Increasing success in first year courses: Assessment re-design, self-regulation and learning technologies

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Concerns about non-completion and the quality of the first year student experience have been linked to recent changes in higher education such as modularisation, increased class sizes, greater diversity in the student intake and reduced resources. Improving formative assessment and feedback processes is seen as one way of addressing academic failure, of enhancing the learning experience and students' chances of success in the early years of study. This paper argues that, if this is to happen, a broader perspective on the purposes of formative assessment and feedback is required; one that links these processes to the development of learner self-regulation. Drawing on the current literature, the paper presents a set of principles for the effective design and evaluation of formative assessment and feedback processes. It then shows, through two case studies drawn from a large £1m Re-engineering Assessment Practices (REAP) project, how ICT might support formative assessment processes, academic success and the development of self-regulation in large first year classes.

Keywords: formative assessment, feedback, self-regulation, first year experience, student success

Introduction

Across the higher education sector there is a growing interest in the quality of the student learning experience in the first years of undergraduate study. This interest is fuelled by statistics showing poor course completion rates and by recognition that the first year lays the foundation for learning in later years. Yorke and Longden (2004) in studying retention issues across a number of countries have identified four broad reasons why students leave academic programmes: (i) flawed decision making in initial choices; (ii) events that impact on students' lives outside the institution; (iii) students' experiences of the programme and the institution; and (iv) failure to cope with the academic demands of programmes. This paper is primarily concerned with the last two reasons: it explores how formative assessment practices might be used to enrich the first year experience and enable students to develop their capacity for self-regulated learning. It also explores how information and communication technologies (ICT) might support formative assessment practices. Case study applications, drawn from a large-scale re-engineering assessment project led by the University of Strathclyde, are used to illustrate some possibilities. A key idea in the retention and non-completion research is the need to maximise students' sense of, and chances of, success particularly when they enter HE and in the early years of study. The concepts of academic success and self-regulated learning are seen as inter-related in this paper.

Formative assessment and academic failure

There is considerable evidence that formative assessment with feedback has an impact on learning quality in education (Black & Wiliam, 1998; Knight & Yorke, 2003; Hounsell, 2003). In higher education, Yorke (1999) has shown that the number of opportunities available for formative feedback is an important variable in non-completion by students in the early years of study. Yorke and Longden (2004) have argued that, where students are uncertain about their ability to succeed, formative feedback is of particular significance. However, over the last 10 years, modularisation, larger student numbers in first year classes, greater diversity and reduced staff–student ratios have all had a negative effect on formative assessment practices. These negative effects include fewer opportunities for students to clarify what is expected of them, a reduction in feedback on assignments and in class, and an increased emphasis on summative assessment at the expense of formative assessment (Yorke & Longden, 2004). The latter has resulted in an excessive concentration by students on getting good marks and playing the assessment game rather than focusing their effort on deep and lasting learning (Gibbs, 2006). These changes have also been shown to impact on the students' sense of self and on their motivation and self-confidence (Higgins, Hartley and Skelton, 2001).

How might assessment practices change in order to enhance the first year experience and increase students' chances of success? A recent literature review carried out by Gibbs & Simpson (2004) was directed at addressing this question (see also Gibbs, 2006). They examined a wide range of case studies and were able to identify eleven conditions under which assessment might support student learning and increase the likelihood of academic success. The conceptual framework underpinning these conditions (and an associated assessment experience questionnaire) is based on two over-riding principles (see Table 1). The first principle, which draws on Chickering and Gamson's (1987) research, is that assessment tasks should be designed to ensure that students spend their study time in productive ways: tasks should encourage 'time on task' (e.g. in and outside class), should lead to a more even distribution of study effort (over the timeline of the course), should engage students in deep rather than surface learning and should communicate clear and high expectations. The second principle is about the effective provision of feedback to students on their academic work: feedback should be of sufficient quantity; timely; it should focus on learning not marks; it should be related to assessment criteria and be understandable, attended to and actually used by students to make improvements in their work.

Table 1: Gibbs and Simpson's (2004) eleven conditions

Assessment tasks [conditions 1–4]

- Capture sufficient study time and effort (in and out of class)
- Are spread evenly across topics and weeks
- Lead to productive learning activity (deep rather than surface learning)
- Communicate clear and high expectations.

