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ABSTRACT Two major frameworks for educational decision making, including decisions on assessment, can be distinguished: quantitative, which is adequate for construing some kinds of learning; and qualitative, which should be the appropriate framework for enabling decisions flowing from most tertiary educational aims. However, for various reasons, institutions implicitly encourage a quantitative framework for assessment-related decision making, particularly evident in the recent emphasis on accountability and performance indicators. This is unfortunate because, through the backwash effect, quantitative modes of assessment encourage surface approaches to learning, which typically lead to low cognitive-level outcomes that are not compatible with stated course objectives. It is argued that an institution and its educational practices comprise a system in equilibrium, and that if educational goals are to be realised, the whole system needs to be compatible with those aims.

The Importance of Assessment

The quickest way to change student learning is to change the assessment system. (Elton & Laurillard, 1979, p. 100)

That assessment methods drive institutional learning is well known (Crooks, 1988; Frederiksen & Collins, 1989). Indeed, the backwash effects of assessment arguably determine what is learned more than do formal curricula and teaching methods themselves. If assessment is so powerful in its effects, then, why don't we improve learning simply by changing the assessment system, as Elton & Laurillard suggest? The answer is simple; it is very difficult to change, and if we try to do so, fierce resistance will be encountered. Only recently in the UK, the Government and a remarkable unanimity of teachers were deadlocked over the question of competency testing of students, neither side giving quarter, both sides claiming the justification of educational principle. How do we explain such passion over an everyday educational routine?

First, there is the pragmatic argument that the formal assessment of a student's learning is the publicly visible tip of the fruits of the formative years of that individual's life. Much hangs upon it; we don't want to get it wrong. If that assessment can be reduced to a number that is unarguably more or less than another individual's number, decisions can be made, life can go on.

Second, assessment taps into belief systems about what learning is; what is important about the experience of education. People hold quite opposing beliefs about this, as elaborated below.

Finally, assessment of student learning plays an important role in the social order of institutions. While institutions may exist primarily to accredit individuals, affirming that they have the competence to carry out important roles in society, they also have their own autonomous existence, with their own attendant management functions. Those functions are rather easier to carry out with some forms of assessment than with others. For example, it simplifies both accreditation and management functions if we standardise forms of assessment into a common currency, so that we all think we know what we are talking about. A long prevailing assumption is that learning may be quantified in a similar currency to that used for buying German herrings; both currencies have an exact value and even the same name: 'marks'. A test mark is something out of a hundred called a 'percent', a currency believed to enable one to compare student with student, and performance in one subject with that in another. Determining grades is simplicity itself: 50% is a Pass, 49% a Fail.

But are things that simple? In one university, a Senate committee recently found that Faculties had different cut-offs for coursework masters' degrees; a D grade required 50 to 56 herring tokens in one Faculty but 50 to 59 in another. B was either 60 to 69, or 64 to 69, depending on the Faculty. Odd this may seem to be, but it would be just as odd if the range for a B grade were found universally to be 60 to 69. It is the assumptions underlying these cut-offs that are faulty, not just particular examples of them.

Assessment and Assumptions about Learning

What does it mean to say that we have learned something? How we answer reveals the conception we have of the nature of learning, and therefore of what it is that has to be assessed. Cole (1990) distinguishes the quantitative and qualitative traditions in our educational thinking.

The Quantitative Tradition

In the quantitative tradition, learning is conceived as the aggregation of content: to be a good learner is to know more. The contents of learning are treated as discrete quanta of declarative or of procedural knowledge: bits of

knowings, with any one bit functionally independent of any other. Under these conditions, the curriculum may easily become a bag containing discrete units of content: facts, skills, competences, behavioural objectives and the like. The competence movement, and the current concern with performance indicators, stem from the same positivistic tradition, which has guided western thinking for most of this century and is only recently being called into question, especially in the behavioural and social sciences (Popkewitz, 1984).

The process of learning in this quantitative view is reductionist, becoming a matter of aggregating more and more bits, internalising them, and being able to reproduce them accurately. Teaching in turn is conceived as transmitting knowledge, or conveying knowledge from one head to another. In this case, the teacher's task is to know the subject and expound it clearly; the learner's to receive accurately, a process commonly and interestingly described in terms of the learning-as-eating metaphor: 'assimilate', 'absorb', 'digest', 'regurgitate', 'spoon-feed', 'chew over', 'get your teeth into'.

Implications for assessment. Assessment in the quantitative tradition involves test situations that indicate reliably whether or not the correct behavioural response to the test stimulus is in the student's response repertoire, so that the ability to reproduce previously learned content quickly and accurately becomes the major criterion for good learning.

