occur. Questions and comments from students can be the basis for rethinking and reconstructing new and exciting ideas, if the ball is picked up and taken in an appropriate direction. The experience gives the phrase 'the social construction of knowledge' real meaning. Papers have originated that way.

Dealing with questions from students

In more intimate surroundings than the large lecture theatre, questioning by students presents a different challenge. Dealing effectively with questions requires a knowledge of topic structure that is sufficiently rich and flexible that you can recognize the students' perspective of it and their access to it. It's not only a matter of having expert knowledge of your subject – that goes without saying – but of understanding where they are coming from in asking it in the way they did and how the understanding they displayed in asking the question can be orchestrated in harmony with your own expert knowledge.

Questions put to students

Convergent questions

Convergent questions are asked with a correct answer in mind and students are steered towards that answer, while divergent questions are open ended, seeking input from the students' perspective. Convergent questions are not necessarily low level. Socratic questioning is a case in point. The teacher goes round the class asking questions that lead subtly to the answer the teacher requires. This is the social construction of knowledge, where all contribute and agree on the structure as it emerges.

Divergent questions

Divergent questions are useful for probing student experiences and using them for constructing fresh ideas and interpretations, for incorporating them as examples of the case in point and for student reflection. In professional programmes, where the students have hands-on experience, there is a wealth of functioning knowledge to be tapped, to be located in a conceptual structure and generalized. Divergent questions can also lead to aimless rambling and that needs controlling. Good questioning skills are required.

High- or *low-level* questions

High-level questions probe the high-level verbs: theorizing, reflecting, hypothesizing; low-level questions enact the low-level verbs: recalling factual answers. High-level questions need *wait time*. High-level thinking takes more time than low-level thinking. Whether out of fear of silence, impatience or bad judgment, the fact is that in most classrooms nowhere near enough wait time is allowed. When allowed unlimited time to answer, tertiary students averaged nine seconds to answer a convergent question, over 30 seconds to answer a divergent question (Ellsworth et al. 1991). The longer students took, the better quality of the response. If you might feel embarrassed by 30 seconds of silence, work out ways of not being embarrassed.

The fact that high-level responding needs time is a major advantage of the asynchronous use of educational technology, that is when students respond to online questions and issues in their own time (see later).

Now for a reflective task about who is doing what in your classes (Task 7.1). How would you redesign your next large class 'lecture' (Task 7.2)?

Managing large class teaching

Large classes require effective and quite specific management skills. It is quite shameful that the least experienced and junior staff members are often allocated to the largest classes to spare the more experienced teachers from this unpopular teaching situation.

Large classes need *meticulous preparation*. The larger the class, the slower

Task 7.1 What happened in your large class 'lecture'?

Reflect on the 'lectures' you have been giving in the last semester. Write down what activities occurred and who was engaged in those activities (the 'doers').

Activities	*The 'doers'*			
	Teacher	Students as a class	Students as peers	Students alone

Now compare the activities and who the 'doers' of those activities are, with the intended outcomes of the 'lecture'. Who was doing the activities that led to achieving the ILOs?

things get done. A spur-of-the-moment change of direction, perhaps in response to a student question, highly desirable and manageable with a group of 30, becomes perilous with 300. Most teachers find large class teaching a 'performance', with the increased likelihood of stage fright (see Box 7.3, p. 124).

As few teachers have any training in public speaking, providing such training would no doubt be helpful. However, even with training, the majority of academics would be pushed to be able to perform centre stage, day after day, inspiring students every time: even Dr Fox would have trouble doing that.

This slow-heaving hulk needs to be carefully directed otherwise it will crush your plans. Establish your procedural rules at the outset: signals for silence, procedures for questioning (how are you going to deal with the forest of hands or with the clown who always asks questions to class groans?), signals for starting and stopping, if you are going to use buzz groups who is to discuss with who, who is to be spokesperson on report back, and how to bring them back to order when it's time. Establish these rules in the first session.

The size and buzz of a large class requires a smooth start:

- Don't just sail straight in. Signal that class has started and wait for quiet. Try playing music while students enter, then when you are ready to start, stop the music. It creates a nice air of expectancy.
- Start with a proper introduction: 'Following from last week when we . . . What we are going to do today.' Why lecture when the topic is in the

Task 7.2 Redesigning your next large class 'lecture'

Take your next large class session, which you would normally regale with a long and carefully prepared lecture. Now is the time to have a go at restructuring the session. Assume the time period is one hour. If more than this, make allowance in your plans.

1 Stage a striking introduction that will grab their attention and be relevant to what follows.

_____
_____
_____

2 Allow for three breaks after 10 to 15 minutes of solid talk by you. What will you do, or rather what will the students do, in each break? One of the activities should involve something you collect at the end and ponder for the next session.

Break 1 _____
_____

Break 2 _____
_____

Break 3* _____
_____

[* if applicable]

3 Consolidate with an active review in the last five minutes by getting them to do something _____
_____
_____

textbook? Because you are going to do something the textbook can't? What is that? Tell them. Then they'll know what they should be getting from this particular lecture (Gibbs et al. 1984).

- If lecture you must, preview with a slide giving the subheadings of the lecture, and some explanation of the sequences of subheadings, or a diagram if that is appropriate.

Following are a few points to watch while talking to a large class:

- Eye contact students while talking; no head buried in notes.
- Ensure clarity: project the voice, check it can be heard at the back. Cordless radio mikes are best.
- Focus on the 'U' rather than the 'T'. Susan and her friends tend to sit along the front row and up the middle (the T), Robert and his friends at

Box 7.3 Dons struggle with stage fright

Brendan O'Keefe

It happens to the best of them. As lecture time approaches, on come the cold sweats and the nerves as confidence departs.

An underperforming student, scared of being found out? No. An experienced lecturer, who has been in the limelight for years, with stage fright? Yes.

One who knows plenty about it – and who wants to know more – is University of Canberra marketing communication lecturer Amanda Burrell.

Ms Burrell has a degree in creative arts (acting) from the University of Wollongong and was a professional performer for a decade before turning to lecturing about 10 years ago.

Returning to the lectern this year for the first time in 15 months after having a baby, Ms Burrell found herself in dread of fronting a class . . . A straw poll of colleagues revealed that many felt the same way. 'People told me stories about losing confidence, how they lost their voice in a presentation, how they fainted or got so muddled they couldn't read their notes,' Ms Burrell said. 'I thought: "There's something worth looking at here".'

Ms Burrell believes stage fright among lecturers is a widespread but little talked about problem. She has set herself the task, as a research project, to find out how many suffer and how they cope. She even rigged up a colleague with a heart-rate monitor to check stress levels. The woman, whose resting heart rate was 80 beats per minute, was described by a third-party observer to be 'as cool as a cucumber' during a presentation. But her heart rate had peaked at 175bpm.

Ms Burrell said she wanted universities to include public speaking as part of their training for new lecturers. Ms Burrell has plans to visit acting schools. 'I'd like to see how the training of professional actors can inform our practice,' she said.

Source: *The Australian Higher Education*, 19 April 2006

the back and down the sides (the U). Focus on grabbing Robert and you will automatically include Susan.

- Handouts should be collected up on entry or exit. If possible, organize the schedule at least a week ahead so that the end of the previous session can be used for handouts for the next. Distributing handouts during class is messy and time wasting.

- Consider putting any lectures on WebCT or BlackBoard and then ask yourself this question: Why give that lecture at all if they all have access to it anyway? Can't you use that time more effectively than merely repeating what they can read at their own pace? Yes, you can: we've just been through that.

Questions provide a break that many students perceive as chat-to-neighbour-time while the nerd has a heart-to-heart with the teacher. To prevent this, the whole class must be included and involved. This means *distancing* yourself, not doing the personable thing and leaning towards the questioner. Move back so that the questioner is part of the class, repeat the question so that it becomes a whole class question. In a very large class, it may be better to ask them to write down their questions and pass them up to the front, rather than shouting them at you. You could take them on the spot or answer them in the introduction to the next session. In *very* large classes – what have we come to? – you might use the large meeting technique, with microphone stands in the aisles.

Most students dislike the *impersonality* of large class teaching: it's a short step from there to a cold Theory X climate. To warm things up a bit, try the following (Davis 1993):

- Stand in front of the lectern, not behind it. Walk about, up and down the aisles if feasible. Get students to leave a few rows empty, so you can move along them. Convey accessibility, not distance, but stand still when delivering important points.
- Do not in your friendly wandering be seduced by a *sotto voce* question. Make it a question coming from the whole class (see earlier).
- At the beginning of the class get neighbouring students to introduce themselves to each other. These may or may not lead to formal learning partnerships (see next section).
- Get students to complete a short biographical questionnaire, giving names, reasons for taking the unit, hobbies, etc. You can then refer to students by name occasionally, selecting examples to illustrate points to match their interests. They'll feel good about that, although not everyone may get a mention.
- Arrive early, and/or leave late, to talk with students. Make your hours of availability in your office known and keep those times sacred. Some teachers may be comfortable inviting groups of students, in circulation to cover everyone, to coffee.
- Where tutors assess assignments, make sure you read a sample and discuss it in class. Let them know you are not delegating entirely.
- Use humour and topical references but take care where there are large numbers of international students. They are likely to be confused by topical references, colloquialisms and culturally specific jokes.

Eric Mazur, he who decided lectures were a waste of time (p. 111), kept the photographs of the 160 students in his physics class in his address file.

When they emailed in their answers to his questions on reading, the tasks were such that errors fell into few categories, so that there were essentially only five generic emails to be sent, to groups of 30 or so students. By clicking on the student's address, up would come their face reminding him who he was talking to. He then tuned the opening and the close to the individual: 'Hi there Jenny. You slipped up a bit here, after last week's great effort. Here seems to be the problem . . . (then he pasted the appropriate generic email). Let me know if it's not clear now. Best.'

Learning partners

A great help for both students and teacher, especially in large classes, is to require students to form a partnership with another student or a small group of students. Partnerships are not so much for working towards a particular goal, such as a group assignment, but for mutual general support. Students need someone to talk to: to share concerns, to seek clarification over assignment requirements, to check their own insecure interpretations of procedure or of content (Saberton 1985).

Partners could be matched by the teacher, perhaps on the basis of the way students complement each other (high performing/at risk, international/local, mature age/straight from school, those with access to desirable resources/those with little access). Alternatively, students could each choose their own partners, which has some advantages but particularly with the presence of international students, there are excellent reasons for ethnically mixed partnerships. Partners then agree to sit next to each other in class and to consult out of class, exchanging telephone numbers, email, etc. They can also collaborate on suitable assessment tasks. Partnerships that do not work because of the personal chemistry should be reformed. Some students may prefer to remain loners and that should be respected: it is their loss, which in time they come to realize.

Learning partners permanently sitting next to each other makes life much easier for the teacher when implementing the kinds of note swapping, active review and so on mentioned earlier. The teacher's out-of-class time in dealing with queries is actually rather more than halved, because the chances are that one partner can put the other partner straight without consulting the teacher.

Large class teaching is difficult, but it doesn't have to follow the pattern of the standard lecture. If you are not convinced already, read *Twenty Terrible Reasons for Lecturing* (Gibbs 1981b). Certainly, large class sizes provide no reason to abandon the principle of alignment, either in designing teaching/learning activities to suit your intended learning outcomes or, as we shall see in Chapter 11, in selecting the assessment tasks needed.

Educational technology

The University of Western Australia has developed 'Lectopia', a system whereby lectures are recorded and posted on the net. With podcasting, lectures can be downloaded at any time on computers, iPods or mobile phones. The system is now used by several Australian universities, allowing students whose work commitments clash with scheduled lectures to listen to the lectures at their convenience. This is a great convenience for them, but it might reinforce the idea that the main function of university teaching is lecturing: the transfer of information, without the interactive learning that – one hopes – took place in the lecture.

Educational technology (ET) opens up a whole new world domain for student activity, of which replaying lectures and downloading gigabytes of information is only a fraction of its potential usefulness. BlackBoard and WebCT, apart from being used as a management platform for all teaching on and off campus, also have supports for interactive teaching/learning activities and for different types of assessment, as we discuss in Chapter 11. The use of these platforms for interactive teaching, perhaps especially intended for off-campus teaching, can be a boon for teachers and students alike with respect to large classes.

The interactive use of ET literally dissolves the boundaries of time and space, allowing many different kinds of interaction between people:

1 *Synchronous and asynchronous use.* Synchronous use is when teacher, or learning package, interact with the student in the same time frame. This is the case when teacher and student are online at the same time, as in tele- or videoconferencing. Students attending a PowerPoint lecture is also a synchronous use. With asynchronous use, participants make their communication in their own time, such as happens when using email or a bulletin board. For example, the teacher may post questions on the board and the students respond with answers or comments, as is convenient to them, prior to the stated deadline. Asynchronous use is particularly valuable in off-campus teaching, so that individuals with full-time jobs can enter their learning space at evenings or weekends or whenever suits them.
2 *Individual and social use.* We normally think of online teaching as involving a lonely individual at a keyboard responding asynchronously to a distant information source. This is only one, limited, use. When used synchronously, student and teacher may converse one to one, or one to many and students may interact with each other at the same time. The social advantages can be enhanced by having pairs or even larger numbers at the same keyboard so that they may discuss their comments, questions or responses before sending them. These groupings can be used synchronously or asynchronously.

The combinations of individual and group, and synchronous and asyn-

chronous use, are many. Each combination has its own advantages and disadvantages; as always, it depends entirely on what and how you want your students to learn. A disadvantage of asynchronous online discussion is that that those who place their views first on online discussion can frustrate others who wanted to make the same points. This might be obviated by requiring students to post to a closed address, which would then be opened on a specified date. It helps considerably if groups can meet face to face first, so that when online discussion begins, people can put a face to the name and feel that they are genuinely conversing.

Personal digital assistants (PDAs) can be used in the classroom, as did Mazur for instant responding to MC-type questions, but the most recent versions have telephone, still, video and internet-accessing options, which make them incredibly flexible as learning and assessment tools. Teacher–student and student–student communication can be maintained outside the classroom in workplace or other learning situations in real or in virtual time.

Bulletin boards, either with PDA or computer, can be used to consolidate and elaborate material. Students can, in their own time – that is, asynchronously – post comments about a reading or lecture, which can lead to conversations about the content, different interpretations, elaborations, corrections. This can provide a tremendous amount of feedback both to the teacher and to the students themselves. An example of enlightened bulletin board use with teachers attending a postgraduate educational psychology course is given by Chan (2001), who integrated computer-supported collaborative learning with regular teaching. The students were asked to post their learning notes and responses to questions on a bulletin board and to comment on the notes and responses of others. The distinctive feature of her use of the bulletin board was the way she posted reflective prompts, such as:

- Is there anything interesting or useful you have learned?
- What are some things that are difficult to understand?
- How did reading these notes help you think about X and Y?
- Have the comments on your ideas made you rethink the issue?

Students did not have to address each as an assignment question, but as reminders to guide their thinking. Students were also asked about their conceptions of teaching and learning at the beginning and at the end of the course; the difference became a measure of the growth of their complexity of thinking about teaching and learning.

Chan found that the frequency of contribution to the bulletin board in itself was unrelated to a gain in complexity of thinking, but when the comments were divided into those that were derived collaboratively or were simply posted as individual contributions, those who entered into collaborative engagement gained most in complexity of thinking. This replicates a finding that face-to-face collaborative learning leads to better structured assignments than individually written ones (Tang 1998).

Knowledge Forum is a powerful program for encouraging collaborative knowledge construction (Scardamalia et al. 1994). Knowledge Forum involves students contributing to a bulletin board by generating their own problems, posing their own questions and commenting on each other's work, rather like Chan's usage. The computer helps search all comments written by a student at different periods, which can then be rated in terms of the quality of the comments. The software comes with a program called Analytical Toolkit that can generate quantitative indices, such as how much each student has written, how much the individual has read others' notes, how often their comments are revised or elaborated, how one student's notes relate to others' notes, who is writing to whom, and so on. However, the program cannot recognize the quality of the comments written and so analyses still need to be done by teachers; in some respects, these analyses are not unlike SOLO. The main difference between Knowledge Forum and other discussion platforms is that it includes thinking prompts and other devices to help students reflect deeply as they contribute and it provides formative assessment of students' ideas as they are posted on the platform continually. One can also make a summative statement about students' growth and learning outputs at the end of the course.

Virtual environments, many available commercially on CD-ROM, provide interesting interactive environments for students to explore. For example, 'Virtual Dig' can take archaeology students through excavating a site; they can alter factors such as time of dig, method, whether to screen dirt for relics and so on. There are many science laboratory virtual environments where students can try expensive or dangerous experiments at a fraction of real cost and with no risk of something going badly wrong.

Computer-mediated conferencing (CMC) is a general term for teaching online with an 'e-moderator', who is in effect a tutor who 'chairs' asynchronous sessions with distance learning students (Salmon 2003). Salmon suggests a five-stage model for CMC:

1 Access and motivation: making sure all participants can go online, keeping them motivated over the inevitable blips and providing technical support.
2 Online socialization: getting to know each other and building a group sense.
3 Information exchange: helping participants with searching, downloading and organizing the relevant information.
4 Knowledge construction: participants become authors, sharing views and contributions. There are many ways of organizing this phase, with individual, dyad and group work, depending on the purpose.
5 Development: participants now become responsible for their own learning, using self-critical and reflective strategies, developing where they want to go.