Feedback [conditions 5–11]

- Is sufficient (in frequency, detail)
- Is provided quickly enough to be useful
- Focuses on learning rather than marks
- Is linked to assessment criteria/expected learning outcomes
- Makes sense to students
- Is received by students and attended to
- Is acted upon to improve work and learning

Gibbs and Simpson's (2004) eleven conditions have been piloted in a range of courses across the UK, and internationally, particularly in science disciplines. The Formative Assessment in Science Teaching (FAST) project team have worked with teachers to analyse existing assessment practice, to propose changes suggested by the eleven conditions framework and to evaluate the effect of these changes (see, www.open.ac.uk/science/fdtl). Those using the eleven conditions for course redesign report positive benefits for student learning. However, despite these benefits, one limitation of the FAST conceptualisation, and the eleven conditions, is that they are largely about the teacher's role in structuring appropriate assessment tasks and in providing feedback. It is the teacher who ensures that students spend their time productively on task and that they receive appropriate feedback. While what the teacher does is an important determiner of academic success, many researchers now maintain that rather than having a reactive role in relation to teacher created activities, students should be given a much more active and participative role in assessment processes (Boud, 2000; Rust, O'Donovan & Price, 2005).

For example, Yorke & Longden (2004) argue that a key component of academic motivation and success is that students perceive themselves as agents of their own learning. Indeed, these researchers maintain that the student perspective is the gateway to solving what they call the 'retention puzzle'. If students are to have a sense of control over their own learning, then formative assessment practices must also help them develop the skills needed to monitor, judge and manage their learning. In line with this approach, the conceptual model underpinning formative assessment and feedback practices in this paper is based on developing learner self-regulation (see Nicol & Macfarlane-Dick, 2006). This perspective on feedback is wider than that provided by Gibbs and Simpson but it also usefully incorporates all of their seven feedback conditions. However, this paper does draw on the first four of Gibbs and Simpson's eleven assessment conditions. This recognizes the fact that, in HE, teachers, especially in the first year, need to provide a clear structure within which student participation in assessment activities is achieved. The key argument here is that both teacher defined structure and self-regulation are important in learning with the balance of these shifting as students move through a course and their undergraduate degree.

Alongside the need to rethink the purposes of formative assessment there is also a need to rethink the ways in which assessment is organised and implemented. Recent advances in information and communication technologies (ICT) are having a large impact on the delivery of student learning in HE. There is also a growing interest in the use of computers to streamline the provision of formative assessment tests and of feedback (Bull & McKenna, 2004). This paper builds on the work of Nicol and Milligan (2006) by demonstrating ways in which ICT can be used to support the development of learner self-regulation, the organisation of assessment tasks and the provision of feedback.

Self-regulation and student success

Formative assessment is defined in this paper as 'assessment that is specifically intended to provide feedback on performance to improve and accelerate learning' (Sadler, 1998 p. 77). Academics tend to think of formative assessment in terms of the judgements they make about students' academic work and the provision of feedback. However, this paper takes a broader view of the source of formative assessment. It is especially concerned with involving students in evaluative judgements about their own work and the work of their peers. The ability to monitor, critically assess and correct one's own work is a key goal of higher education and of lifelong learning.

In 2006, Nicol and Macfarlane-Dick reinterpreted the literature on formative assessment and feedback in relation to learner self-regulation. From this they were able to identify seven principles of good feedback practice that, if implemented, would contribute to the development of self-regulation (autonomy) in learning. Each of these principles is defined in detail in the earlier paper with the supporting research and examples of its implementation. Table 2 presents the seven principles.

Table 2: Seven principles of good feedback practice

Good feedback:

1 Helps clarify what good performance is (goals, criteria, standards)
2 Facilitates the development of self-assessment and reflection in learning
3 Delivers high quality information to students about their learning
4 Encourages teacher and peer dialogue around learning
5 Encourages positive motivational beliefs and self esteem
6 Provides opportunities to close the gap between current and desired performance
7 Provides information to teachers that can be used to help shape teaching.

Nicol and Macfarlane-Dick (2006)

The work of Nicol and Macfarlane-Dick builds on that of other researchers who have emphasised the importance of developing autonomy in both learning and assessment processes (e.g. Knight & Yorke, 2003; Boud, 2000). However, it departs from the work of others in one important respect. In the seven principles framework, the starting assumption is that students are already engaged in self-regulation but that some students are better at self-regulation than others; and it is the weaker students that need opportunities to enhance their sense of control. There are at least four reasons for this argument. Firstly, students are always informally engaged in the self-regulation of learning when they engage in academic tasks. They assume goals (e.g. write an essay) and they engage in purposeful activities while monitoring and regulating progress towards these goals. Secondly, active and constructivist conceptions of learning logically imply the notion of self-regulation (Winne, 2005). In constructing meaning students are assumed to be active agents of their own learning.