A common further assumption is that the contents of knowledge are learned in binary units, correct or incorrect, and that the correct units may be summed to give an aggregate or total score that is an index of competence in what is learned. Multiple-choice tests, for example, represent learning as a total score of all items correct, any one item being worth the same as any other. Even essay marking is likely to have a quantitative bias in practice. The most common procedure in marking open-ended essay responses is to award a mark for each relevant point made, and convert the ratio of actual marks to possible marks into some kind of number, which the teacher may then adjust for overall quality. The final grade (A, B or D; Pass, Fail or Distinction) is thus essentially arrived at quantitatively.

Such a quantitative framework thus makes assumptions about the nature and acquisition of knowledge that are not really compatible with what we know about human learning. Nevertheless, much current test technology, involving test construction, item analysis, and establishing reliability and validity is (however sophisticated) quantitatively based, and in widespread use. This technology may be appropriate to those cases where learning involves aggregating items learned accurately (for example foreign vocabulary, technical terms, formulae), but it would be wrong to make an implicit generalisation that all learning, especially at the tertiary level, is acquired in unitary bits and may be assessed accordingly.

The Qualitative Tradition

In the qualitative tradition, students are assumed to learn cumulatively, interpreting and incorporating new material with what they already know, their understanding progressively changing as they learn. Thus, learners' comprehension of taught content is gradual and cumulative, more like climbing a spiral staircase than tallying chips, with qualitative changes taking place in the nature both of what is learned, and how it is structured, at each level in the spiral. The contents of learning being meanings, the curriculum question is to decide what meanings or levels of understanding are reasonable at the stage of learning in question. Content thus evolves cumulatively over the long term, having horizontal interconnections with other topics and subjects, and vertical interconnections with previous and subsequent learnings in the same topic.

As regards teaching method, the teacher's task is not to transmit correct understandings, but to help students construct understandings that are progressively more mature and congruent with accepted thinking, recognising that in many subjects students' everyday experiences have helped them to construct alternative frameworks for construing reality. The techniques used are thus not only expository, but those requiring constructive activity on the part of the student: deliberate and explicit use of the relevant knowledge base, peer and student-teacher interaction, a motivating context, and much student activity, both reflective or self-directed as well as task-directed (Biggs, 1989).

Implications for assessment. Whereas the logic of assessment from a quantitative point of view implies aggregating units of learning, that from the qualitative tradition implies charting longitudinal growth. The outcomes of learning become the constructions the learner has made at any given stage. Assessment in these circumstances becomes either developmental, that is to discover where students are in the development of understanding or competence in the concept or skill in question, or ecological, that is to apply current knowledge to test situations that are 'authentic' or ecologically valid. The question in this last case is functional; can the student solve a problem involving instructed knowledge in a real context?

In the developmental model of assessment, it is necessary to chart the course of development of a concept or principle, so that the stages of development can be defined. This may be done on a topic-by-topic basis, as has been for some topics by Marton and his co-workers (Marton, 1988; Ramsden, 1988), who have shown that the understanding of some concepts passes through a clearly identifiable but unique hierarchy of conceptions that can be used to form assessment targets, given that the appropriate research has been devoted to each such topic. A more general model is the SOLO taxonomy (Biggs & Collis, 1982; 1989), according to which a general sequence may be assumed in the development of many concepts and skills, and that sequence may be used to guide the formulation of specific targets or the assessment of specific outcomes; an application to marking assignments in a standard letter-grade system is given in Biggs (1992).

The applied or ecological approach to qualitative assessment simply situates the test in an authentic setting. In a sense, this is simply saying that tests should be valid, yet so detached and quantitative has assessment become that authentic testing has become a recent catch-cry, and testing problem solving by giving students the sort of problem they would meet in real life, rather than giving them an exam in the declarative knowledge prerequisite to problem solving, a major innovation (Masters & Hill, 1988; Wiggins, 1989).

The developmental approach to assessment is probably more relevant to declarative knowledge, the ecological approach to procedural; the former describing increasingly sophisticated ways of understanding the world, the latter of operating upon the world. This last form of knowledge is of course of major concern in professional training at the tertiary level, which is vulnerable to the accusation that students are taught and examined in theoretical subject knowledge, not in the procedural knowledge they are so soon to deploy on the public. The work by Entwistle & Entwistle (1992) on forms of understanding highlights this problem in institutional assessment, as discussed below.