There is a view popular among politicians, among others, that online teaching is the answer to large classes. This view assumes a Level 1 theory of

teaching as a one-way transmission: teaching is merely providing information. But as we have seen, effective teaching involves engaging students in relevant activity, so there are obvious limits to the numbers that can be handled appropriately. The difference between a teacher responding interactively to 30 students online and 3000 is obvious. Salmon's five stages of online teaching should put paid to that view. As student enrolments in a course increase, it becomes correspondingly necessary to engage online teaching assistants or e-moderators who are both computer wise and content expert.

Box 7.4 tells of a nice example of reflective practice, which led to a Level 2 theory of using ET becoming Level 3, where what mattered was what the students did – and assessment became a TLA.

Box 7.4 How reflection led to assessment being used as a TLA

Problem: 90 per cent of nursing students experience difficulty in understanding the topic: oedema associated with cardiac failure.

Hypothesis: A visual approach is more suited to the subject and to students' learning styles.

Solution: Develop 'a multisensorial approach from which there could be no escape'. It has to have visual appeal and movement: hence *multimedia*, an animated slide show.

Result: Only a 'slight' improvement in students' understanding.

Reflection: 'I had wasted my time'

But then Tyler read the first edition of this book and learned:

1 Don't blame the students.
2 Don't blame the teacher.
3 Don't blame the teaching tool.
4 Do blame the lack of alignment.
5 Do blame the lack of assessment.

On further reflection: 'The multimedia program was worthwhile . . . what it lacked was alignment and assessment.'

Students now:

1 Complete an assessable worksheet at home (marked and assessed by peers).
2 Complete a similar worksheet in class (again marked by peers).

Result: Pass rates in clinical studies increased from 80 per cent to 99.5 per cent.

Source: Tyler (2001)

Before leaving this chapter, you can now try to design teaching/learning activities for some of your course ILOs relating to declarative knowledge. Task 7.3 gives a framework that should help you.

Task 7.3 TLAs for declarative knowledge

Select two of your course ILOs relating to declarative knowledge. Design TLAs that would facilitate achievement of these ILOs.

Course ILO1: _____
Course ILO2: _____

Number of students in the course:

Course ILO	*Teaching situation*	*Teaching activities (what the teacher does)*	*Learning activities (what the students do)*
1			
2			

Now doublecheck if the student learning activities are aligned with the verbs nominated in the respective course ILOs.

Compared with the teaching situations that you have been using so far for the same course ILOs:

a What changes have you made?
b What do you expect to achieve through these changes?

Summary and conclusions

Three changes needed in the way we usually think about teaching

We need to question three assumptions:

1 That lectures and tutorials are the default teaching methods. Rather they are types of *situation* in which different teaching/learning activities can be organized, depending on the learning outcomes that are intended.
2 That the focus should be on what teachers are doing. The term 'lecture' focuses on what teachers should be doing. In the lecture or any teaching/learning situation it is more important to focus on what the students are doing.
3 That relevant learning occurs only when inside the classroom with a teacher orchestrating the proceedings.

What teachers do: What students do

The term 'lecture' is teacher-centred: it says what teachers do. The important thing is what students are doing while the teacher is lecturing. Even in a simple ILO involving the verb 'explain', students are unlikely to be doing any explaining themselves in the typical lecture situation. This needs turning around, so that the ILO prescribes what *students* should be doing in a teaching/learning situation if they are to build the solid, well-structured knowledge base that is prerequisite even to such ILOs as 'explain'. Such a knowledge base is even more important to achieving yet higher order ILOs.

Teaching declarative knowledge in large classes

Lecturing is logistically convenient, being able to handle large numbers of students simultaneously, but it has no advantage over other teaching situations, except that when given by an active researcher it exposes students to a scholar's ongoing thinking. Otherwise the learning that takes place in lecturing is demonstrably worse than in other teaching situations. A more articulated focus on ILOs and the TLAs that foster them is needed. This requires interactive teaching.

Interactive teaching

Interactive teaching can be brought to the large class quite readily. The most prolific resource in large classes is the students themselves; using them appropriately engages a different lot of verbs that address a range of ILOs scarcely touched by teacher-directed TLAs. Creating semi-permanent learning partnerships can make life easier for both you and them, providing a continually accessible resource for discussing, reciprocal questioning and mutual support in an otherwise anonymous environment. In resource-starved times, it is amazing that peer teaching in its various forms, including the use of paid students as in PASS, is not used more widely. In smaller classes, interactivity between teacher and students is more personal and requires in particular effective questioning skills.

Managing large class teaching

Large classes raise management problems of their own. A plenary session demands management strategies quite different from those appropriate to small classes. Such things as preparing before class, commencing the session, effective strategies of talking and questioning during the session and ensuring that students know what to do and who is to report back after student–

student interaction sessions are important to work out in advance. A management issue of a different kind is overcoming the anonymity and alienation that many students feel and dislike in large classes.

Educational technology

Educational technology offers a range of TLAs addressing ILOs for both declarative and functioning knowledge; we concentrate on the former here. ET can support TLAs that mimic standard classroom TLAs, while others offer possibilities of engaging learners that are not possible in the classroom. Computer-mediated conferencing and Knowledge Forum are examples that belong in the latter group. Both may operate in real time or asynchronously, the latter allowing students to go online at their own convenience and to post contributions after serious reflection. ET may obviate some problems of large class teaching, but effective online interaction with students demands teacher time just as much as offline teaching.

Further reading

On lecturing in large classes

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Gibbs, G. (1981) *Twenty Terrible Reasons for Lecturing.* Oxford: Oxford Polytechnic.

Gibbs, G. and Jenkins, A. (eds) (1992) *Teaching Large Classes in Higher Education.* London: Kogan Page.

O'Neill, M. (Project Director) *Teaching in Large Classes.* A very comprehensive CD-ROM, produced at the University of Western Australia, showing examples of expert teachers in action at all stages of teaching, from getting prepared for lecture to closing elegantly. Has interviews with novice teachers, expert teachers and students at each teaching stage.

Teaching and Educational Development Institute, University of Queensland, Project on Teaching Large Classes. http://www.tedi.uq.edu.au/largeclasses/

On interactive teaching

Chalmers, D. and Fuller, R. (1996) *Teaching for Learning at University.* London: Kogan Page.

Race, P. and Brown, S. (1993) *500 Tips for Tutors.* London: Kogan Page.

Salmon, G. (2003) *E-moderating: The Key to Online Teaching and Learning.* London: Kogan Page.

Chalmers and Fuller remind you to teach students how to handle the information you are teaching them. The 'tips for . . .' genre contains useful collections of

procedures, but you must use your own judgment as to their applicability to your own problems. There is a danger of falling into the Level 2 mode: tell me what are good teaching techniques and I'll use them. You know by now it doesn't work like that. Salmon gives solid practical advice for using computer-mediated conferencing, an interactive technique developed from the Open University for teaching distance learning students.

Websites

Making active learning work, University of Minnesota: http://www1.umn.edu/ohr/teachlearn/tutorials/active/index.html

Active learning: http://alh.sagepub.com/cgi/reprint/5/1/87 (this item requires a subscription to Active Learning in Higher Education Online).

The enterprising James Atherton's website on university teaching. Browse contents: http://146.227.1.20/~jamesa//teaching/contents.htm

On peer tutoring

Goodlad, S. and Hirst, B. (eds) (1990) *Explorations in Peer Tutoring*. Oxford: Blackwell.

Topping, K.J. (1996) The effectiveness of peer tutoring in further and higher education: a typology and review of the literature, *Higher Education*, 32: 321–45.

The first book provides case studies of peer tutoring, Topping provides a useful classification of different types of peer tutoring and a summary of research results.

On e-learning and teaching

Oliver, R. and Herrington, J. (2001) *Teaching and Learning Online: A Beginner's Guide to E-learning and E-teaching in Higher Education*. Mt Lawley, WA: Centre for Research in Information Technology and Communications, Edith Cowan University.

Salmon, G. (2003) *E-moderating: The Key to Online Teaching and Learning*. London: Kogan Page.

8

Teaching/learning activities for functioning knowledge

In this chapter we are concerned with teaching/learning activities that put knowledge to work, with particular reference to professional contexts. The teaching/learning situations that may be used are much more diversified than 'lecture' and 'tutorial' while the TLAs, which are located within them, are quite specific. We need therefore to be selective: we focus here on TLAs for 'apply', 'create', 'solve problems' and for 'lifelong learning'. The students themselves provide a rich source of many of these TLAs, in various forms of specially designed groups and in the workplace. Creativity has often been regarded by teachers as a 'gift' the student either has or hasn't, and therefore cannot be taught. We argue that creativity can indeed be fostered as it must be, given its status as a common graduate attribute. Lifelong learning is a broad concept that interfaces between institution and the workplace from pre-university to continuing professional development after graduation. We focus here on what the university can do to prepare students for lifelong learning in the undergraduate years. One example is problem-based learning, which was designed so that students would enter the professional world as independent lifelong learners.

Functioning knowledge and professional education

In many courses in the humanities or basic sciences the intended learning outcomes may appropriately focus mainly on building a base of declarative knowledge. In other courses, however, the more important ILOs refer to putting that knowledge to work in practical contexts. This is clearly the case in professional programmes such as in architecture, business, dentistry, engineering, fine arts, medical and healthcare programmes, psychology and social work, to name just a few. In these, much of the declarative knowledge is learned, not for its own sake so much but to construct a platform for

launching informed decision makers and performers into the workforce. A major difference between a professional and a technician is not so much about what each might *do* – a dentist and a dental technician will often perform identical tasks – but about the basis for doing it. Essentially, the technician does what he does because he has been trained to do it: the professional does what she does because she has thought about it and made an informed decision to do it this way and not that way.

There are thus two broad steps in educating students for such professional decision making. The first is to build up the appropriate declarative knowledge base, which was the subject of the previous chapter, and the second is to put that to work, which is our present concern. Thus far, this follows the traditional fill-up-the-tanks model: declarative knowledge is built up first, the application of that knowledge second. Another model is just-in-time learning: students' declarative knowledge base is built up as need arises. This is the case in problem-based learning (PBL), where professional knowledge is rooted in practice from the outset. PBL is used in many professional programmes and we deal with it in a later section. Just-in-time learning is now conceived more broadly in connection with lifelong learning in the workplace, with particular reference to the role of information technology (Brandenburg and Ellinger 2003).

But whether the fill-up-the-tanks or the just-in-time model is used, the teaching/learning activities facilitating the ILOs relating to functioning knowledge require more overt performance than those relating to declarative knowledge and they will often best be situated beyond formal teacher-directed situations. Often, the teaching/learning activity and the assessment task will be identical. For example, a reflective diary may be used as a TLA to the ILO addressing 'reflect', but it, or sections of it, can also become the assessment task. In such cases, the alignment is obvious: the ILO is about reflection, the TLA is carrying out a reflective task, and the assessment task is how well the reflection has been carried out, on the basis of (selected) diary entries.

Unfortunately, many ILOs that are in the domain of functioning knowledge are addressed with TLAs more suitable for declarative knowledge. For example, in dealing with an ILO containing the verb 'apply', teachers may only *talk about* applying the knowledge instead of getting the students to *do* the applying (see Table 8.1).

After first addressing the ILOs that establish the relevant declarative knowledge, let us say that the teacher, when addressing the ILO 'apply', discusses what is meant by 'application' in the context in question and models an example or gives a demonstration. Here, the students are doing what they do when taught declaratively: they listen and take notes. They are not doing any applying themselves and, as always, it is more important that the students' activities are aligned to the ILO in question than the teacher's. The students may be required to 'apply' in the final examination but by then, as we saw with 'explain' in the last chapter, they were not explicitly given that opportunity before they were assessed. In our consulting work, we have come

Table 8.1 What teachers and students do in a lecture leading to an ILO containing 'apply'

Teacher activity	*Student activity*
Introduce	Listen
Explain	Listen, take notes
Elaborate	Understand (but correctly? deeply enough?)
Discuss application in area	Listen, take notes
Give examples of application	Listen, take notes
Show some PPT slides	Watch, note points
Questions on slides	Write answers to the questions
Wind up	Possibly ask a question

across teachers who are quite convinced that she or he is dealing with 'application' as mentioned in the ILO – but *they* are dealing with it, not the students. It's that mindset, once again, that sees teaching being about what teachers do, not about what learners do.

In later sections of this chapter, we suggest teaching/learning activities that are more clearly aligned to ILOs for functioning knowledge. Table 8.2 suggests some of the teaching/learning situations where each is likely to be developed.

Table 8.2 Some areas for developing functioning knowledge with sample ILOs and the teaching/learning situations where they may be located

Programme ILOs relating to	*Sample ILOs*	*Teaching/learning situations*
Professional competence	Apply, solve problems	Laboratory, workplace, placement
Creativity	Design, invent	Workplace, home
Communication	Explain, write	Everywhere
Teamwork	Cooperate, lead	Simulated, workplace, classroom
Lifelong learning	Reflect, develop	Everywhere
Ethical sense	Explain codes of practice	Classroom
	Behave ethically	Workplace, placement

We see that the teaching/learning situations are now highly diverse, some located in the classroom, but others are best located in the workplace or its substitute, the placement or practicum, while others again can be at home, in front of the computer or virtually anywhere. Certainly we can move out of those large lecture theatres. We can gather with our students in more personably arranged rooms, sprawl under the trees in companionable groups, log into chat rooms in the comfort of our homes and, perhaps most important, let our students report back to us about their learning in the world of work.

The task is to develop TLAs within these teaching/learning situations to suit the ILOs, which now are quite specific to the particular professional programme concerned. We can only discuss general principles with a few particular examples here. In designing TLAs it helps to consider them as the assessments tasks as well – then you have excellent alignment. For example, say the ILO requires the application of a concept to a real-life case, the teaching/learning activity is simply applying that concept to a case study and the most appropriate assessment task is how well that concept is applied to the case study.

Let us say we are teaching a course in client relationships in a bachelor programme of social work and the ILO is to establish rapport with a client. We could give a lecture explaining what rapport is and then give the students a written test on what they think good rapport is. This is poor alignment: the students learn *about* rapport, not necessarily how to *create* rapport, which is one intended outcome of the course. No, let us give the lecture by all means – but call it an explanation of the need for rapport or a briefing – but the most appropriate learning will take place when the students are themselves required to create rapport with a client and the assessment is how well they do that. Here you have perfect alignment throughout: the intended outcome becomes the activity of teaching and of learning, the TLA, and it is also the assessment task. A different assessment task might address an ILO about their ability to explain why rapport is essential.

Let us now take a few ILOs, starting with 'apply'.

Teaching/learning activities for 'apply'

'Apply' is one of the most common verbs, but it is too wide ranging on its own and is focused down to apply *something* to *something* or *someone*. We offer a range of teaching/learning situations where application is involved, some of which will better suit a particular context than others.

Case-based learning

Case-based learning of some kind or another has been around for some time in law and business schools. It can apply to most professional education. There are several variants, a common one having two stages: (i) presenting cases that have already been carried out and (ii) requiring students to carry out their own cases.

Documents presenting the case to students may be in the form of narratives, outlining a real-life situation or an event – the court proceedings, the person or business with a problem – and through teacher–student, and student–student interactive discussion, draw out what happened, who the participants were and their differing perspectives of the issues. Many ILOs could be addressed: application, the role of theory in the decision making involved in

the case, the role of teamwork and collaboration, critical thinking, creativity. Box 8.1 presents a case in environment education.

Box 8.1 A case in environmental education

The ILOs addressed in this case study are:

1 Apply relevant ecological principles to conservation and exploitation of natural resources to solve real-life problems and explain the rationale for doing so.

2 Critically evaluate the merits, limitations and future trends and apply techniques in environmental conservation and resources management.

Mr Wong and his family are indigenous villagers in Yuen Long. Mr Wong owns three hectares of land and five hectares of fishponds inherited from his ancestors. With assistance of his two sons, Mr Wong manages to produce vegetables and freshwater fish for sale at the local markets. To keep up with production, he, like many farmers and fishermen in the New Territories, has been applying fertilizers and pesticides to the field, and trying to stock as many fish as possible in his ponds. However, in recent years, he sees his harvest decline gradually. One day, he woke up to discover that a great quantity of his fish were floating belly up. He could not believe his eyes!

What is going wrong? What can he do? How can he be assured that he is doing the right thing?

Provide reasons to support your answers.

Source: Dr Paul Shin, Department of Biology and Chemistry, City University of Hong Kong

Case-based learning can be used to illustrated particular issues or, as in problem-based learning (see later), it can be used throughout a course to address the whole syllabus, the cases being carefully selected so that the contents areas that are to be addressed are represented and sequenced in the logic of the build-up of knowledge.

The second stage of case-based learning more closely addresses the verb 'apply': the students experience the various roles in the appropriate case themselves, either through role play or in a more advanced way by dealing directly with a real-life case, as in problem-based learning. This time round, the students, through role play or directly, enact the activities that lead to the desired ILOs. The first stage may be viewed as the declarative stage of case-based learning, in the sense that to the students it is second hand, while the second stage addresses our concern, functioning knowledge.

Group work

Case-based learning makes a great deal of use of group work, so here is a good place to discuss various kinds of group. Most TLAs for functioning knowledge make use of student–student interaction, both in the form of role play or of a variety of kinds of group work, which require students to apply their knowledge and to address functioning knowledge in general learning.