Thirdly, when students receive feedback from teachers they must engage in self-assessment if they are to use that information to improve academic performance: that is, they must decode the feedback message, internalise it and use it to make judgements about and modify their own work. This implies that self-assessment is at the heart of formative feedback (from teachers) and is a key component of self-regulation. Fourthly, students in some very large first year classes in higher education (e.g. over 500 students) receive almost no feedback and still make progress. Hence they must be making ongoing judgements about, and managing aspects of, their own learning – otherwise they would not be able to make progress. In summary, if students are already involved in self-assessment and self-regulation then the argument is that higher education teachers should build on this capacity rather than focus all their efforts on providing expert feedback.

The REAP project

The following sections present two case studies showing the ways in which assessment might be structured so as to enrich the first year student experience. Assessment is broadly defined to include formal and informal processes and self, peer and tutor feedback processes. In particular, each case study shows how the structure of assessment tasks (based on Gibbs and Simpson's four conditions) might be balanced with opportunities for learner self-regulation (based on Nicol and Macfarlane-Dick's seven principles of good feedback). Each case study uses different technologies – a discussion board, electronic voting systems and online tests. The context of these case studies is the Re-engineering Assessment Practices [REAP] project, one of six projects funded by the Scottish Funding Council under its e-Learning Transformation Programme.

The overall aim of the REAP project is to demonstrate learning quality enhancement and more effective use of staff time in large first year classes (150-800 students) through the application of learning technologies. The project involves three Scottish HE Institutions each piloting different approaches and technologies across a range of disciplines. The REAP project draws on current research on assessment (Nicol & Macfarlane-Dick, 2006; Nicol & Milligan, 2006; Gardner, 2006) with the key objective of assessment re-engineering being to lay a foundation for autonomy and self-regulation in learning during the first year (see www.reap.ac.uk).

Example 1: Psychology

The first year Basic Psychology course is designed to introduce all students to key findings, theories, and debates in general contemporary psychology. In addition the class provides an introduction to a number of specific areas of study within psychology which are dealt with in depth in second, third, and fourth year classes. The course comprises six topic areas delivered by 48 lectures, 4 tutorials and 12 practical laboratories over the year. The class size is approximately 550 students. Before the changes reported here, assessment comprised two paper-based multiple-choice tests over the year (25%), tutorials (4%), participation in an experiment (5%) and a final exam where students write five essays from twelve (66%). Feedback was only available through marks given on the multiple-choice tests and there were concerns that students were not given any feedback on their writing, essential for good exam performance. Technology-supported assessment was seen by the class leader as having the potential to enhance the first year experience, increase students' understanding of the topics being studied and enhance success in written work without increasing staff workload.

The pilot study

In the psychology pilot, the basic class was re-designed to provide opportunities for constructive formative assessment (scaffolding) linked to supportive peer discussion. This project draws on research showing cognitive gains where peer discussion is directed at the resolution of conflicting views (e.g. Anderson, Howe, Soden, Halliday & Low, 2001; Doise & Mugny, 1984). The discussion board within the institutional virtual learning environment (WebCT) is the technology in use.

Students were invited to participate in the pilot study, and 78 students volunteered (15% of the class). The students were divided into groups with a maximum of six students per group. There was an initial induction task where students were asked to introduce themselves to each other within their groups via the online discussion board. The main academic task followed this and involved students being presented with three questions of increasing complexity in a specific topic area (e.g. human memory) over a four weeks. For the first question (stage 1) they were asked to post an individual 50-word response to a private submission area in WebCT: other students could not see these individual responses. After all individual submissions had been received the students were then directed to engage in an online discussion within their groups about their answer; the instructions were to debate/argue what they believed the correct answer to be and then post an agreed 50-word response to the discussion board. For the second question they are asked to engage in online discussion in their groups and then to post an agreed 100-word response to the discussion board by a certain date. For the third question they also engaged in online discussion but the task required them to post a 300-word group response. Before students engaged with the second and third questions they were directed to a model answer written by the teacher; they could also retrieve a model answer after the 300-word response.

Key features of this pilot are that the task questions are progressively more difficult, that responses move from an individual to a group and that there is a model answer for comparison at each stage. Tutors did not provide any feedback; neither did they moderate the discussion. What is important here however is how this course design (i) applies the seven principles and helps develop learner self-regulation and (ii) creates a structure for assessment tasks that encourages frequent, but productive, learning activity (Gibbs and Simpson's four conditions).