How Backwash Affects Learning

The characteristics of the test, and the context in which it is given, may provide the objective basis for backwash effects, but it is the student's perception of the test, and of the demands that it is seen to make, that generate the effects of backwash. Students differ greatly in their ability to read the cues provided, cue seekers being very alert to what will tell them how best to prepare for the test, and go out of their way to optimise, while the cue deaf seem unaffected by backwash (Miller & Parlett, 1974). Further, students' perceptions of what is required, and teachers' own intentions, may be very different.

Several mechanisms are involved in this hiatus between intention and perception.

Forms of Understanding

Students' forms of understanding seem to set the process of backwash in train (Entwistle & Entwistle, 1992). When students study for an examination, they attempt to understand the material in ways that they perceive will meet requirements. The meaning of understanding depends on how students perceive the examination context; understanding the content of a lecture to meet the requirements of a quick true-false test the following week will involve a different perception of the form of understanding than that required, say, when the student is expected to summarise the lecture publicly for a tutorial the following week.

Thus, the expected mode of assessment creates a framework, or form of understanding, within which the student first interprets and then reconstructs the content of the course to meet the perceived need for that kind of understanding. Here, we begin to see how assessment begins to drive learning; it is the expected mode of assessment, rather than any formal aims or curricular intentions, that determines the nature of the understanding the student derives from the taught content. Entwistle & Entwistle describe five forms of understanding, which appear as a hierarchy:

- (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 solely to generate answers to anticipated exam questions.
- (4) Adjusts structures from strategic reading 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 is directed towards understanding and applying the discipline itself, the others being focused on examination requirements, a situation the Entwistles find "worrying", in that the examinations in most cases stand in the way of students achieving their own personal understandings of the content. Given that many of these students were studying in order to practise as professionals rather than to pass exams, this is indeed worrying, because for many students the assessment system seems to be pre-empting a professionally relevant level of understanding of their coursework.

Approaches to Learning

If forms of understanding act as goals for students' efforts in study, telling them what to aim for, approaches to learning dictate how they get there. How this may be so is seen in the experiment by Marton & Saljo (1976), which is now recognised as paradigmatic in the student learning literature (being one of the most cited educational research studies, according to the Social Science Citations Index).

In this study, students were asked to read academic articles and then to describe what they had learned, and how they had gone about learning it. It soon became clear that the level achieved depended on what the learner intended to gain from the article. Students generally expressed one of two major intentions: either to understand the author's intended meaning, or to recall key terms or memorise details as accurately as possible, in anticipation of subsequent questions. Those having the first intention processed the text for meaning, focusing on themes and main ideas; those having the second focused on words and sentences.

These intentions and methods of reading became called the deep and surface approaches, respectively. The deep approach was associated with abstract, high-level accounts of the passage, with the details being used for illustration and support, while the surface approach was associated with simple, factual statements that overlooked interconnections between aspects of the passages, and which usually missed the author's point. Thus, anticipating questions drove these students to adopt a strategy that in fact prevented them from obtaining a holistic view of the text and its argument. In other words, much as Entwistle & Entwistle later formulated, the test questions created a low-level framework for establishing the form by which the content was understood.

Work since Marton & Saljo's original study has clarified the meaning of these approaches. The surface approach arises out of an intention to satisfice rather than to satisfy task demands; that is, to get by and keep out of trouble with minimum effort. For example, a student might be reasonably certain that a particular kind of problem is going to be tested, but doesn't intend to bother trying to understand it; instead that student deliberately rote learns a standard solution, fingers crossed that reproduction of the standard form will meet the requirements of the test. All too often they do, as the following quotation from a British undergraduate studying psychology illustrates:

I hate to say it, but what you have got to do is to have a list of 'facts'; you write down the important points and memorise those, then you'll do all right in the test . . . if you can give a bit of factual information--so and so did that, and concluded that--for two sides of writing, then you'll get a good mark. (Ramsden, 1984, p. 144)

The deep approach is based on the intention to understand, and therefore to engage the task as appropriately as the student can. Such an approach involves: a great deal of relevant content knowledge, the need to operate at an abstract level of conceptualisation and the use of optimal strategies for handling the task. What those strategies are will obviously depend on what the task is.

However, as the Entwistles' work shows, the forms of understanding that are engendered by most assessment tasks are, except for the fifth level of form, specific to the assessment context and do not engage the course content in its higher levels, say for professional application. Tertiary teachers need to know this, and as a first step in signalling to students that a surface approach just will not do, they should set questions that will not be satisficed by short-cut tactics. And yet we continue to set such questions, and students responding with surface approaches continue to get by.