Although the essence of group work is student–student interaction, the initiating, orchestrating and managing of many kinds of group need to be performed by teachers. The following outcomes are likely in effective student–student learning interactions in small groups (Collier 1983; Johnson and Johnson 1990; Topping 1996):

- *Elaboration of known content.* Students hear of different interpretations, things they themselves hadn't thought of. This facilitates:
- *Deriving standards for judging better and worse interpretations.*
- *Reflective awareness of how one arrives at a given position.* How did that guy arrive at that conclusion? How did she? How did I get to mine? Which is better?
- *Applying theory to practice.*

The reflective aspects are sharpened because students readily identify with each other's learning in a way they do not do with top-down teacher-directed learning (Abercrombie 1969). Abercrombie herself used this style of group work with medical students in applied areas such as interpreting X-rays, as described below (pp. 141–2).

In all group work, the students must have sufficient background to contribute, either from reading enough to have an informed discussion or where the topic relates directly to personal experience. Above all, the group leader needs to be able to create the right sort of atmosphere so that students can discuss uninhibitedly. Some teachers find it hard not to correct a student, not to be seen as the expert or to arbitrate in disputes between students. But to become Expert Arbitrator kills the point of the exercise, as students then tend to sit back and wait to be told what to think.

As to the optimal size of a group, there is no set answer as it depends on the nature of the group task and the group dynamics. The principle is that each member should feel responsibility and commitment. The larger the group, the more likely 'social loafing' will take place, one jerk leaving it to the others to do the work. Interestingly, this is a western phenomenon – in ethnic Chinese groups, members work harder in larger groups (Gabrenya et al. 1985). If the architecture permits, students can be allocated to groups of 10 or so in the same room, but it can be awkward where lecture rooms are tiered, with fixed seats – outside under the trees is preferable, weather permitting. When the groups have reached their conclusions, one person speaks to the plenary session on their behalf, making sure that spokesperson is nominated in advance. When reporting back, individuals then need not feel shy about saying something others might criticize: it comes from the group.

In forming groups, Yamane (2006) strongly recommends assigning students to groups randomly. He found groups formed by friends or voluntary membership much more likely to gossip or otherwise discuss off-task. Random assignment 'solved the problem', as he puts it.

Buzz groups

Students are given a question or problem or issue to discuss in the course of a class or asked to apply theory to analyse and solve a case study. The success of free ranging depends on the size of the group and making absolutely sure the students are clear about what they have to do. Brainstorming groups have a topic and no rules, except to say whatever comes to mind. Brainstorming can be used wherever the verbs 'generate', 'hypothesize', 'speculate' and the like are on the agenda.

Syndicate groups

These are formed out of a class of 30 or so into four to eight students each (Collier 1983). Each group has an assigned task, which could be part of a larger project, a problem or a case study. The heart of the technique is the intensive debate that is meant to go on in the syndicates. The assignments are designed to draw on selected sources as well as on students' first-hand experiences, so that everyone has something to say. The syndicates then report back to plenary sessions led by the teacher to help formulate and to consolidate the conceptual structures that have emerged from each group. Collier reports that student motivation is high, and that higher level skills are enhanced, as long as they are addressed in assessment.

Jigsaw groups

Here the groups are allocated sub-tasks and the plenary is to put the finished sub-tasks back together to solve the main task. This is a good way of getting a complex task handled where every person has had some active input into the solution. The downside is that each group only gets to see the working of their own sub-task, and may miss the whole. Again, assessment is the answer: the assessment task must address the whole. Each student could be asked to write a reflective report on the task and their role in it. Concept maps are also useful here, as they are what the whole complex is about, not just the sub-concept.

Problem-solving groups

Abercrombie (1969) worked with medical students in problem-solving groups. Her groups consisted of 10 or so students, and the task was diagnosis, mostly using X-ray films as content (about what the X-ray may be of and what it might mean). The principle is applicable to any situation where students are learning to make judgments, and where there is likely to be a strong difference of opinion. Students have to construct a hypothesis where the data are insufficient to reach an unambiguous conclusion. Different individuals typically seize on different aspects of the data or use the same data to draw different conclusions, so that astonished students find themselves at

loggerheads with others equally convinced of the correctness of their own interpretations. The shock of that discovery can be powerful, forcing students to examine closely the basis of what theories they used and how they arrived at their own conclusions. Students taught in this way made better diagnoses, based more firmly on evidence, and they were less dogmatic, being more open to consider alternative possibilities (see also Abercrombie 1980). In addition to increased professional competence, she found motivational and social outcomes that are also professionally relevant, such as increased self-concept, communication skills and self-knowledge.

Learning cells

Learning cells are dyads formed not so much for mutual support, as are learning partners, but for working jointly on a problem or skill. The justification is simply that students work better when working in pairs (McKeachie et al. 1986). This is particularly useful in laboratory situations, learning at the computer terminal or question–answer on set tasks.

Many of the common group structures discussed earlier can be replicated online. Some groups work better online, some worse. For example, going from student to student, seeking the opinion of each on the discussion topic, works much better asynchronously online than synchronously, either online or face to face. In the asynchronous use, students are not under pressure to say something – anything – when it is their turn, but rather they can take their time to think out their view first and then post it on the bulletin board after due reflection. Buzz groups, by the same token, work better face to face, where oral spontaneity is an important feature (Maier and Warren 2000). Syndicates also work well online, which can work synchronously at first, then subgroups may confer and then report back, which can be synchronously for some phases and asynchronously for others.

Reciprocal questioning

Students are trained to ask generic questions of each other, following the teaching of a piece of content (King 1990). Generic questions get to the point of the content; in SOLO terms they are relational. For example:

- What is the main idea here?
- How would you compare this with . . .?
- But how is that different from . . .?
- Now give me a different example.
- How does this affect . . .?

King compared answers to these kinds of question presented in the reciprocal teaching situation to answers to the same questions presented in open-ended discussion that took the same time. While the latter were often longer, they were almost all low level. On critical thinking and high-level elaboration, the questioning groups were far superior. These findings emphasize that when getting students to interact in order to reach specific outcomes, make sure there is a clear and high-level agenda for them to address.

Spontaneous collaboration

Some student groups are unofficial, formed spontaneously to focus on coping with specific tasks, such as set assignments (Tang 1996, 1998). Tang studied spontaneous collaborative learning among physiotherapy students, who after the announcement of an assignment formed their own groups, deciding who would check out what set of references, what ideas might be included and so on. The collaborative effort extends variously through the planning phase of the assignment or project, but the final detailed plan and write-up is conducted individually. Over 80% of Tang's students collaborated to some extent and those who did showed greater structural complexity (higher SOLO levels) in their assignments. Such a high proportion of spontaneous collaboration may not occur with western students, but Goodnow (1991) reports that Australian students at Macquarie University formed syndicates, mainly for the purpose of exchanging wisdom on examination questions. An interesting question is how far teachers might encourage, or have any interaction with, these groups (Tang 1993).

ICQ ('I seek you') and MSN are used by students mainly for non-academic purposes, but many students use them for spontaneous collaboration over set work such as assignments.

Workplace learning

Workplace learning, variously known as 'placement', 'attachment', 'practicum', 'clinical' or 'internship' according to discipline, is an integral component, even the apex of, professional education.

Depending on the nature of individual professions, each professional education programme has its own specific ILOs. However, the major ILOs of workplace learning which would likely be applicable to many professional programmes are for the students to be able to:

1 integrate knowledge and skills learned in university to real-life professional settings
2 apply theories and skills to practice in all aspects of professional practice
3 work collaboratively with all parties in multidisciplinary workplace settings
4 practise with professional attitudes and social responsibilities in their respective professions.

Workplace learning is an active learning experience focusing on student participation in situated work activities (Billet 2004). It provides a teaching/learning situation where students learn through experiencing and active participation in learning (usually under supervision) in various aspects of professional practice situated in the real-life professional context. It could be a hospital clinical placement of internship in medical and healthcare programmes, field placement in social work, industrial attachment in business and engineering or law firm placement for law students. This teaching/learning situation is most suited to facilitate the functioning ILO of applying

theories and concepts to perform professional practice such as making clinical decisions and diagnosis, planning and implementing treatment or intervention programmes, conducting industrial projects, producing a stage play and making a legal case etc.

To enable students to achieve these outcomes, teaching/learning activities that are aligned to the ILOs must be designed. In most workplace learning situations, these activities include the following.

Teaching activities, conducted by placement educators:

1 Plan and coordinate the logistics of the placement.
2 Design appropriate learning activities.
3 Select cases or projects.
4 Provide appropriate level of guidance and scaffolding to learning.
5 Provide feedback to learning.
6 Assess the learning outcomes.

Learning activities, conducted by the students either in groups or individually:

1 Interview a patient or client to collect relevant data.
2 Analyse the data to identify a situational problem or issue.
3 Formulate solution to the problem through application of theory to the problem or situation in hand.
4 Implement actions to effect the solution.
5 Evaluate effectiveness of intervention or project.
6 Collaborate with other team members either intra- or inter-disciplinary.
7 Reflect on own performance to identify areas for improvement.

It is important to ensure the alignment between these student learning activities and the ILOs for that particular workplace learning situation.

A learning contract, a negotiated agreement between the student and the placement educator regarding the particular learning experience, may well form part of the placement. In such contracts, students are actively involved in designing their learning experience, in identifying their learning needs, their ways of fulfilling those needs and how they will be assessed. A learning contract provides an authentic and contextualized learning experience that students will encounter in a real-life situation.

Although workplace learning involves experiences in the workplace, it is closely integrated with classroom learning. It is important that the ILOs for workplace learning are clearly defined and understood by all parties concerned. In particular, the need for students to integrate and apply theory to practice should be explicitly emphasized to help them understand the link between classroom and workplace learning. It is important that students should see the common ILOs in both learning situations and how they are interrelated and mutually supportive to provide a holistic professional learning experience.

Workplace learning naturally enough is closely related to 'apply' in the sense of lifelong learning. We look at that connection in a later section.

Teaching/learning activities for creativity

Creativity is not only an intended learning outcome in the fine or performing arts. Graduate attributes make it clear that creativity is required in all disciplines and professional areas. So what is meant by creativity in higher education?

We have already used the terms 'convergent' and 'divergent' in connection with student questioning. They were originally coined by Guilford (1967) to describe two different forms of ability:

- *Convergent* ability, as in solving problems that have a particular, unique answer, as in most intelligence and ability test items. Convergent thinking is 'closed'. A common perception is that convergent thinking is what academic ability is about: knowing a lot and getting it right, but that should be only part of the academic story.
- *Divergent* ability, as in generating alternatives, where the notion of being correct gives way to other assessments of value, such as aesthetic appeal, originality, usefulness, self-expression, creativity and so on.

We prefer to see the terms 'convergent' and 'divergent' as describing processes, ways of going about thinking, that are involved in most high-level thinking and in professional work, rather than as simple abilities. However, it is difficult to 'generate', 'hypothesize', 'theorize' or 'reflect' without prior content mastery. You have to know what you are to hypothesize about or to reflect on. But, by the same token, having a solid knowledge base is no guarantee that one will be creative in using it. Many, perhaps most, academics focus on establishing that knowledge base, but neglect the next step of making it function creatively.

Creativity also requires, or at least is accompanied by, intense interest and involvement in a specific area, the end result of which is a product, a 'creative work', as Elton (2005) puts it, comprising something new, a synthesis that didn't exist quite like that before. The job of teachers is thus not to help students 'be' creative, but to help them create works, products, outputs, that are founded in the discipline or area and that add to it in an original way.

A common perception is that outcomes-based teaching and learning is antithetical to creativity on the ground that the outcomes are predetermined, specified in advance and so form a 'closed loop'. The essence of creativity, by way of contrast, is to concentrate on process and produce outcomes that are unexpected and often unintended (Jackson 2005). This is true when the intended outcomes are low level, such as competencies, or are convergent, working towards the one correct answer. However, when the outcomes are high level, at the extended abstract end, they contain verbs such as 'design', 'invent' or the verb 'create' itself. Here the outcome is itself an open-ended process, the product not being pre-determined at all.

Addressing open-ended verbs like these with an appropriate teaching/learning activity is igniting a creative process with an unspecified outcome. A common TLA for the ILOs just examined is brainstorming in groups, after

which students can individually work on their ideas and possibly regather to provide mutual feedback. There are many ways of triggering the creative verb, as appropriate for each discipline or area: an engineering TLA for 'design' will obviously be very different from a TLA for a creative writing course for 'create a character . . .'. 'The Imaginative Curriculum' is a large-scale project designed to help teachers whatever their teaching area to foster students' creativity through specific examples of teaching practice (Jackson et al. 2006).

Some areas, such as dramatic art, require situations in which TLAs are reflective and improvised. Box 8.2 provides an example.

Box 8.2 An example of teaching/learning activities in acting skills

TLAs in drama involve private rehearsal and reflection and public interaction with the teacher in workshop, skills classes and before-the-camera situations. Both student and teacher are looking for organic application and generation. The quality of reflection, whether intuited or consciously thought through, can be measured by repeating the exercise; and by making sure that the doing of the exercise is connected/aligned to the thinking of the reflection. Self-control, which includes extensive private preparation, is paramount.

ILO: *Create a character and establish credible relationships.*

TLA: *Character object exercise.* The student seeks the core of the character by being in a character-familiar space (e.g. bedroom), using meaningful objects and carrying out physical activities, e.g. getting dressed.

ILO: *Achieve an organic perception of action and of the sequence 'reaction–action–variation'.*

TLA: *Playing the action*: Generating interaction through trying to make another character do something, as opposed to simply saying the lines and 'indicating' (not effecting an activation). When an action is played, the actor induces curiosity and, most significantly, becomes a storyteller, i.e. what will happen next? The TLA ought to be self-controlled or the student will lack ownership/authenticity. An element of peer control can be a great support. If the partner is activated, the student will at least receive a good energy-inviting reaction, which also amounts to interaction (the result of action playing). Proaction and reaction are the two halves of activation (or action playing). In dramatic terms, action playing, with its character-informed variations, naturally represents alignment.

A good piece of material can be found in Act I, scene vii of *Macbeth.* Lady

Macbeth tries to make Macbeth kill the king. That is her action. To get what she wants, she must be proactive. She will have to use more than one approach or variation (otherwise, the scene would be resolved after only a line or two) and that is obtained by drawing on a range of so-called psychological activities (transitive verbs). These must generate tempo rhythms that can organically affect and potentially change a partner. High-level verbs must be sought, e.g. flatter, rebuke, encourage, humiliate. 'Beg' is self-indulgent, 'persuade' or 'question' are generalizations, 'shout' is intransitive. Applying these verbs and then reflecting on the exercise with a view to progressing should be givens. But sometimes the student may only pay lip service to the verbs; or struggle with reflection.

Source: Alan Dunnett, Drama Centre, Central Saint Martins, University of the Arts, London

Powerful TLAs can be constructed using educational technology. In her discussion of e-learning, Laurillard (2002) outlines *adaptive* media that change their state in response to users' actions thus giving intrinsic feedback, internal to the action, as opposed to a commentary which is external. Simulations allow students to change parameters and see what happens, which encourage the 'what would happen if?' enquiry. *Productive* media allow students to construct micro-worlds, where they may build their own systems.

Unfortunately, it is much easier to stifle creativity than to encourage it. Whatever the TLAs relevant to a creative ILO, the right climate for encouraging creativity is one where the students can feel they can take risks and can feel free to ask 'what would happen if?' without being ridiculed either by the teacher or by other students for making a 'silly' response (Box 8.3).

Box 8.3 How not to encourage creativity

Teacher: And now, who can tell me what infinity means? (*Silence*). What is infinity?
Billy: Uh, I think it's like a box of Creamed Wheat.
Teacher: Billy, you're being silly.

Source: Jones (1968: 72)

Billy is, of course, quite right, infinity *is* like a box of Creamed Wheat breakfast cereal, on which there is a picture of a man holding a box of Creamed Wheat who is holding a box of Creamed Wheat . . . *ad infinitum*. It is likely, however, that Billy will in future keep his insights to himself, at least in that teacher's class. This homely example illustrates some further points that also

apply to tertiary teaching. Snap value judgments by teachers are not a good idea. The teacher in the box might better have picked this up with (laughs): 'Good, but can anyone explain what Billy might mean?' and an enlightening discussion could ensue. We can too easily dismiss an insight that at first glance seems irrelevant.

A Theory X climate of criticism, mistrust and high anxiety is death to creative responses from most people. An example of this, familiar to all academics, is the difference in adventurousness, originality and freshness between a term assignment and the answer to a question on the same topic held under invigilated examination conditions: we return to this later when discussing the assessment of creativity.

Teaching/learning activities relating to lifelong learning

Lifelong learning, the ultimate aim of university teaching, has the generic and the embedded meanings of many other graduate attributes (pp. 65–6). The generic meaning – that graduates can learn to handle whatever life throws at them – is vacuous, empty rhetoric. The embedded meaning, however, that students can learn to handle unseen problems in their chosen field of study is significant and attainable. One somewhat blinkered interpretation is that lifelong learning is 'a political response to a need to upskill the working population in order to obtain a competitive advantage in the economy' (Burns and Chisholm 2003: 179).

Burns and Chisholm relate lifelong learning to work-based learning in the context of engineering. They propose an ongoing interface between educational institutions and engineering firms, but they claim their models of work-based learning can be applied to any professional area. The general principle is just-in-time learning where, as in PBL but now in the workplace proper, people seek to learn what they have to know when need arises, most frequently now with the aid of e-technology (Brandenburg and Ellinger 2003).