Often, teachers are simply unaware of the effects of their question types, a situation not helped by the fact that a general quantitative approach to assessment, invoking the lower level forms of understanding, is actually encouraged in most institutions, so that the longer many students are exposed to institutional learning, the more surface and less deep orientated their approaches to learning become (Biggs, 1987; Gow & Kember, 1990; Stokes et al., 1989; Watkins & Hattie, 1985). In a comprehensive review of effects of assessment practices on students, Crooks (1988) concluded that many practices are in fact detrimental to the quality of learning, precisely because in meeting the requirements of many assessment tasks, students are allowed to get away with the kind of short cuts that are associated with surface learning.

Format of testing seems to create differential backwash. Generally, multiple-choice and short-answer tests elicit low-level, reproductive strategies, while assignments elicit deep approaches (Tang, 1991; Thomas & Bain, 1984).

Tang's study further showed that how students cope with assessment depends in large part on what they see as the assessment task requirements, but they also need to be familiar with the task and to have coping strategies to hand. In her interviews with first-year physiotherapy students, Tang found that students overwhelmingly saw deep approaches as the way to prepare for assignments, but in the event only a minority used them. Assignments were a novel form of assessment for most of these students and they simply did not know how to approach assignment writing in a deep way. The majority spontaneously formed collaborative learning groups and exchanged knowledge; and subsequently wrote more structured assignments than those who went it alone. Thus, this study brings home the need for teachers to provide training for students in how to approach complex tasks, no doubt also a requirement for teachers in setting and marking them appropriately.

Assessment in the Institutional Context

To summarise the argument thus far, learning is driven by assessment, making it vital that high-level assessments tasks are set that truly reflect the overall aims of the institution and the particular course objectives. While these latter invariably specify high-quality learning, the evidence is that by and large teachers are not setting such assessment tasks, and that even when they do, many otherwise bright and well-motivated students do not know how to approach them appropriately. This is not a matter of personal irresponsibility or incompetence, however, but a situation entirely predictable from a systems interpretation of the way institutions run.

A system is a working whole made up of a set of component parts, each of which affects the other until the whole forms an equilibrium; the state of equilibrium so engendered is in fact the system (von Bertalanffy, 1968). Introduce a new part, or change one of the existing parts, and one of two things happens:

(1) If the existing system is stable, it will be resistant to change; then the new part will die, or change to merge imperceptibly with the existing system.

(2) If the system is fragile, the new component will change the old equilibrium, forming a new system. Things will work differently in future.

Systems theory can apply to almost any complex situation, the prime example of course being an ecological system. In the classroom, the system comprises teacher, students, curriculum, teaching method and methods of assessment; the balance they achieve will affect the learning outcomes (Biggs, 1993). The classroom is, however, part of the larger system of the institution, and the extent to which the institutional tolerates deviance at the classroom level varies of course between institutions.

In the system of educational institutions Reid (1987) was concerned with three major components: the rhetoric, or the official aims of teaching; the technology, which would make possible the realisation of these aims; and the social system of the institutions, which determines what is allowable within the institution. The social system has two aspects:

(i) the informal requirements established on a collegial basis;

(ii) the formal requirements of bureaucracy.

The following example illustrates both formal and informal requirements in action. One university in Hong Kong still has regulations preventing the release of examination results to students, as once did most UK universities. The practice obviously cannot be justified on educational grounds, but is so on grounds of institutional and collegial convenience. An academic claiming the right to use his own judgement on releasing marks was recently told, "But if you do, students will put pressure on all of us to follow suit. That's just not cricket!", with the institutional follow-up: "Anyway, you can't. It's against the regulations."

The effects of bureaucracy are seen in virtually all structures and procedures that affect teaching and assessment. While such procedures are meant for the good (for example, to maintain standards), the effects are not so unequivocal. Thus, the use of external examiners may constrain the nature of the assessment tasks to those that an outsider to the teaching process can handle. Returning and re-collecting assignments becomes a real bother, especially in large classes, and so detailed feedback to students on their assignments is de facto discouraged, because the assignments have to be returned by the student for the use of the examiner, who then tends to become the audience for the comments, not the student. The use of personalised assessment tasks such as portfolios, diaries, etc., or tasks involving self-assessment and peer assessment, which are rightfully the student's property and may be confidential, are likewise discouraged, despite the relevance of these modes of assessment to teaching objectives and to higher order learning processes (Harris & Bell, 1986; Masters & Hill, 1988).