A somewhat related but more flexible idea is the *emergent* curriculum (Jackson et al. 2006). The 'curriculum' here comprises problems that emerge in real life and that cannot be predicted and that usually require ongoing 'conversations' to invent, create and implement new enterprises that work in a business sense. As Jackson (private communication) elaborates:

> No-one knows where we are heading until an idea or a perception of needs begins to crystallise. We are trying to establish the conditions and resources for co-operative just-in-time learning and then respond to what emerges. We have students on year long placements scattered all over the world experiencing a multitude of cultures and problem working situations. The emergent curriculum is driven by a highly contextualised situation and need and the way it is met is not through

text-book knowledge but by creating conditions, relationships and networks for purposeful and sympathetic conversation informed by experiences of dealing with similar situations or operating from principle-based positions.

These views of work-based and just-in-time learning can apply to pre-university, undergraduate, postgraduate and continuing professional development in the workforce. Important though lifelong learning is in this sense, we must limit ourselves here to our focus: what can be achieved within the general run of institutional undergraduate programmes.

The role of the institution in this context is twofold: what it can achieve externally by locating teaching/learning activities and assessments in work-based placements wherever feasible; and what it can achieve in providing students with the skills needed for independent lifelong and just-in-time learning. The latter addresses both second-tier attributes of 'information literacy' and 'personal and intellectual autonomy' that Barrie (2004) suggests comprise 'lifelong learning' (see Figure 5.1, p. 68). Students need to learn how to seek new information, how to utilize it and evaluate its importance and how to solve novel, non-textbook, professional problems. They will need high-level reflective skills and an abstract body of theory on which to deploy them, so that they can judge how successfully they are coping with novel problems, and how they may do better. Action learning for life, if you like.

As for Barrie's 'personal and intellectual autonomy', we are dealing with three levels of self-directed learning:

1 generic study skills
2 study skills that relate to learning particular content
3 reflective learning.

Generic study skills

Study skills are ways of managing time and space. For example:

- Keeping notes and references neatly and systematically so that they can be found when needed.
- Apportioning time and keeping track of deadlines, so that all topics and subjects are given adequate time, and in proportion to their importance.
- Seeking new information without being overwhelmed, using search engines strategically and relevantly, prioritizing searches.

Adults are very much better at such organizing and planning than are students straight from school, while women are generally better than men (Trueman and Hartley 1996). Teaching generic study skills, particularly long-term planning, has positive effects on performance (Hattie et al. 1996).

Study skills that relate to learning particular content

These skills include:

- Underlining/highlighting the key words in a passage.
- Reading for main ideas, not details, as in SQ4R (Thomas and Robinson 1982).
- Taking notes properly, by capturing the main idea of several sentences in own words, rather than copying every second or third sentence.
- Using concept maps to derive a major structure.
- Composing essays according to a pre-planned structure; using review and revise, not first drafts.

But consider this experiment. Ramsden et al. (1986) taught study skills to first-year undergraduates from a variety of faculties, focusing on reading and note taking, examination preparation and writing skills. The effects were the opposite of what was intended: in comparison to a control group, the students increased their use of *surface* approaches. Subsequent interviews with the students revealed that they believed that to be successful in first year you needed to retain facts accurately, so they selected from the study skills course just those strategies they believed would help them memorize better. You will recall first-year students rejected concept maps for the same reason (pp. 115, 117). Students get these ideas from the way they have been taught and assessed and from the general culture of the class. No doubt the teachers did not at all intend that the students would interpret their first-year experience in this way, but they did.

This misalignment, between what the teachers intended and what the students perceived, can be overcome if teachers embed useful study skills in their teaching so they are not only teaching *what* they want their students to learn, but *how* to learn it. Chalmers and Fuller (1996) suggest teachers teach strategies for *acquiring* information (note making, memorizing, skim reading), strategies for *working with* information (explaining ideas, organizing ideas, writing summaries), strategies for *confirming* learning (handling assessment tasks) and so on. These are adapted to suit the particular unit or course content.

If study skills are supported by the context in which they will be used, it becomes clear why those strategies are useful. Building knowledge is so much more effective when the tools needed for building are used on the spot, thoughtfully.

Reflective learning

Lifelong learning and just-in-time learning require *informed self-direction*. That is, students need to operate from a sound knowledge base and use reflective or metacognitive skills to work strategically towards solving novel problems, to self-monitor their emerging solutions. The outcomes are not spelled out,

they are emergent: one doesn't know what the intended outcome is to be until it emerges from a fuzzy problem situation. The teaching/learning activities are entirely self-managed or negotiated with others in the field and the ongoing formative assessment has also to be entirely self-managed. The judgment has to be made that *this* is the best solution in these complex circumstances.

When faced with such a novel situation, the learner might consider the following questions:

- This is a 'fuzzy' problem; how can I reformulate it in a way that relates to first principles leading to good solutions?
- What do I know that might be relevant? What problems like this have I met before? What did I do then?
- How can I find out further information? From where? How do I test it?
- I'll try this solution; does it work? How could I improve it?

These constitute a different order of question, using study skills in order to organize and conceptualize what is known prior to *re*-conceptualizing it. The verbs involved are open ended and extended abstract: planning, theorizing, hypothesizing, generating.

Alongside these divergent processes, it is also necessary to monitor what is going on, to test ongoing outcomes for adequacy, to see that learning is on track. Evaluating one's own work, of prime importance in everyday professional life, is one skill that graduates feel their university education least prepared them to do (Boud 1986). Self-evaluation or self-monitoring skills therefore need to be addressed. Accordingly, self- and peer-assessment are as much teaching/learning activities as assessment tasks. Other relevant TLAs are reflective diary, selecting critical incidents and suggesting how to deal with them.

If dealing with emergent problems is what graduates are supposed to be able to do, undergraduate teaching should foster self-managed learning and assessment. The generic and content-specific study skills mentioned earlier only challenge students to apply, generalize and refine their understanding of what is given. Reflective learning skills and strategies require students to go further: to manage problems and questions that they have *not* previously addressed.

This is also the aim of problem-based learning.

Problem-based learning

Problem-based learning (PBL) reflects the way people learn in real life; they simply get on with solving the problems life puts before them with whatever resources are to hand. They do not stop to wonder at the 'relevance' of what they are doing, or at their 'motivation' for doing it: it is the traditional model of education that gives birth to these questions.

Education for the professions for years followed the fill-up-the-tanks

model of knowledge acquisition and much of it still does. The disciplines are taught first, independently of one another, and, armed with all that declarative knowledge and with some professionally relevant but atheoretically taught skills, the student is accredited as ready to practise as a professional. Professional practice, however, requires functioning knowledge that can be put to work on the spot. Traditionally taught graduates manage to do that with varying degrees of success and, with experience in the real world, become increasingly better at it. However, if students graduate with that functioning knowledge already to hand, their induction into real-life professional practice is that much quicker. The problem in the traditional model is that the programme ILOs nominate professional competence on graduation but declarative knowledge is the main output: curriculum, teaching and assessment are not aligned.

PBL is alignment itself. If the aim is to become a doctor – PBL originated in a school of medicine – then the best way of becoming one is being one, under appropriate guidance and safeguards. If the ILO is to make clinical diagnoses then making clinical diagnoses is the obvious teaching/learning activity and how well they are made is the obvious assessment task. And so it goes for any professional problem.

Savin-Baden (2000) argues that problem-based learning is commonly confused with problem-solving learning. The latter simply means setting problems for students to solve after they have been taught conventionally and then discussing them later. In PBL, contrariwise, 'the starting point for learning should be a problem, query or a puzzle that the learner wishes to solve' (Boud 1985: 13). The problem, or a series of problems, is where learning starts and, in going about solving those problems, the learner seeks the knowledge of disciplines, facts and procedures that are needed to solve the problems. The traditional disciplines do not define what is to be learned, the problems do. However, the aim is not only to solve those particular problems, but in the course of doing so, the learner acquires knowledge, content-related skills, self-management skills, attitudes, know-how: in a word, professional wisdom. This means the problems had better be carefully selected.

Although PBL is used most commonly in education for the professions, it can also be used in the teaching of basic disciplines (see 'Further reading' at end of this chapter, where a couple of websites on PBL for teaching physics and biology are provided).

In a fully blown PBL programme, the problems are selected so that by the end of the programme, the learner is ready to move directly into the workforce. Less content may well be covered than in a traditional programme, but the knowledge so gained is acquired in a working context and is put back to use in that context. Coverage, so dominant in discipline-centred teaching, is considered less important. Instead, students learn the skills for seeking out the required knowledge as the occasion demands.

A typical PBL sequence goes like this:

- The *context* is pressing. In a typical medical programme, students in their first week of first year are faced with the responsibility of a real patient with, say, a broken leg. The felt need to learn is strong.
- Learners become *active* very quickly. They are assigned to small problem-solving groups and begin *interacting* with teachers, peers and clients (who present the problem).
- Learners start from what they already know and *build a knowledge base* on that. They learn where to go to check what they know and to seek out more. They are variously guided towards resource materials, including films, videos, the library and lecture room. Knowledge is *elaborated and consolidated*. Students meet with a tutor and discuss the case in relation to the knowledge they have obtained.
- The knowledge is functioning: it is *applied* to the problem in hand. *Feedback* is ongoing.
- The problem is reviewed and learners develop *self-management* and *self-monitoring skills*, which they review throughout the programme.

The italicized words may remind you of the characteristics of a rich learning context described in Chapter 6.

PBL makes use of them all.

Goals of PBL

There are several modifications and versions of what is called 'PBL', but all should address the four goals distinguished by Barrows (1986):

1 *Structuring knowledge for use in working contexts.* Professional education is concerned with functioning knowledge. PBL is concerned with constructing knowledge that is to be put to work.

2 *Developing effective reasoning processes.* Such processes refer to the cognitive activities required in the professional area concerned and include: problem solving, decision making, hypothesizing, etc. Each professional area has its own specific processes to be developed as relevant problems are solved.

3 *Developing self-directed learning skills.* Included here are the three levels of skill mentioned earlier (pp. 149–51): generic study skills, content-specific study skills and especially the metacognitive or self-management skills for lifelong learning are specifically addressed in PBL, where they are learned in context, as they should be.

4 *Increased motivation for learning.* Students are placed in a context that requires their immediate and committed involvement. Thus, in terms of motivational theory (see Chapter 4), the value is high, the expectation of success is high, as problems and cases are selected in which students are likely to be successful, so motivation is high.

To these four may be added a fifth:

5 *Developing group skills, working with colleagues.* Many professions require

teamwork, so this becomes a goal in many PBL programmes. It might be noted that such teamwork takes place in a workplace-like context, unlike much group project work.

PBL varies according to two major variables (Barrows 1986):

1 *The degree to which the problem is structured.* Some problems are tightly structured, with all the information needed to solve it. Others have some facts provided, the student having to find the rest. Open or 'ill-defined' problems present no data, it being entirely up to the student to research the case and decide what needs to be found out and what to do to handle it.
2 *The extent of teacher direction.* The most conservative case, arguably not PBL, is where the teacher controls the amount and flow of information. In the case of 'ill-defined' problems, teacher direction is minimal, the students going off on their own to solve the problem. Variations in between depend on how much the teacher provides clues and information handling support.

The optimal amount of structure of the problem, and of teacher direction, depends at least initially with the educational philosophy of the teachers and tutors participating, and what freedom the students can initially handle (Ryan 1997). In a study at the Polytechnic University of Hong Kong modifications were introduced to fit the aims of six departments and the different expectations of full- and part-time students (Tang et al. 1997). The full-time students found most difficulty with assessment, not surprisingly given their exam-dominated school background. As one student put it, 'It is difficult to guess what is the marking scheme of the lecturer' (Tang et al. 1997: 586). Part-time students, by way of contrast, took to PBL straight away because it mimicked the workplace: 'When I encounter a problem, I will have a solution, like that in my workplace' (Tang et al. 1997; Tiwari et al. 1999).

Nature and construction of the problems

A good problem has the following characteristics (Johnston 2002):

1 It calls on different disciplines and integrates them in solving the problem.
2 It raises options that promote discussion.
3 It activates and incorporates previous knowledge.
4 It requires new knowledge the students don't yet have.
5 It stimulates participants to elaborate.
6 It requires self-directed learning.
7 And, of course, it meets the course ILOs.

Such problems are open ended and 'ill structured'; that is, they do not present the students with enough information.

Here's a problem for you: 'You plan to use PBL in teaching your unit. What are you going to do?' Ill structured, definitely. You see straight away that you don't have enough information, while seeking a solution involves

higher order thinking, such as hypothesizing, evaluation, reflection. It also involves divergent thinking, as there is likely to be more than one way of reaching a solution. A sensible first step, then, might be to read the rest of this chapter, then some of the readings. Are there any colleagues in your institution using PBL? If so, talk to them.

The characteristics of a good problem are given in Box 8.4.

Box 8.4 Designing a problem

1 Map all the *concepts* likely to be involved from different disciplines, including the *knowledge* and *skills* required to solve the situation. Maybe a knowledge tree would help.

2 Write the *ILOs*. What do you expect the students to do with the new knowledge and skills?

3 Identify a *real problem* from a real-life situation that is important to students, such as one they are likely to meet in their future employment. Authenticity is highly motivating.

4 Repeat (3) until all your ILOs are addressed.

5 When *writing* problems make sure to:

- Use the present tense. Otherwise problems look like another textbook exercise.
- Provide a context and specific role of practitioner: what, when, where.
- Provide specific rather than vague data.
- Require the students to deliver something: a decision or report.

6 Many situations or problems *evolve over time*. It might be appropriate to provide an extended problem (called 'roll-out' problem or case). Such a problem is in parts, covering a sequence of events or the problem is addressed in stages as more data become available and may last over more than one semester.

7 Write a *facilitator guide* for others involved in the PBL, including:

- the problem
- the ILOs
- the learning issues, including all the new knowledge you expect participants to learn and discuss
- content background information for the facilitators
- suggested resources for students.

With permission of David Johnston, Director, Hong Kong Centre for PBL

So there you have it. For those interested in trying PBL, you can now handle Task 8.1.

Task 8.1 Getting going with PBL

Take a topic you are teaching and turn it into PBL.
Be guided by Box 8.4.

We deal with assessment issues in PBL in Chapter 11.

Does PBL work?

The goals of PBL have already been listed as: structuring knowledge for professional use, developing effective reasoning processes, developing self-directed learning skills, increased motivation for learning and effective teamwork. How effectively does PBL attain these goals?

Albanese and Mitchell (1993) conducted a major meta-analysis of all studies published between 1972 and 1992. The following conclusions emerge:

1. Both staff and students rate PBL higher in their evaluations and enjoy PBL more than traditional teaching.
2. PBL graduates perform as well and sometimes better on clinical performance. More PBL (medical) graduates go into family practice.
3. PBL students use higher level strategies for understanding and for self-directed study.
4. PBL students do worse in examinations of basic science declarative knowledge.
5. PBL students when compared to traditionally taught students become progressively deeper in their approaches to learning (McKay and Kember 1997; Newble and Clarke 1986).

Hmelo, Gotterer and Bransford (1997) argue that PBL by its nature requires a *different way* of using knowledge to solve problems. They distinguish two strategies in clinical decision making:

- *Data driven*: 'This patient has elevated blood sugar, therefore he has diabetes.'
- *Hypothesis driven*: 'This patient has diabetes, therefore blood sugar should be up, and rapid respiration, "fruity" breath odour . . .'

Experienced and expert doctors use the data-driven strategy, except for unfamiliar or complex problems. Novice doctors, such as students in training, lack that experience and should therefore work top-down from first principles, with longer reasoning chains: 'If this, then because of that, it would follow that we should find symptoms X, Y, and Z. . . .' The traditionally taught students tried to follow the experts – and couldn't, they didn't have

the background. PBL taught students increasingly used hypothesis-driven reasoning, with longer and clearer reasoning chains. PBL students also used a wider variety of knowledge resources, whereas traditionally taught students stuck with the textbook. Such findings are completely in line with what PBL is trying to do.

An important aspect of evaluating PBL is its implementation, particularly cost benefits. The economies of large lectures are offset by the economies of self-directed learning and on the size and number of tutorial groups complementing the lectures. Albanese and Mitchell (1993) estimate that for fewer than 40, and up to around 100 students, PBL once set up can be equivalent in cost to traditional teaching. Savin-Baden (2000) is more optimistic still, saying that because of the move to mass education, fee-paying students from diverse backgrounds are more likely to be attracted to interesting ways of learning like PBL than to mass lectures.

Let's hope so.

Problem-based problems

PBL is particularly sensitive to context and climate. Remember the disastrous effect a know-it-all tutor had on the questioning strategy needed for the problem-solving process ('That's for me to know and you to find out') (pp. 97–8). An equally devastating effect was achieved in another case when the course coordinator decided to retain the traditional final-year examination, leaving the students unsure whether their conclusions drawn from case study work would be relevant to the final exam. They weren't. Not surprisingly, performance was low and the course evaluation of PBL was unfavourable (Lai and Tang 1999).

Both cases are examples of poor alignment. The tutor was creating affective misalignment in that the climate created was incompatible with the spirit of PBL, while the coordinator was creating instructional non-alignment in that the assessment matched neither the ILOs nor the TLAs used.

Albanese and Mitchell (1993) say that in PBL, students cover only 80% of the traditional syllabus and do not perform as well in standard examinations. That worries traditional critics more than PBL teachers. The latter would prefer the PBL graduate to know less declarative knowledge but be able to put what they do know to work more readily. When what they know is insufficient, the students have the self-directed skills to know just-in-time where to go and how to acquire what knowledge they will require when attending to a particular case.

PBL is undoubtedly an effective approach to teaching. It exemplifies a high degree of alignment. To practice as a particular professional requires solving problems that belong to that profession. Thus, professional knowledge and skill are the intended learning outcomes, professional practice comprises the teaching/learning activities, professional knowledge and skill are what are assessed (among other things). It is distinguished from apprenticeship in

that it is theory based; it is not just a matter of performing the skills in an uninformed manner.

There are two major reasons that PBL is not used more widely. First, PBL requires teachers to adopt a different philosophy of professional education; that education is something more than the acquisition of separate bodies of knowledge, in one of which the teacher is professed expert. The teacher has to be prepared to drop the role of expert. Many find this hard to do: their very career path is expedited by their demonstrating their specific expertise. It is much easier for experts to give lectures on their specialty, leaving integration and application as the students' problem to solve. Most students probably will, but years down the track.

Second, PBL requires considerable institutional flexibility. Most universities are organized into departments with specific content foci. PBL is multidisciplinary as usually the problems presented require knowledge from several areas: it therefore challenges the traditional model of university organization.

So where do you place the horse – before or after the cart?

Now design a TLA to help your students put knowledge to work (Task 8.2, p. 159).

Summary and conclusions

Functioning knowledge and professional education

Professional education is chiefly concerned with putting declarative knowledge to work as functioning knowledge. The usual means of doing this is to build the declarative knowledge base first, as we saw in the last chapter, but in problem-based learning, that knowledge base is built in the process of its being applied. 'Apply' is the most typical verb in functioning knowledge. It is important to see that the TLAs used ensure that the students themselves do the applying and not just watch someone else doing it or telling them about it. Functioning knowledge may be used in teacher-managed, student-managed or self-managed situations.

Teaching/learning activities for 'apply'

Case-based learning has had a long history in applying theory to practice. A common teaching/learning situation for 'apply', depending on applying what to what, is groupwork. We looked at different types of group: syndicate, jigsaw, buzz groups, brainstorming, learning cells, or reciprocal questioning, to name a few. Students may on their own initiative set up their own spontaneous learning groups. The suitability of which type will, of course, depend on the ILO in question. Workplace learning is used precisely because it is concerned with application and also in service of lifelong learning.

Task 8.2 ILOs and TLAs in putting knowledge to work

Take one of your course ILOs relating to functioning knowledge, where students are expected to put knowledge to work in practical contexts. Identify what teaching/learning situations you use and identify the teacher and student activities. Are the student activities aligned to the ILO? Would they really help the students achieve that ILO?
ILO relating to functioning knowledge in my course: _____

Teaching/learning situation	*TLAs*	
	Teacher activities	*Student activities*

Are the students performing the ILO verb(s)? _____

Do I need to change the TLAs? _____

What changes would I make? _____

Teaching/learning activities for creativity

Almost all graduate attributes mention 'creativity' in some form or another, but most university teaching emphasizes convergent rather than divergent thinking. Both ways of thinking are important in all high-level functioning. Creativity is characterized by open-ended thinking based on a sound knowledge base, resulting in products with some degree of originality. Such creative work can be positively encouraged in a number of ways. Unfortunately, it is all too easily discouraged by insisting on a regimen of correct answers rather than experimenting with ideas and creating a Theory X type of climate in which students are fearful of taking risks and exploring different possibilities.

Teaching/learning activities relating to lifelong learning

Lifelong learning opens a range of learning: just-in-time learning, work-based learning and continuing professional education, which go well beyond undergraduate education. Undergraduate courses can, however, prepare students for later just-in-time and work-based learning – as indeed PBL has been already doing for many years. TLAs for ILOs preparatory for lifelong learning need to emphasize learner information literacy and reflective self-direction. The latter may be achieved by teaching students both generic and content-specific study skills and by reflective practice. Students need to be able to manage their space and time effectively, to be able to seek new information, especially by using search engines strategically and to carry out effectively those strategies that are specific to their content area. Additionally, they need to be able to reflect on past practice, with the intention of improving what they have done and of solving new problems they haven't met before.

Problem-based learning (PBL)

PBL is an example of a total approach to the main aims of lifelong learning. In solving the selected curriculum problems, the intended outcomes that students will acquire are: the necessary declarative knowledge and applications to real problems; the skills and strategies needed for acquiring new knowledge; and the metacognitive skills for applying that knowledge to unseen, 'fuzzy' problems and evaluating the effectiveness of problem solutions. Students taught by PBL think differently from traditionally taught. They may have less declarative knowledge, but use what they have to reason more effectively and to apply the products of their reasoning; they have greater self-awareness and self-direction; and they enjoy learning more, as indeed do their teachers. However, PBL is sensitive to insensitive teaching. An institutional problem is that the infrastructure for PBL is not discipline based, whereas most universities are organized on disciplinary lines. Teachers tend to identify themselves as scholars in their home discipline and PBL might seem to threaten their academic identity.

Further reading

On group work

Abercrombie, M.L.J. (1980) *Aims and Techniques of Group Teaching*. London: Society for Research into Higher Education.

Collier, K.G. (1983) *The Management of Peer-Group Learning: Syndicate Methods in Higher Education*. Guildford: Society for Research into Higher Education.

Johnson, D.W. and Johnson, R.T. (1990) *Learning Together and Alone: Cooperation, Competition and Individualization*. Englewood Cliffs, NJ: Prentice-Hall.

The first two are very practical accounts of using groups effectively. Johnson and Johnson is the classic on setting up cooperative learning groups.

Working in Groups – A Note to Faculty and Quick Guide for Students. Derek Bok Centre for Teaching and Learning, Harvard University.

The following website has links to all aspects of classroom teaching and assessment: http://www.brookes.ac.uk/services/ocsd/2_learntch/2_learnt.html

On case-based learning

Lynn, L.E. (1996) *What is the Case Method? A Guide and Casebook*. Tokyo: The Foundation for Advanced Studies on International Development.

Rangan, K. (1995) Choreographing a case class. http://www.hbsp.harvard.edu/products/cases/casemethod/rangan.pdf; www.queensu.ca/ctl/goodpractice/case/resources.html; www.use.edu/programs/cet/resources/casebased; www.healthsci.utas.edu.au/faculty/cases/newindex.html

On the effectiveness of case-based learning: www.cuhk.edu.hk/sci/case-learning/doc/reflections.pdf

On creativity

Jackson, N., Oliver, M., Shaw, M., and Wisdom, J. (eds) (2006) *Developing Creativity in Higher Education: The Imaginative Curriculum*. London: Routledge.

Laurillard, D. (2002) *Rethinking University Teaching*. London: Routledge Falmer. See references to adaptive and productive media.

Jackson et al. derives from the Imaginative Curriculum Project. Concerned that current quality assurance, peer review, pressures on research output and so on were discouraging innovation and creativity, academics teaching across all disciplines show how creativity can be integrated into normal university teaching. The chapters by Jackson and Sinclair on a pedagogy for creativity and Baillie on art, science and engineering are noteworthy for deriving TLAs. Laurillard shows how technology can be used with conversations between student, teaching and machine to advance high-level and creative thinking.

Mycoted, on teaching for creativity: 'The A to Z of creativity techniques': http://www.mycoted.com/creativity/techniques/

And the link to creativity on the Higher Education Academy website: http://www.heacademy.ac.uk/creativity.htm

Mycoted has an extensive range of 'creativity techniques' that will provide a source of ideas; the Higher Education Academic website has many useful links.

On workplace learning

The Journal of Workplace Learning. http://www.emeraldinsight.com/info/journals/jwl/jwl.jsp

Guidelines for workplace learning from the University of Tasmania: www.utas.edu.au/tl/supporting/workplace_learning.html

On lifelong learning

Knapper, C. and Cropley, A. (2000) *Lifelong Learning in Higher Education*. London: Kogan Page.
http://www.lifelonglearning.co.uk/
http://www.adelaide.edu.au/clpd/materia/leap/leapinto/LifelongLearning.pdf

Where do we start selecting? Knapper and Cropley's book is one of the classics in this area. The two home pages are of lifelong learning sites, one in the UK, the other in Australia, with plenty of links.

On problem-based learning

Boud, D. and Feletti, G. (eds) (1997) *The Challenge of Problem-based Learning*. London: Kogan Page.
Savin-Baden, M. (2000) *Problem-based Learning in Higher Education: Untold Stories*. Buckingham: The Society for Research into Higher Education/Open University Press.
Research and Development in Problem Based Learning. The Australian Problem-Based Learning Network c/o PROBLARC, CALT, The University of Newcastle, NSW 2308.

Boud and Feletti contains contributions by users in many different areas. Savin-Baden introduces a little-discussed aspect: what happens *inside* when teachers and students experience PBL. Both books are important for anyone seriously interested in PBL. The last is a serial publication of the Australian Problem-Based Learning Network, which holds biennial conferences, of which these volumes are the proceedings.

Waters, L. and Johnston, C. (2004) Web-delivered, problem-based learning in organisation behaviour : a new form of CAOS, *Higher Education Research and Development*, 23, 4: 413–431.

An e-version of PBL in teaching organizational behaviour is based on *Case Analysis of Organisational Situations*.

PBL in biology (20 case examples): www.saltspring.com/capewest/pbl.htm
PBL in physics, chemistry, biology and criminal justice: www.udel.edu/pbl/problems
PBL in engineering: http://fie.engrng.pitt.edu/fie2001/papers/1102.pdf

9

Aligning assessment tasks with intended learning outcomes: Principles

What and how students learn depends to a major extent on how they think they will be assessed. Assessment practices must send the right signals to students about what they should be learning and how they should be learning it. Current practice, however, is distorted because two quite different models of summative assessment have, for historical reasons, been confused and the wrong signals to students are often sent. In this chapter, these issues are clarified. We examine the purposes of assessment, the relation between assessment and the assumed nature of what is being assessed, assessing for desirable but unintended or unexpected learning outcomes and who might usefully be involved in the assessing process. The underlying principle is that the assessment tasks should comprise an authentic representation of the course ILOs.

Formative and summative assessment

There are many reasons for assessing students: selecting students, controlling or motivating students (the existence of assessment keeps class attendance high and set references read), satisfying public expectations as to standards and accountability, but the two most outstanding reasons are for *formative feedback* and for *summative grading*. Usually – and perhaps unfortunately – both are referred to as types of 'assessment'. Both are based on seeing how well students are doing or have recently done, which is what assessment is, but the purposes of the two forms of assessment are so different.

In formative assessment, the results are used for *feedback* during learning. Students and teachers both need to know how learning is proceeding. Formative feedback may operate both to improve the learning of individual students and to improve the teaching itself. Formative feedback is inseparable from teaching: as we have already noted (p. 97), the effectiveness of different teaching methods is directly related to their ability to provide formative feedback. The lecture itself provides little. The improvements to the lecture

mentioned in Chapter 7 were almost all formative in function: they got the students learning actively and feedback was provided on their activity, either from teacher or from peers. Formative feedback is a powerful TLA that uses error detection as the basis for error correction: if error is to be corrected, it must first be detected. Thus, students must feel absolutely free to admit error and seek to have it corrected. Students also need to learn to take over the formative role for themselves, just as writers need to spot error and correct it when editing a text by reflecting critically on their own writing. Self- and peer-assessment are particularly helpful TLAs for training students to reflect on the quality of their own work.

In summative assessment, the results are used to grade students at the end of a course or to accredit at the end of a programme. Summative assessment is carried out after the teaching episode has concluded. Its purpose is to see how well students have learned what they were supposed to have learned. That result, the grade, is final. Students fear this outcome; futures hinge on it. They will be singularly unwilling to admit their mistakes. Error no longer is there to instruct, as in formative assessment; error now signals punishment. This difference between formative and summative reminds us that continuous assessment (see later) is problematic when it is used for both formative and summative purposes. What then does the student do about admitting error? This is one area where the same word 'assessment' leads to confusion.

Nevertheless, there is one similarity: in both we match performance as it is, with performance as it should be. When the student is aware of the immediate purpose to which it is being put, the same task can act as a TLA, in the formative sense, and as the assessment task when it is time to do the summative assessment: 'When the chef tastes the sauce it is formative assessment; when the customer tastes, it is summative' (Anon.). Figure 9.1 places tasting the sauce in a classroom context.

Say four topics are to be learned in a semester. The ILOs of each are symbolized as IL01, IL02, IL03 and IL04. At the start of the semester (labelled 'baseline') students enter with little or some knowledge, which the TLAs nurture until the end of the semester. Formative assessment checks that growth and sees that it is on track. Then it is time to see where each student now stands with respect to each of the four topics; this is the task of summative assessment. Finally, there is the administrative matter of converting those four positions into a grade, taken here as A, B, C and D.

A caution in interpreting Figure 9.1. While the same assessment task may be used formatively throughout the course and summatively at the end, it must be clear to the students when it is being used for what purpose. To use it for *both* formative and summative purposes, as may happen in continuous assessment, creates a conflicting situation for the students: they are being asked to display and to hide error simultaneously. When assessment is continuously carried out throughout a course, and it is intended to use some of the results summatively, the students must be told *which* assessment events are formative and which summative. They can then decide how they will handle the task to best advantage.

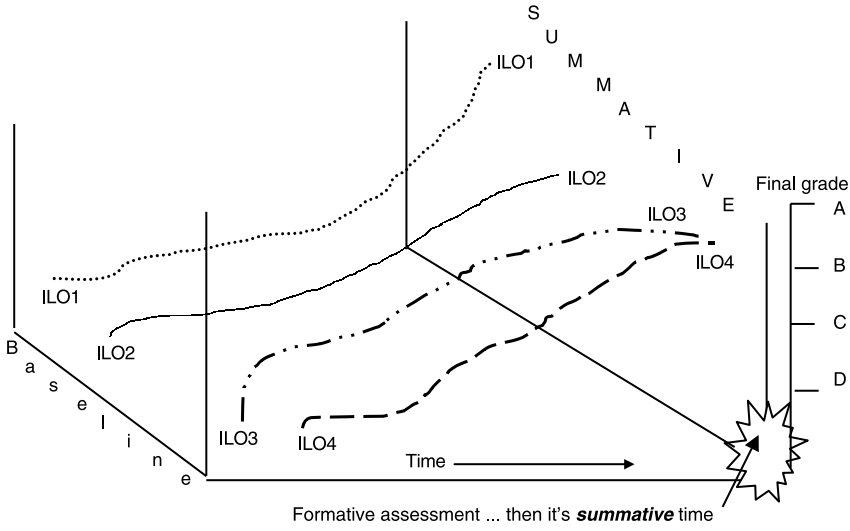

Figure 9.1 Learning in four topics and their formative and summative assessment

Two quite different models of summative assessment have become confused. Our intended learning outcome of this chapter is that readers will unconfuse themselves so that they may apply the appropriate model to their own assessment practices.

But before we do this, Task 9.1 present six dilemmas ('cases') relating to assessment practice. Go through these, writing your responses down. When you have completed this chapter you might like to revisit what you wrote to see if your thoughts might have changed.

Task 9.1 Some cats to place among your collegial pigeons: six assessment dilemmas for you to consider

Case 1. Misunderstanding the question

You are assessing assignments and find that one student has clearly misunderstood the question, the only one to have done so. It is now past the due date for handing in. If you assess it as it is, she will fail. What do you do?

a Fail her.
b Hand it back, explain that she has misunderstood and give her an extension.
c As in (b), but assess it pass/fail only or deduct a grade.
d Set her another assignment, to be assessed later. Meantime record 'result withheld'.
e Other. What?

What are the reasons for your decision? _____

_____

_____

_____

Would you have decided differently if she would otherwise graduate with distinction?

_____

_____

Case 2. Grading on the curve

The guidelines for awarding a grade of A are outlined in a programme document:

> *Outstanding*. Demonstrates thorough understanding and interpretation of topics and underlying theories being discussed, and shows a high level of critical thinking and synthesis. Presents an original and thorough discussion. Well organized and structured, fluently written and correctly documented. There is evidence of substantial studies of the literature.

You use these guidelines in grading the assessment tasks of your class of 100 students and find to your delight that 35 (35%) meet these criteria, so you award A to all of them. Your departmental head, however, is unhappy about this because you are 'not showing enough discrimination between students and we don't want this department to get a reputation for easy marking'. The results have not been announced yet, so he suggests that you regrade so that only 15% of your students are given an A. What do you do? Why?

a You agree you must have been too lenient, so you do as he says, giving A to the top 15 only, the remaining of the original As being given B.
b You compromise, splitting the difference: you give As to 25 students.
c You say something like: 'Sorry, but the guidelines are clear. I must in all conscience stick with the original. The conclusion to be drawn is that this was an exceptionally good group of students and that they were taught well.'
d 'I must stick with the guidelines. However, I am prepared to entertain a second opinion. If I can be persuaded that I have been too lenient, I will change my grades.'
e Other.