Most institutions require that the gradings obtained in course units are combined in order to determine levels of Honours, say, or Distinction/Pass levels in the total programme. This puts almost irresistible pressure on markers, through Faculty or programme committees, to use quantitative marking schemes. It need not do so, as profiling or other qualitative schemes can be used, but in practice teachers are required to come up with a grade that can be quantified in a common metric. Most teachers therefore mark quantitatively in the first place, which for many subject areas provides them with an inappropriate mind-set when marking: so many marks for this, so many for that . . . In an extended piece of writing, the shape of the total argument becomes lost in this approach to marking; at most, the shape of the argument figures minimally as just another thing to be tallied when arriving at the final grade.

And of course the message to students is clear; they use the strategy of knowledge-telling, which is an obvious one if each point of information gets a mark (Bereiter & Scardamalia, 1987). Knowledge-telling students present as long a list of points as possible, as densely packed as the word limit requires, pre-empting a structured, reflective argument.

We are thus beginning to see why Elton & Laurillard's statement quoted at the beginning of this paper is deceptively simple. Although existing assessment systems are not doing the job we want them to, in terms of providing a framework for learning of a quality that matches our espoused aims (Crooks, 1988), these systems are not so easy to change (Figure 1).

Figure 1 is meant to illustrate that existing assessment systems ("what is likely") have evolved as a stable compromise between our aims ("what we want"), how we can achieve those aims ("what is possible"), and what our administrations and colleagues will permit ("what is allowable"). Our aims appear to drive decision making in the first instance. Having defined what we want, we hopefully turn to technology to enable us to judge whether or not those aims are being met (assuming we don't simply use what is already in place). But then we come across the formal and informal requirements of the social system. All these components may affect the other: we may change our aims in light of the possible, or of the allowable; the social system may preclude much of what is technically possible; it could even be that the weight of the desirable and of the possible changes what is allowable (after protracted and weighty deliberations at all levels). That last flow of influence, changing the social system, is clearly the most difficult, as Reid (1987) argues. Thus, changing the assessment system means setting up a new equilibrium, perhaps requiring a new technology, almost certainly requiring a new deal to be struck with the existing social system of the institution.

A particular recent and universal problem in tertiary institutions is that the formal social system, the nature and demands of the bureaucracy, have themselves been reconstructed in terms of a wider community political system, which sees things in one form or another of economic rationalism, a quintessentially quantitative view if ever there was one, seeing higher graduation rates with diminished per capita resources as the way to go. This means, given existing social institutional systems with their established structures, competences and inertias, even larger mass lectures, with A/V piping of lectures to overflow classrooms, and multiple-choice testing to cope with assessment load: a virtual prescription for surface learning.

The non-systems way of thinking sees the solutions to problems in terms of the deficit model: that if something is not working, then some component is faulty. In this case, the deficit is seen to lie in the students: they lack high-level study skills or a deep approach to learning. The remedy is simple: teach students how to use a deep approach to learning. However, a deep approach is not something that inheres inside the student, which they either have or lack, but a way of describing how a student relates to a task. To say that immediately implicates what the task is, how it is presented, how it is assessed, and so on. Teaching a student a bundle of deep strategies for future use is likely to be useful only if the teaching and particularly the assessment context call out deep approaches. As Ramsden's (1984) psychology student made clear, if you can "get a good mark" with low-level strategies, why bother about deep approaches? There is no point in blaming the student for cynically cutting corners: his approach is an adaptive one for the system in which it evolved. The system should make such an approach maladaptive, and the problem is that for the most part in today's tertiary institutions it does not.

Conclusions

Assessment occupies a key place in determining quality learning outcomes, but assessment practices are part of a wider picture that includes but extends beyond the responsibility of any individual teacher. An institution is a holistic, interactive system, which for its own management has many procedures in place, which have their own functional use but which determine teaching and assessment procedures, and which in turn impinge on students' perceptions of what and how they will learn. It is not sufficient to leave it to individual teachers to juggle as best they may the conflicting demands of bureaucracy and of learning quality. This is a major reason why each tertiary institution should have a policy and guidelines on assessment, providing a coherent set of principles and procedural knowledge about assessment.

The advent of the academic audit and performance indicators may not be the catastrophe many tertiary educators think it is, if institutions ask whether the practices they adopt, in assessment and elsewhere, are likely to further their explicit educational aims and objectives. Backwash is no bad thing, particularly if it can be harnessed from the centre outwards, so that performance indicators send out the kind of messages to teachers that teachers say they want to send out to their own students.

Supplying factual information for two sides of writing is a game that can be played by administrators and teachers as well as by students, but there are deeper and better alternatives.

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Note on Contributor

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CHART: FIG. 1. Balancing the desirable, the possible and the allowable in tertiary education.

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