_____

_____

_____

_____

Case 3. A matter of length

It is policy that the maximum word length of assignments is 1000 per credit point. You are teaching a 2-credit point module. One of your better students has handed in an assignment of 2800 words. What do you do and why?

a Count up to 2000 words, draw a line and mark or assess up to that point only.
b Hand it back to the student with the instructions to rewrite, within the limit, with no penalty.
c As for (b) but with a penalty. (What would you suggest?)
d Hand it back unassessed.
e Assess or mark it but deduct a grade or part-grade, or marks, according to the excess.
f Other.

_____

_____

Would your decision have been any different if it were a poor student?

_____

_____

Case 4. Exam strategy

You are discussing the forthcoming final exam with your first year class. You explain that, as usual, there will be five sections in the paper, each section covering an aspect of the course, and there are two questions per section. They are to choose one of the two, making a total of five questions, to be completed in three hours. You alone will be doing the assessing. A student asks: 'If I think I will run out of time, is it better to answer four questions as best as I can, or to attempt all five, knowing I won't finish most questions?'

What do you say in reply and why?

_____

_____

_____

Case 5. Interfering with internal affairs?

You are the head of a department that has decided to use problem-based learning in the senior level subjects. In PBL, the emphasis is on students applying knowledge to problems, rather than carrying out detailed analyses of the research literature, as has been the tradition in the past. Faculty regulations require you to set a final examination for

the major assessment of the course, despite your own judgment and that of your staff that this format is unsuitable for PBL. It is therefore decided that the final exam will contain questions that address application to problem solving rather than questions that require students to demonstrate their familiarity with the literature.

On seeing the paper, however, the external examiner insists that the questions be reworded to address the research literature. You argue, but he insists that 'academic standards' must be upheld. If they are not reworded, you know that he will submit an adverse report to the academic board, where there are vocal critics of your foray into PBL.

What do you do?

Case 6. What is the true estimate of student learning?

A department is trying to arrive at a policy on the proportion of final examination to coursework assignments. In discussing the issue, the head collates data over the past few years and it becomes very clear that coursework assessments are consistently higher than examination results. In discussing this phenomenon, the following opinions are voiced. Which argument would you support?

a Such results show that coursework assessments may be too lenient and because the conditions under which they are undertaken are not standardized, and are unsupervised, the results may well be inflated by collaboration and outright plagiarism. Examination conditions control for these factors. Therefore final exams must be a higher proportion of the final grade than coursework assessments.

b The conditions under which final examinations are conducted are artificial: working under time pressure, little and often no access to tools or data sources, and mode of assessment limited to written expression or MCQ, means that exam performances are sampling only a narrow range of students' learning. Therefore coursework assessments must be a higher proportion of final grade than exams.

c Other. What?

Effects of assessment on learning: Backwash

We teachers might see the intended learning outcomes as the central pillar in an aligned teaching system, but our students see otherwise: 'From our students' point of view, assessment always defines the actual curriculum' (Ramsden 1992: 187). Students learn what they *think* they will be tested on. This is *backwash*, a term coined by Lewis Elton (1987: 92), to refer to the effects assessment has on student learning, to the extent that assessment may determine what and how students learn more than the curriculum does.

Backwash is almost invariably seen negatively (Crooks 1988; Frederiksen and Collins 1989). Recall the 'forms of understanding' that Entwistle and Entwistle's (1997) students constructed to meet presumed assessment requirements (see pp. 74–5). Negative backwash always occurs in an exam-dominated system. Strategy becomes more important than substance. Teachers actually teach exam-taking strategies, such as telling students to attempt all questions even if they don't finish any because they gain more marks than by thinking deeply over a question and providing a complete answer. Students go through previous papers, best-guessing what questions they will encounter and then rote learning answers to them. This sort of backwash leads inevitably to surface learning. Yet learning for the assessment is also inevitable; students would be foolish if they didn't. So, what do we do about it?

In fact, backwash can work positively, encouraging appropriate learning. This is when the assessment is aligned to what students should be learning (Figure 9.2).

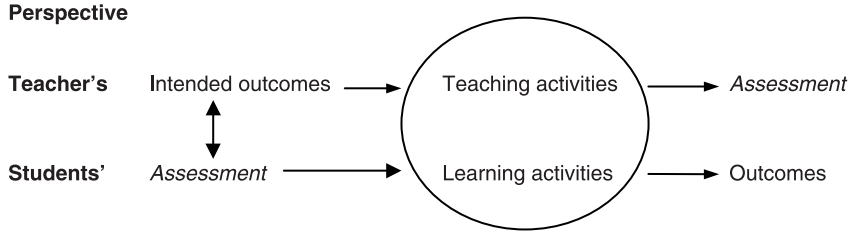

Figure 9.2 Teacher's and student's perspectives on assessment

To the teacher, summative assessment is at the end of the teaching–learning sequence of events, but to the student it is at the beginning. If the intended outcomes are reflected in the assessment, as indicated by the downward arrow, the teaching activities of the teacher and the learning activities of the student are both directed towards the same goal. In preparing for the assessments, students will be learning the intended outcomes.

It sounds easy, but there is a long tradition of thinking about assessment, and some time-honoured assessment practices, that complicate matters. In this chapter, we clarify some of the conceptual issues involved; in the next, we deal with designing and grading assessment tasks for declarative knowledge

and, in the chapter after that, designing and grading assessment tasks for functioning knowledge.

Measurement model of assessment

Two quite different models of assessment underlie current thinking and practice: the *measurement* model and the *standards* model (Taylor 1994). Understanding the difference between the two models is basic to effective assessment.

In the Chinese Han Dynasty in the 4th century BC, the purpose of education was selective. Students were required to master a huge classical curriculum, in order to put into effect Confucius' belief that 'those who excel in their study should become officials' (quoted in Zeng 1999: 21). The winners, however lowly their background, were motivated by a rich prize: a lifetime of wealth and prestige. The idea was to select the best individuals in terms of stable characteristics: 'not only intelligence, but also character, determination, and the will to succeed' (Zeng 1999: iv).

Twenty-three centuries later, psychologists in the 19th century also became interested in sorting people out. Sir Francis Galton (1889) found that physical and mental differences such as height, weight and performance on various mental tests, which he called 'traits', were distributed in 'an unsuspected and most beautiful form of regularity' (Galton 1889: 66). He was of course referring to the normal curve, a distribution that occurs inter alia as a result of the extent of the polygenetic inheritance of such traits. Galton's assumptions, not only about statistical techniques, but also about the inheritance of ability and of educability, were built into the burgeoning industry of mental testing in the early part of the 20th century.

Educability was assumed to be about how bright people were and, back to the Han Dynasty, education was seen as a device for sorting people out: usually the brightest, but sometimes to sort out those who weren't educable in normal schools. The present so-called 'parametric' statistical procedures such as correlation and factor analysis were based on Galton's work and are used for constructing educational tests, establishing their reliability and validity and interpreting test scores. Taylor (1994) refers to this individual differences model as 'the measurement model' of educational assessment.

The measurement model was originally designed by psychologists to measure stable traits and abilities and to express that measurement along a graduated scale so that individuals could be compared, either against each other or against population norms. This is fine for research, or for diagnosis when dealing with individuals – for example to say how atypical a person is on reading ability – but the model was hijacked and applied to assessing *educational* outcomes in the form of norm-referenced assessment (NRA).

In NRA, results of assessment are reported in terms of comparisons between students. The rank order is the simplest example, which tells who

performs better than who, but there are sophisticated versions of NRA, such as grading on the curve, which we discuss later.

For now, let us examine some of the assumptions the measurement model is based on when applied to assessing classroom learning.

Some assumptions of the measurement model

(*Note*: Beware the following subheadings: all are either wrong or misleading.)

Knowledge can be quantified

Measurement requires that the learning outcomes of individual students are quantified as scores along a single dimension or continuum so that individuals may be compared with each other. In practice, this means that learning is evaluated according to *how much* material has been learned correctly. Good learners know more than poor learners. The Level 1 view of teaching makes essentially quantitative assumptions, as we noted in Chapter 2: teaching involves transmitting the main points, assessment involves marking students on their ability to report them back accurately. The uni- and multistructural levels of the SOLO taxonomy are quantitative, where learning is a matter of finding out more and more about a topic. But if you assess only using quantitative techniques, what happens to the higher levels of the SOLO taxonomy: to our ILOs addressing critical analysis or hypothesizing?

Percentages are a universal currency

One of the commonest forms of quantification is the percentage, derived either as the ratio of number right to maximum possible multiplied by 100, or as sets of ratings the maxima of which total 100. When this transformation is carried out, it is assumed that percentages are a universal currency, equivalent across subject areas and across students, so that different students' performances in different subjects can be summed, averaged and directly compared. This is completely unsustainable, yet that doesn't stop university senates having long and earnest debates about one faculty using 75% as the cut-off for an A grade and another using 70% as the cut-off: 'We must level the playing field across faculties! It's not fair if it's easier to get an A in arts than it is in science!' Such debates are silly: they are trying to extract certainty from the unknowable. There is simply no way of knowing if 75% in physics is the 'same standard' as 75% in history; or even if a student's result of 75% in Psychology 201 this year represents an improvement over 70% the same student obtained in Psychology 101 the previous year.

Educational tests should be designed to clearly separate the high and low scorers

Measurement experts used to maintain that a good attainment test yields 'a good spread', following the bell curve (back to Galton). However, grades follow the bell curve only if two conditions apply: that ability is normally

distributed, and that ability is the sole determinant of academic attainment. But the ability of our students is not likely to be normally distributed because students are not randomly selected – not quite yet, anyway. And neither is ability the sole determinant of students' learning outcomes. Other factors are called 'teaching' and 'learning'. As argued in Chapter 1, good teaching narrows the initial gap between Robert and Susan therefore producing a *smaller* spread of final grades than that predicted by the initial spread of ability. The distribution of results after good teaching should not be bell shaped but skewed, with high scores more frequent than low scores. At university level there is therefore every reason *not* to expect a bell curve distribution of assessment results in our classes. Forcing assessment results to follow the curve actually prevents us from seeing how students are really performing.

Quantitative approaches to assessment are scientific, precise and objective

Numbers mislead. The measurement model yields an extended continuous scale that invites us to make minute distinctions between students, but we have to be careful. The error of measurement in our usual class sizes is bound to be rather more than one percentage point. Worse, the way we use the scales prevents them from being equal interval scales, where the difference between any two adjacent numbers is the same as any other two. This is an *essential* property if we are to average and accumulate marks. The difference between 73 and 74, say, must be the same as the difference between 79 and 80, if marks are to be added or averaged. But the difference between 79 and 80 often becomes zero if first class honours is awarded to a dissertation of 79 marks when the cut-off is 80 (see Box 9.3, p. 182). Many times, teachers and boards of examiners are faced with the borderline case and argue that as the scale is not accurate to one mark, we'll give the student the benefit of the doubt. This, however, makes our scale elastic, distinctly more rubbery at some points along the scale than at others.

Do such decisions show how human we are or just how sloppy? We are both and neither. We are being wonderfully inappropriate, like cooking dinner in the chemistry lab. The precision of the parametric measurement model is just as out of place in the classroom as is weighing sugar in milligrams. It is worse, actually, because the procedure of quantifying qualitative data, such as shifts in students' understandings, requires arbitrary judgments as to what is a 'unit', what is 'worth' one mark, what is worth five or however many marks. These judgments are not only subjective; they often do not even have an explicit and examinable rationale, beyond a vague norm referencing: 'I am marking out of five, this is the best so it gets five, this is average so it gets three marks.' What the *criteria* are that allow the judgement that this one is 'best' and that one 'average' may not be examined.

What happens, then, is that a series of independent minor subjective judgments – a mark for this, a mark for that – accumulate. The big decision – pass or fail?, first class or upper second? – is made on the aggregate of numbers, which includes the aggregate of error in all those minor judgments. That big decision should be made, not on the accumulation of

unknowably flawed minor judgments, but on a reasoned and publicly sustainable judgment about the performance itself. This requires a holistic judgment made on publicly stated criteria.

The application of a precise, scientific model to an area where it does not apply cannot be scientific.

University education is selective

Comparing students with each other assumes that universities are a selective device to find the intellectuals in the population, as in Han Dynasty China, or that the purpose of the undergraduate years is to weed out the 'pass' level students from the potential postgraduate research students.

The only place for assessing students selectively in the university context is for entry to university or to graduate school. At entry, a convenient estimate of scholastic ability is obtained by summing a student's best three, or best five, HSC or A level subjects, with or without adjustments for second attempt. What you get is a measure of scholastic ability, which is robust enough to allow direct comparisons between students in different subject areas. It is rough, but it works over large numbers. Once students have been selected, however, the aim of undergraduate teaching is to get students to learn what is in the curriculum, an enterprise in which the measurement model has no place.

But shouldn't the entry into university, and especially into graduate school, be based on whether the students are able to meet the criteria or standards necessary for doing graduate work? You don't answer that question by comparing students with one another.

The above assumptions give rise to some common practices.

Grading on the curve

After ranking, a common form of norm-referenced assessment is 'grading on the curve'. The top 10% of the class, say, are awarded 'high distinction', the next 15% 'distinction', the next 25% 'credit' and 45% 'pass'. The results will appear to be stable from year to year and from department to department. If there is a query from the odd student about the grade awarded, it is easy to point to an unarguable figure: all objective, very precise. 'You didn't earn enough marks to beat the others. They were too good for you. Sorry.'

The very term 'high distinction' is comparative, applicable only to that blessed few who are highly distinguished. This puts the brake on the number of HDs awarded. Even if one-third of the class met the criteria set for obtaining a high distinction, it would be seen by colleagues on the board of examiners, with the bell curve tolling in their heads, as a contemptible fall in standards, not as it should be a cause for congratulation. Rather than calling the highest grade a 'high distinction', the neutral term 'A' makes it easier to accept that a high proportion of students could reach that high standard.

Many people, teachers, administrators, and even students, feel it 'fitting' that a few should do extremely well, most should do middling well and a

few do poorly, some failing. This feeling comes straight from the assumptions that ability determines learning outcomes and that ability is normally distributed. Both assumptions are untenable, as we have seen.

Unfortunately, grading on the curve is so easy. All you need is a test that will rank order the students – a quick and dirty MCQ will do – and then you simply award an A to the first 10%, B to the next 25%, or whatever has been decided, and so on. Alignment is irrelevant.

Grading on the curve also appeals to administrators, because it conveys the impression that standards over all departments are 'right', not too slack, not too stringent, so that a few do really well, most middling and a few poorly: we have got it *right*, year after year. But that result is an artefact: the distribution has been defined that way, whatever the actual results in any given year or department.

Grading on the curve precludes aligned teaching and criterion-referenced assessment. It is a procedure that cannot be justified on educational grounds.

Marking

Marking is an assessment procedure that comes directly from quantitative assumptions and is so widespread as to be universal. It is, however, a procedure that needs to be examined closely. Marking is quantifying learning performances, either by transforming them into units (a word, an idea, a point), or by allocating ratings or 'marks' on a subjective if not arbitrary basis. For marking to be acceptable, we have seen that one mark must be 'worth' the same as any other, so that they can be added and averaged and a grade is awarded on the number of marks accumulated. Two most peculiar phenomena are associated with marking:

1 Half the total number of marks available is almost universally accepted as the pass mark.
2 It does not matter *what* is correct, as long as there are enough of them.

Multiple-choice tests enact these assumptions exactly. Learning is represented as the total of all items correct. Students quickly see that the score is the important thing, not how it is comprised, and that the ideas contained in any one item are of the same value as in any other item. The strategy is to focus on the easy or trivial items; and of the alternatives you don't know, check the ones that seem vaguely familiar. You'll almost certainly get more than half correct – and by defintion you'll pass.

The essay format, technically open ended, does not preclude quantitative means of assessment. When multiple markers use marking schemes, they give a mark or two as each 'correct' or 'acceptable' point is made, possibly with bonus points for argument or style. This too sends misleading messages to students about the structure of knowledge and how to exploit its assessment. A good example is the strategy in timed examinations of attempting all

questions and finishing none. The reasoning is that the law of diminishing returns applies: the time spent on the first half of an essay nets more marks than the same time spent on the second half. The more facts the more marks, never mind the structure they make. But students don't learn 'marks', they learn such things as structures, concepts, theories, narratives, skills, performances of understanding. These are what should be assessed, not arbitrary quantifications of them. It is like examining architects on the number of bricks their designs use, never mind the structure, the function or the aesthetic appeal of the building itself.

Assessment separated from teaching

In the measurement model, assessment is a standalone activity, unrelated to teaching as such. Accordingly, it attracts its own context and culture. One feature is the need for standardized conditions including the same assessment tasks for all, a necessary condition when students are to be compared with each other. Guaranteeing standardized procedures leads to a Theory X, bureaucratic assessment climate: emphasis on decontextualized assessment tasks that address declarative, not functioning, knowledge.

In universities that work in this way, teaching occupies the greater part of the academic year, assessment a frantic couple of weeks at the end. Both the present writers can recall, now with shame, not even thinking about the final examination until the papers were due to be sent to the central examinations section. You teach as it comes, you set an examination, the examination centre invigilates it for you, you allocate the marks.

Alignment doesn't come into it.

Effects of backwash from the measurement model

Measurement model procedures send unfortunate messages to students:

- *The trees are more important than the wood.* Maximizing marks is the important thing, not seeing the overall structure of what is being learned. Put another way, the measurement model encourages multistructural thinking, not relational or extended abstract.
- *Verbatim responses will gain marks.* Although a verbatim replay of a unit in the text or in the lecture may not be very noble, it has to be given some credit when using a multistructural marking scheme, given cheating has been ruled out. This happens even when the teacher warns that verbatim responses will be penalized (Biggs 1973 (regrettably)).
- *Success or failure is due to factors that are beyond the student's control.* An individual's result under NRA depends on the competition, who is more able. Thus, in the event of a poor result, the student can either blame bad luck or, more damagingly, come to the conclusion that he or she is simply not as able as other people. Students can't do anything about luck or ability,

so why bother? The attribution under the standards model is different: 'Here is what I am supposed to have achieved, I didn't achieve it, so what went wrong?' The answer to that could be: 'I didn't put in enough effort', 'I didn't know how to do it' but, at worst: 'I am dumb.' The first two attributions are under the students' control and they can do something about doing better next time. The last couldn't be more discouraging.

The case against the measurement model is pretty convincing, so why do its procedures remain? Box 9.1 suggests some answers.

Box 9.1 Why measurement model procedures remain

1 *Tradition, habit.* Why question what has worked well in the past, especially when administrative structures and procedures make change difficult?

2 *Bureaucratic convenience*

- Dealing with numbers gives the illusion of precision. Any appeal or disagreement is over trivial issues. Let the numbers make the big decisions.
- Grading on the curve gives the illusion of constant standards, no egregious departments or results.
- The language of percentages is generally understood (another illusion).
- Given the tight security of exams, avoidance of plagiarism can be assured.
- Combining results from different departments needs a common framework: the percentage and normalized scores (both illusions, see earlier point).

3 *Teaching convenience*

- You teach, the exam questions can be left until well into the teaching, exams section will see to the details. It is flexible on coverage, what questions you set.
- You can easily average and combine marks across tasks and across courses.
- You can use marks for disciplinary purposes (deduct for late submission).
- It's easier to argue numbers with students in case of dispute than to argue 'subjective' structures.

4 *Genuine belief in the measurement model.* My job *is* to sort the sheep from the goats.

Let us now turn to the alternative, the standards model.

Standards model of assessment

The standards model of assessment is designed to assess changes in performance as a result of learning, for the purpose of seeing what, and how well, something has been learned. Such assessment is criterion-referenced (CRA), that is, the results of assessment are reported in terms of how well an individual meets the criteria of learning that have been set. This model is the relevant one for assessment at university (Taylor 1994). The point is not to identify *students* in terms of some characteristic, but to identify *performances* that tell us what has been learned, and how well. Unlike in NRA, one student's result is quite independent of any other student's.

In 1918, R.L. Thorndike made it very clear that CRA was most appropriate for educational purposes, and predicted that CRA would displace NRA from public schooling (Airasian and Madaus 1972). He was right about the first point, but, unfortunately, his prediction was wrong. The idea still lurks that education *is* a selective exercise, and that norm-referenced examinations are appropriate. But even where this idea is not explicit, the procedures of constructing and administering tests, establishing reliability and validity and interpreting and reporting test scores are based on parametric statistics, as if the biological assumptions of polygenetic inheritance, which produce the normal curve, are appropriate for educational assessment. As already argued, for purposes of classroom assessment such statistics as the correlation and the usual tests of reliability and validity are entirely inappropriate. Reliability and validity of assessments are important, but they have entirely different meanings in the standards model (pp. 188–90).

Outside educational institutions, the standards model is assumed whenever anyone teaches anyone else anything at all. The teacher has a standard, an intended outcome of their teaching, which the learner is to learn satisfactorily. Parents intend their children to learn to dress themselves to a given standard of acceptability, swimming instructors have standards they want their learners to achieve. Parents don't lecture a toddler on shoe tying, and give a multiple-choice test at the end to see if their child ties her shoes better than the kid next door. The parent's ILO, the teaching/learning activity and the assessment are all the same: it is tying a shoe. In the case of driving instruction it is driving a car. The alignment is perfect. Outcomes-based teaching and learning is placing this approach back into the institution.

The logic is stunningly obvious: Say what you want students to be able to do, teach them to do it and then see if they can, in fact, do it. There is a corollary: if they cannot do it, try again until they can. This principle is used in 'mastery learning' (Bloom et al. 1971) and the Keller Plan, a mastery model for universities (Keller 1968). Students are allowed as many tries at the assessment as they need – within reason – in order to pass the preset standard. Some students pass in short order, others take longer. The main objections to mastery-learning models were not to the principle, but to the fact that the preset criteria were defined quantitatively, mainly because quantitative criteria are easy to define. In one study with high school biology

students, the Roberts who focused on memorizing detail performed well in such a mastery-learning approach, but not the Susans who were bored stiff (Lai and Biggs 1994).

Such objections do not apply when the standards are defined *qualitatively*. Qualitative assessment does not directly address the question of *how much* the student knows, but *how well*. This requires an explicit classification of learning quality that needs to be derived for each topic or skill taught. The SOLO taxonomy is a general model of learning quality that can be adapted to suit particular content (see Chapter 5).

Let us now look at the assumptions needed to make the standards model of assessment work.

Some assumptions of the standards model

We can set standards (criteria) as intended learning outcomes of our teaching

Yes we can, as outlined in Chapter 5. If the intended learning outcomes are written appropriately, the job of the assessment is to state how well they have been met, the 'how well' being expressed not in 'marks' but in a hierarchy of levels, such as letter grades from 'A' to 'D', or as high distinction through credit to conditional pass, or whatever system of grading is used. Deciding at the level of a particular student performance is greatly facilitated by using explicit criteria or rubrics (examples on pp. 210–Table 10.2, 214–Table 10.4, 226–Table 11.2). These rubrics may address the task, or the ILO.

Different performances can reflect the same standards

While standardized conditions are required when individuals are to be compared to each other, when we are seeking to find the optimum performance of individuals, the more standardized the conditions the less valid the test is likely to be for any given individual. Individuals learn and perform optimally in different conditions and with different formats of assessment. Some work better under pressure, others need more time. As in professional work itself, there are often many ways of achieving a satisfactory outcome. Individual students demonstrate their best work in different ways; assessment tasks such as portfolios allow for that.

Teachers can judge performances against the criteria

This is critical when using the standards model but it is skirted when using the measurement model. In the latter, teachers need to answer the following question: 'How many marks do I give this section?' and in the former: 'How well does this performance as a whole meet the criteria for high distinction (or whatever)?' In order to make these holistic judgments teachers need to know what is poor quality performance, what is good quality and why.

Constructive alignment operates on these same assumptions and addresses how they may work in practice.

Norm- and criterion-referenced assessment: Let's get it straight

Differences between NRA and CRA

Because of the universality of many NRA practices in assessing students, and the educational logic of CRA, we should be clear about the differences. To recap briefly:

1. In NRA, the results are expressed in terms of comparisons between students after teaching is over. CRA results are expressed in terms of how well a given student's performance matches criteria that have been set in advance.
2. NRA makes judgments about *people*, CRA makes judgments about *performance*.

Task 9.2 presents a criterion-referenced test to sort the sheep from the goats (joke).

Task 9.2 NRA or CRA?

A teacher assesses two students in a CRA system and notes that Robert has been awarded a B and Susan an A. On a recheck of the papers, the teacher notes with a shock that Robert's paper *is* as good as Susan's! He is reassessed and given an A too.

Is this now NRA (comparing students) or CRA (judging on standards)? Why?

_____

_____

The answer is at the end of this chapter.

A summary of the differences between CRA and NRA is captured in Table 9.1, which lists a lexicon of NRA and CRA words. The only word common to both? Summative assessment.

Nevertheless, it is easy to blur the two models. Box 9.2 (p. 181) represents a valiant attempt by an arts faculty at one university to move towards the standards model. Previously, a marks system was used to define 'A+', 'A' and 'A–' and so on, and the attempt was made at faculty board to devise a scheme that defined the grading categories, avoiding marks. The following was issued to all teachers in the faculty.

You work out what the problem is. Then turn to Box 9.3 (but no peeking!) (p. 182).

Table 9.1 Two lexicons

Norm-referenced assessment
Mark, percentage, decile, rank order,* summative assessment, decontextualized assessment, standardization, 'fairness', quantitative, average, grade-point average, normal/bell curve, normal distribution, grading on the curve, a good spread of scores, parametric statistics, test–retest reliability, internal consistency, discrimination, selection, competition, high flier, ability
Criterion-referenced assessment
Assess, authentic/performance assessment, contextualized, standards, formative assessment,* summative assessment, criteria, individualization, optimal performance, student-centred, qualitative, grading categories, ILOs, alignment, judgment, distribution free, non-parametric statistics, effort, skill, learning, competence, expertise, mastery

* The one word in common!

A double problem

Despite the prevailing norm-referenced cast of mind at undergraduate level, the sheer logic of criterion-referenced assessment is generally seen in assessing theses and dissertations. We expect a dissertation to display certain characteristics: coverage of the literature, definition of a clear and original research question, mastery of research methods, and so on. The categories of honours (first class, upper second, lower second) originally suggested qualities that students' work should manifest: a first was qualitatively *different* from an upper second, it was not simply that the first got more sums right. Today, this approach might be in jeopardy, as these categories seem increasingly to be defined in terms of ranges of marks, which is unfortunate. In Box 9.4 (p. 183) we see a doubly unfortunate instance: defining the level of honours in terms of marks, and allowing non-academic factors to influence the judgment of academic quality.

In the standards model, and in constructive alignment in particular, this double problem could not occur. The ILOs would refer to academic qualities only, not sexual harassment, lateness or anything else, and the assessment would be aligned to those ILOs. There are other and more appropriate ways of dealing with the non-academic issues than by adjusting final grades.

Some important concepts in assessment

Authentic and performance assessment

In assessing functioning knowledge in particular, the assessment tasks need to represent the knowledge to be learned in a way that is authentic to real life. Verbal retelling is not often authentic; for example, we do not teach

Box 9.2 How Faculty Office suggests final grades should be determined (and the best of British luck!)

The following guidelines were issued to all staff in the faculty. They were to use these in arriving at their final grade distributions:

A (A+, A, A–)	Excellence, up to 10% of students. The student must show evidence of original thought as well as having a secure grasp of the topic from background reading and analysis
B (B+, B, B–)	Good to very good result, achieved by next 30% of students who are critical and analytical but not necessarily original in their thinking and who have a secure grasp of the topic from background reading and analysis Occasionally, a student who shows originality but is less secure might achieve this result
C (C+, C, C–)	Satisfactory to reasonably good result. The students have shown a reasonably secure grasp of their subject but probably most of their information is derivative, with rather little evidence of critical thinking Most students will fall into this category
D	Minimally acceptable. The students have put in effort but work is marred by some misunderstandings, but not so serious that the student should fail Students falling into this category, and outright failures, would not normally comprise more than about 10%

Source: *Faculty of Arts Handbook*, the University of . . .

What is the problem here? _____

_____

_____

_____

psychology or any other subject just so that students can tell us in their own words what we have told them. We need some sort of 'performance of understanding' (see pp. 74–6) that reflects the kind of understanding that requires an *active demonstration* of the knowledge in question, as opposed to talking or writing about it. This is referred to as 'authentic assessment' (Torrance 1994; Wiggins 1989). The term 'authentic' assessment may imply that all other forms of assessment are inauthentic, so many prefer the term 'performance assessment' (Moss 1992). It reminds us of what we already know in aligned teaching, that the assessment task should require students to do more than

just tell us what they know – unless, of course, declarative knowledge is all that we require in this instance.

Box 9.3 The problem in Box 9.2

The intention is to assess according to quality, but the thinking is still measurement model. Where there is a conflict, it seems that the NRA guidelines would be expected to prevail. For instance, if 30% of students 'showed evidence of original thought as well as having a secure grasp, etc.' that would be seen in this scheme to be anomalous, but as teachers we should be happy if this is what we found. Likewise, we should be disappointed if not ashamed that most students displayed 'derivative information' (C): it looks like they hadn't been taught properly, but here we are told that that is what we should expect. What is wrong here is that the definitions of learning outcome appear to be based on expected distributions of ability. Major departures from that distribution suggest either that there is something wrong with our teaching or that we are too soft in assessing.

Decontextualized assessment

A related issue is whether the assessment tasks should be decontextualized, requiring students to perform in the abstract, out of context. Where the ILOs target declarative knowledge, it is quite appropriate to assess it using decontextualized assessments, such as written examinations. We thus arrive at an important distinction in assessment formats:

1. Decontextualized assessments such as a written exam, or a term paper, which are suitable for assessing declarative knowledge.
2. Performance assessments, such as a practicum, problem solving or diagnosing a case study, which are suitable for assessing functioning knowledge in its appropriate context.

While both decontextualized and contextualized learning and assessment have a place, in practice decontextualized assessment has been greatly overemphasized in proportion to the place declarative knowledge has in the curriculum. As we saw in Chapter 5, functioning knowledge is underwritten by declarative knowledge and we need to assess both. A common mistake is to assess only the lead-in declarative knowledge, not the functioning knowledge that emerges from it. The following ILOs are taken from rehabilitation science, with their SOLO level and type of knowledge assessed:

1. Describe the bones and the muscles of the hand (multistructural, declarative).

Box 9.4 How not to 'mark' a dissertation

A student's postgraduate thesis, carried out at an Australian university, was submitted late, and given a mark of 76. However, during an oral examination, in which the student left the room in tears, one examiner persuaded the other two examiners that because of 'supervisory difficulties', the thesis be upgraded to 79, which meant a classification of second class honours for the degree. The student then raised other issues, including sexual harassment and claimed her thesis was worthy of first class honours. An internal enquiry suggested that 79 be converted to 80, so the dissertation was now awarded first class honours. But the case was then referred to the deputy ombudsman, who advised that the 'real' mark should have been 73, when readjusted for lateness and the bonuses for stress.

A 'real' mark is surely that which reflects the genuine worth of the work done, but here we have a thesis variously marked at 73, 76, 79 and 80, ranging from second to first class honours. The variation is due not so much to differences in staff opinion on the intrinsic academic worth of the thesis, as to differences in opinion on non-academic matters – lateness, stress, supervisory difficulties and sexual harassment – which were factored in arbitrarily and after the event. The public, employers, other universities – not to mention the poor student – would simply have no idea whether the thesis demonstrated those qualities of flair and originality that are associated with first class honours or of the less dazzling but high competence that is associated with good second class honours. It is ironic that a lay person, the deputy ombudsman, seems to have been the one who was least swayed by non-academic issues.

Source: 'From a flood of tears to scandal', *The Australian*, 26 January 2001: p. 4

2 Explain how the bone and muscle systems interact to produce functional movement of the hand, for example in picking up a small coin from the floor (relational, but still declarative).

3 Given a trauma to one muscle group *(x)* rendering it out of action, design a functional prosthesis to allow the hand to be used for picking up a coin (relational, functioning).

Holistic and analytic assessment

Analytic marking of essays or assignments is a common practice. The essay is reduced to independent components, such as content, style, referencing, argument, originality, format, and so on, each of which is rated on a separate scale. The final performance is then assessed as the sum of the separate

ratings. This is very helpful as *formative* assessment (Lejk and Wyvill 2001a); it gives students feedback on how well they are doing on each important aspect of the essay, but the *value* of the essay is how well it makes the case or addresses the question as a whole. The same applies to any task: the final performance, such as treating a patient or making a legal case, makes sense only when seen as a whole.

A valid or authentic assessment must be of the total performance, not just aspects of it. Consider this example from surgery. You want to be sure that the student can carry out a particular operation with high and reliable competence. An analytic assessment would test and mark knowledge of anatomy, anaesthesia, asepsis and the performance skills needed for making clean incisions and then add the marks to see if they reach the requisite 50% (or in this case perhaps 80%). Say a student accrues more than the number of marks needed to pass but removes the wrong part. On the analytic model a pass it must be.

Absurd though this example may seem to be, in an analytic marking scheme some aspects of knowledge are inevitably traded off against others. The solution is not to blur the issue by spreading marks around to fill in the cracks, but to require different levels of understanding or performance, according to the importance of the sub-topic. In this example, the student's knowledge of anatomy was insufficient to allow the correct performance, hence the proper judgment is 'fail'. Assessment of components certainly should be undertaken as formative assessment but, at the end of the road, assessment should address the whole.

In making holistic assessments, the details are not ignored. The question is whether, like the bricks of a building or the characters in a novel, the specifics are tuned to create an overall structure or impact. This requires a *hermeneutic* judgment; that is, understanding the whole in light of the parts. For example, an essay requiring reasoned argument involves making a case, just as a barrister has to make a case that stands or falls on its inherent plausibility. The judge does not judge the barrister's case analytically: uses legal terms correctly (+10 marks), makes eye contacts with jury members (+5 marks), for too long (–3 marks) and then aggregates, the counsel with most marks winning the suit. The argument, as a whole, has to be judged. It is the whole dissertation that passes, the complete argument that persuades, the comprehensive but concise proposal that gets funded, the applicant's case that wins promotion. That is what holistic assessment is about.

Critics argue that holistic assessment involves a 'subjective' judgment. But as we have seen, awarding marks is a matter of judgment too, a series of mini-judgments, each one small enough to be handled without qualm. The numbers make the big decisions: if they add up to 50 or more, then it is a pass. At no point does one have to consider what is the *nature* of a passing grade as opposed to a fail or of a distinction level of performance as opposed to a credit. One of the major dangers of quantitative assessment schemes is that teachers can shelter under them and avoid the responsibility of making the

judgments that really matter: What is a good assessment task? Why is this a good performance? (Moss 1992).

The strategy of reducing a complex issue to isolated segments, rating each independently, and then aggregating to get a final score in order to make decisions, seems peculiar to schools and universities. It is not the way things work in real life. Moss (1994) gives the example of a journal editor judging whether to accept or reject a manuscript on the basis of informed advice from referees. The referees don't give marks, but argue on the intrinsic merits of the paper as a whole and the editor has to incorporate their advice, resolve conflicting advice and make a judgment about what to do with the whole paper: reject it, accept it or send it back for revision. Moss reports that one of her own papers, which argued for a hermeneutic approach to educational assessment, was rejected by the editor of an educational journal on the grounds that a hermeneutic approach was not the model of assessment accepted in the educational fraternity. But it just had been! Moss gleefully pointed out that the editor had used a hermeneutic approach to arrive at that conclusion. Her paper was accepted.

In order to assess learning outcomes holistically, it is necessary to have a conceptual framework that enables us to see the relationship between the parts and the whole. Teachers, like journal editors, need to develop their own framework. The SOLO taxonomy can be useful in assisting that process (see pp. 79–80; Boulton-Lewis 1998; Hattie and Purdie 1998; Lake 1999).

Convergent and divergent assessment: Unintended outcomes

We used the terms 'convergent' and 'divergent' in Chapter 8 in connection with teaching for creativity. A Level 1 view of teaching sees all assessment as convergent: Get right what I have just taught you. When essays are marked with a checklist, marks are awarded only for matching the prescribed points, none for other points that might be just as good or better. This is not what assessment should be about. Virtually all university-level subjects require at least some divergent assessment. Setting only closed questions is like trying to shoot fish in murky water. We need to use open-ended assessment tasks that allow for *unintended outcomes*, that follow from such verbs in the ILOs as 'hypothesize', 'create', 'design', 'reflect' and the like.

A student teacher provided the following metaphor for assessment:

> When I stand in front of a class, I don't see stupid or unteachable learners, but boxes of treasures waiting for us to open.
>
> (An inservice teacher education student, University of Hong Kong)

What 'treasures' students find in their educational experience is something that can surprise, delight and, of course, disappoint too. When we assess using closed questions something like this occurs:

Teacher How many diamonds have you got?
Student I don't have any diamonds.
Teacher Then you fail!
Student But you didn't ask me about my jade.

Students' treasures need not be just in diamonds. If you only ask a limited range of questions, then you may well miss the jade: the treasure that you didn't know existed because you didn't ask. Of course, if the ILOs are expressed only in diamonds that is one thing, but frequently they are not, or ought not to be if they are.

Any rich teaching context is likely to produce learning that is productive and relevant, but unanticipated. The value of many formal activities lies precisely in the surprises they generate, such as field trips, practica or lab sessions, while informal activities bring about unanticipated learning in infinite ways. The student talks to someone, reads a book not on the reading list, watches a television programme, browses the net, does a host of things that sparks a train of thought, a new construction. Such learning probably will not fit the questions being asked in the exam, but they could nevertheless be highly relevant to the course ILOs. Most if not all important discoveries came about as a result of paying attention to unintended outcomes.

Assessment practices should allow for such rich learning experiences, but rarely do. One psychology professor included the following in the final exam paper: 'Based on the first-year syllabus, set and answer your own question on a topic not addressed in this paper.' Another was: 'Psychology. Discuss.' You had to answer these questions extremely well. He also used the instruction: 'Answer *about* five questions.' The conservative or insecure students answered exactly five. The more daring answered three, even two. They were, of course, the deep learners. Other ways of assessing unintended outcomes are reflective journals, critical incidents and the portfolio. We look at these in due course.

Some may see a problem of 'fairness' here. Shouldn't all students be assessed on their performance in the same task? This complaint has weight only in a norm-referenced context, when you are comparing students with each other. Then, yes, you have to standardize so that all have a fair crack at however many As or HDs have been allocated. In portfolio assessment, however, the complaint is irrelevant. If student A can justify task X as addressing the ILOs, and student B task Y, where is the problem?

> To treat everyone the same when people are so obviously different from each other is the very opposite of fairness.
>
> (Elton 2005 on assessing student learning)

If the ILOs specify creativity and originality and the assessment does not allow for them, now that *is* unfair.

Who takes part in assessing?

Three stages are involved in assessing students' performances:

1 *Setting the criteria* for assessing the work.
2 *Selecting the evidence* that would be relevant to submit to judgment against those criteria.
3 *Making a judgment* about the extent to which these criteria have been met.

Traditionally, the teacher is the agent in all three assessment processes. The teacher decides in advance that the evidence for learning comprises correct answers to a set of questions that again in the teacher's opinion addresses and represents the essential core content of the course and the teacher makes the final judgments on meeting the criteria.

Self-assessment (SA) and *peer-assessment* (PA) usually refer to student involvement in stage (3), but students can and often should be involved in stages (1) and (2) as well. Arguments can be made for all or any of these combinations (Boud 1995; Harris and Bell 1986). Students can be involved in discussing with the teacher what the criteria might be, which need not be the same for all students, as happens in a learning contract system (pp. 220–1). Students can also be involved in (2), that is, as the ones responsible for selecting the evidence to be put up against the criteria, as happens with assessment by portfolio. Finally, students can be involved in making the summative judgment (3). This can be as self-assessment or as peer-assessment and either or both can be used as a teaching/learning activity and as an assessment task. Their judgments may also be included in the final grade. All these possibilities are discussed in due course.

Probably the strongest arguments for self- and peer-assessment are that they provide a TLA that engages crucial and otherwise neglected aspects of student learning:

1 First-hand knowledge of the criteria for good learning. Students should be quite clear about what the criteria for good learning are, but when the teacher sets the criteria, selects the evidence and makes the judgment of the student's performance against the criteria, the students may have little idea as to what they should have been doing and where they went wrong. It is too easy for the students just to accept the teacher's judgment and not reflect on their own performance. They should be more actively involved in knowing what the criteria really mean. They should learn how to apply the criteria, to themselves and to others.
2 What is good evidence for meeting the criteria and what is not? Telling students may not engage them. They need to learn what is good evidence being themselves actively involved in selecting it.
3 Making judgments about whether a performance or product meets the given criteria is vital for effective professional action in any field. Professionals need to make these judgments about their own performance (SA) and that of others (PA). It is the learning experience professionals say is

most lacking in their undergraduate education (Boud 1986). Brew (1999) argues that students need to distinguish good from poor information now they are faced with an incredible overload of information from the net: an essential skill in lifelong learning (pp. 148–51). A more general argument along these lines is that conventional assessment disempowers learners, whereas education is about empowering learners and assessment can be made to play an empowering role (Leach et al. 2001).

Reliability and validity

A frequent criticism of qualitative assessment is that it is 'subjective' and 'unreliable'. This is the measurement model talking. Let us rephrase so that it applies to both models of assessment: Can we rely on the assessment results – are they reliable? Are they assessing what they should be assessing – are they valid?

Can we rely on the assessment results?

In the measurement model, reliability means:

- *Stability*: a test needs to come up with the same result on different occasions, independently of who was giving and marking it. Hence, procedure of test–retest reliability: give the same test to the same group again and see if you get the same result.
- *Dimensionality*: the test items need to measure the same characteristic, hence the usual measures of reliability: split-half, internal consistency (Cronbach α).
- *Conditions of testing:* each testing occasion needs to be conducted under standardized conditions.

Here reliability is seen as a property of the test. Such tests are conceived, constructed and used within a sophisticated framework of parametric statistics, which requires that certain assumptions be met, for example that the score distributions need to be normal or bell shaped.

In the standards model reliability means something rather different:

- *Intra-judge reliability.* Does the same person make the same judgment about the same performance on two different occasions?
- *Inter-judge reliability.* Do different judges make the same judgment about the same performance on the same occasion?

Here reliability is not a property of the test, but of the ability of teachers/judges to make consistent judgments. This requires that they know what their framework of judgment is and how to use it: the criteria need spelling out in what are now known as grading criteria or *rubrics*, which are simply clear criteria of grading standards. We deal with these in Chapters 10 and 11.

Reliability here is not a matter of statistical operations, but of being very clear about what we are doing, what learning outcomes we want, what is to be the evidence for those outcomes and why. In other words, reliable assessments are part and parcel of good teaching. We have been explicating the framework and the specific criteria for making informed and reliable judgments about students' learning from Chapter 5 onwards.

Do the test scores assess what they should be assessing?

In the measurement model, the test needs to be validated against some external criterion to show that the trait being measured behaves as it should if it were being measured accurately. Thus, the scores could be correlated with another benchmark test or used as a variable in an experimental intervention, or in predicting an independent outcome.

In the case of the standards model, by way of contrast, validity resides in the *interpretations and uses* to which test scores are put (Messick 1989), that is, in the test's alignment with the total teaching context. For example, if sitting an exam results in students rote-learning model answers, then that is a consequence that invalidates the test. An aligned, or properly criterion-referenced assessment task is valid, a non-aligned one is invalid. The glue that holds the ILOs, the teaching/learning environment, and the assessment tasks and their interpretation together is, again, *judgment*. There is now quite a good deal of agreement about reliability and validity in qualitative assessment (Frederiksen and Collins 1989; Moss 1992, 1994; Shepard 1993; Taylor 1994).

Table 9.2 draws all these points together, contrasting the measurement and standard models.

Task 9.3 (p. 191) is a reflective exercise to help you see where you stand in your thinking about your assessment practice.

Table 9.2 Comparing the measurement and standards models

	Measurement model	*Standards model*
Theory	Quantitative. Classic test theory, using assumptions of parametric statistics	Qualitative. A theory of learning enabling consistent judgments. No assumptions about distributions
Stability	Scores remain stable over testing occasions	Scores after teaching should be higher than before teaching
Dimensionality	The test is unidimensional. All items measure the same construct	Test multidimensional (unless there is only one ILO) The items address all the course ILOs
Testing conditions	Conditions need to be standard	Conditions reflect an individual's optimal learning in the intended application of the learning

(Continued)

Table 9.2 Continued

	Measurement model	*Standards model*
Validity	External: how well the test correlates with outside performances	Internal: how well scores relate to the ILOs and to the target performance domain
Use	Selecting students. Comparing individuals, population norms. Individual diagnosis	Assessing the effectiveness of learning, during and after teaching and learning

Now take a second look at Task 9.1 (p. 165). Would you make different decisions now?

Answers to Task 9.2 The NRA/CRA problem

Despite the fact that Susan's and Robert's performances were compared, the purpose of comparing was not to award the grades but to check the consistency of making the judgment. What happened here was that the initial judgment of Robert's performance was inaccurate, very possibly because of a halo effect: 'Ah, here's Robert's little effort. That won't be an A!' It took a direct comparison with Susan's effort to see the mistake. The standards themselves were unaltered.

Summary and conclusions

Formative and summative assessment

The first thing to get right is the reason for assessing. There are two paramount reasons that we should assess: formative, to provide feedback during learning; and summative, to provide an index of how successfully the student has learned when teaching has been completed. Formative assessment is basic to good teaching, and has been addressed in earlier chapters. Our main concern in this chapter is with summative.

Effects of assessment on learning: Backwash

The effects of assessment on learning are usually deleterious. This is largely because assessment is treated as a necessary evil, the bad news of teaching and learning, to be conducted at the end of all the good stuff. Students second-guess the assessment and make that their syllabus, and will under-

Task 9.3 Where does your assessment stand?

Reflect on your assessment practice so far, put a cross on the continuum on a point that best represents what you currently do in assessing your students:

Formative	_____	Summative
Involving your students	_____	All teacher controlled
Using open-ended assessment tasks	_____	Using closed-ended assessment tasks
Authentic tasks	_____	Decontextualized tasks
Criterion-referenced	_____	Norm-referenced
Using grading criteria	_____	Using model answers
Awarding grades for quality	_____	Awarding marks for quantity
Assessing the task as a whole	_____	Assessing individual components of the task

If you were to adopt constructively aligned assessment, what changes would you need to make in your assessment practice?

estimate requirements if the assessments tasks let them, so they get by with low-level, surface learning strategies. In aligned teaching, contrariwise, the assessment reinforces learning. Assessment is the senior partner in learning and teaching. Get it wrong and the rest collapses. This and following chapters aim to help us get it right.

Measurement model of assessment

The measurement model of educational assessment was hijacked from individual differences psychology, which is concerned with measuring stable characteristics of individuals so that they can be compared with each other or with population norms. However, when this model is applied to assessing educational outcomes, numerous problems arise. Unfortunately, many procedures deriving from the measurement model are incompatible with constructive alignment but remain in current practice: grading on the curve so that students have to compete for the higher grades; marking, despite its universality, has implications for the nature of knowledge that are unacceptable; separating assessment from teaching, which ignores alignment and imposes a separate culture of assessment as apart from the culture of teaching and learning. The backwash from the measurement model sends unfortunate messages to students about the nature of knowledge and about assessment preparation strategies that lead to surface learning.

Standards model of assessment

The standards model of educational assessment defines forms of knowledge to be reached at the end of teaching, expressed as various levels of acceptability in the ILOs and grading system. This framework requires higher levels of judgment on the part of the teacher as to how well the students' performances match the ILOs than does quantitative assessment. The assessment tasks need to be 'authentic' to the ILOs, stipulating a quality of performance that the assessment tasks demand. The backwash tells students they need to match the target performances as well as they are able.

Norm- and criterion-referenced assessment: Let's get it straight

Although norm- and criterion-referenced assessment are logically different, there is still room for confusion, which we try to dispel with some exercises.

Some important concepts in assessment

We present a list of concepts that are important in thinking about and implementing constructive alignment. Authentic assessment directly engages the student with functioning knowledge in its context, decontextualized assessment is more suitable for declarative knowledge. While formative feedback often should be analytic by informing students how well they are managing different aspects of the task, the summative judgment should be of the whole, not the sum of its parts. Open-ended assessment tasks allow for unintended and divergent outcomes, and students themselves need to be involved in the various stages of assessment, in both peer- and self-assessment.

Reliability and validity

Measurement modelists accuse qualitative assessment methods of being 'subjective' and 'unreliable'. What they fail to recognize is that reliability and validity are not the exclusive domains of number crunchers. As the quantitative scaffolding is dismantled, we find that notions as to reliability and validity depended more and more on the teacher's basic professional responsibility, which is to make judgments about the quality of learning.

Further reading

Dart, B. and Boulton-Lewis, G. (eds) (1998) *Teaching and Learning in Higher Education*. Camberwell: Australian Council for Educational Research.

Moss, P.A. (1994) Can there be validity without reliability?, *Educational Researcher*, 23, 2: 5–12.

Taylor, C. (1994) Assessment for measurement or standards: The peril and promise of large scale assessment reform, *American Educational Research Journal*, 31: 231–62.

Torrance, H. (ed.) (1994) *Evaluating Authentic Assessment: Problems and Possibilities in New Approaches to Assessment*. Buckingham: Open University Press.

The Taylor and Moss articles are seminal, outlining the principles of the rethink on assessment, where the criteria that are qualitatively defined are included. Taylor traces the historical and conceptual roots of NRA and CRA, clearly outlining where the confusions in current practice have crept in, while Moss goes into the conceptual issues in terms of assessment theory. Torrance's book contains some commentaries on the new approach. Dart and Boulton-Lewis contains chapters by Boulton-Lewis, Dart, and Hattie and Purdie, which specifically deal with SOLO as a conceptual structure for holistic assessment.

Websites

University of Melbourne, see especially the Assessment in Australian Universities project: www.cshe.unimelb.edu.au/assessinglearning

The Higher Education Academy: www.heacademy.ac.uk/default.htm

Oxford Brookes University: www.brookes.ac.uk/services/ocsd/2_learntch/2_learnt.html

The Hong Kong Polytechnic University's Assessment project, see especially the Assessment Resource Centre: www.assessment.edc.polyu.edu.hk/

Queensland University of Technology: www.tedi.uq.edu.au/teaching/index.html. Click 'Assessment' and choose your topic.

10

Assessing and grading declarative knowledge

In this chapter, we discuss designing assessment tasks for intended learning outcomes relating to declarative knowledge, and grading students' performance. Assessing declarative knowledge is overwhelmingly by the written essay, under either invigilated or open conditions, and by multiple-choice testing. The latter has its uses for assessment but typically the MCQ addresses only low-level outcomes. We look at the ordered-outcome item, which is an objective format that aims to assess high level ILOs. An important problem in grading the written essay format is its unreliability. We discuss eliminating halo effects and other sources of unreliability and suggest the use of assessment criteria, or rubrics, to use in both the analytic and the holistic assessment of extended prose.

Designing assessment tasks

We now turn to designing assessment tasks that are to be aligned to the learning outcomes we intend to address. An appropriate assessment task (AT) should tell us how well a given student has achieved the ILO(s) it is meant to address and/or how well the task itself has been performed. Assessment tasks should also *support* student learning, not sidetrack students, as do some traditional assessment tasks, into adopting low-level strategies such as memorizing, question spotting and other dodges. The backwash must, in other words, be positive, not negative. It will be positive if alignment is achieved because then, as we saw in the previous chapter, the assessment tasks require students to perform what the ILOs specify as intended for them to learn.

In designing appropriate assessment tasks, the following need to be taken into account:

1 The criteria for the different grades, assigned to describe how well the assessment tasks have been performed, should be clearly outlined as