Relation to seven feedback principles

- Standard format and model answer provide progressive clarification of expectations. (Principle 1)
- Students encouraged to self-assess (reflect) by comparing their responses against the model answers. (Principle 2)
- Online peer discussion around the learning task with the goal of reaching consensus about the group response. (Principle 4)
- The increasing complexity of the questions scaffolds learning development and the focus on learning rather than marks should enhance students' motivation. (Principle 5)
- The repeated cycle of topics and tasks provides significant opportunities to close the gap between desired and actual performance. (Principle 6)
- Tutors can monitor progress and adapt their teaching in relation to student's responses. (Principle 7) – *This principle was not enacted in the pilot but see commentary.*

Relation to four assessment conditions

- The individual and group responses require regular study activity out of class. (Condition 1)
- The tasks are staged for each topic over a number of weeks. (Condition 2) – *See commentary below regarding roll out to other topics.*
- The staged questions require progressively deeper levels of conceptual analysis. (Condition 3)
- The tasks have clear goals and there is a progressive increase in challenge. (Condition 4)

Commentary

Preliminary findings from focus groups and questionnaires show that the students were positive about this learning experience. They reported that working collaboratively enhanced their understanding of the discussion topic (92%). Typical student comments were "*we know everything there is to know about this topic now*" and "*I found it very beneficial, at the time… I did not realise how much I was learning…it was learning without thinking about what I was doing*". It is notable that these comments, and many others made by the students, emphasised both the way the task enhanced their confidence and the perceived benefits in learning. Another finding was that the early induction task where students introduced themselves helped create more supportive social interaction in the first year. This was evidenced through the extensive use of the discussion board for social postings. In traditional settings, being part of a large first year class does not guarantee, and may even inhibit, the establishment of social contact with others.

The findings from this pilot have given the Department of Psychology the confidence to propose a radical redesign of the first year class commencing in 2006/7, abolishing half the scheduled lectures and replacing these with similar online group exercises and making self-assessment and peer feedback core components of the class. These online tasks will become progressively more demanding within and across the six taught topic areas as the year progresses (memory, social psychology etc.).

Example 2: Mechanical engineering

The second example explores how a range of technologies including electronic voting systems (EVS) are being used to support assessment practices and the development of learner self-regulation in mechanical engineering. Eight years ago the Department of Mechanical Engineering at the University of Strathclyde embarked on a radical change in its teaching methods for first year students (see Nicol & Boyle, 2003; Boyle & Nicol, 2003). The aim of the New Approaches to Teaching and Learning in Engineering (NATALIE) initiative was to introduce collaborative learning in large lecture classes. The standard lecture/tutorial/laboratory format was replaced by a series of two-hour active-learning sessions involving short mini-presentations, videos, demonstrations and problem-solving all held together by peer instruction. Peer instruction is a form of Socratic Dialogue or 'teaching by questioning' pioneered by Mazur at Harvard (1997) using electronic voting technologies.

A typical peer instruction class would begin with the teacher giving a short explanation of a concept or presenting a video demonstrating the concept (e.g. force in mechanics). This is followed by a multiple-choice question test (MCQ). Students respond to the concept test using handsets (similar to a TV remote) that send signals (radio frequency or infrared) to receivers linked to a computer. Software collates responses and presents a bar chart to the class showing the distribution across the alternatives. In peer instruction, if a large percentage of the class have incorrect responses the teacher instructs the class to: 'convince your neighbours that you have the right answer'. This request results in students engaging in peer discussion about the thinking and reasoning behind their answers. The learning gains from this procedure have been interpreted in terms of cognitive conflict and scaffolding, both of which have been shown to benefit learning (Nicol & Boyle, 2003). After the discussion the teacher usually retests the students' understanding of the same concept. Another strategy is for the teacher to facilitate 'class-wide discussion' on the topic by asking students from different groups to explain to the class the thinking behind their answers to the MCQs: explaining the reasoning behind incorrect as well as correct answers results in lively discussions. The EVS sequence usually ends with the teacher clarifying the correct answer. There are many other ways of using EVS to facilitate interaction and collaborative learning, and EVS have been used across a range of disciplines (see Draper & Brown, 2004; Banks, 2006). In Interactive Mechanics, where EVS is used, class size is 260 students (there are two sessions of 130 with each EVS class lasting two hours). Summative assessment comprises 10 fortnightly written homework exercise, a two-hour class test and a written exam.

Through REAP project funding, the Department of Mechanical Engineering is piloting new uses of EVS software (e.g. ranking tests) as well as other web-based tools such as Intelligent Homework Systems. Two developments are important in relation to this paper. Firstly, the use of online tests has been integrated with the use of electronic voting. Students are presented with online problem solving exercises or MCQs before the in-class EVS sessions. The teacher then uses the results of these tests to establish areas of weakness and to determine the focus of the classroom EVS sessions. This procedure, often called 'just-in-time-teaching' (Novak, Patterson, Gavrin & Christian, 1999), is a way of targeting teaching to students' needs and level of understanding. A second innovation is the use of confidence or certainty-based marking (CBM) during EVS sessions. This uses multiple-choice questions but students must also rate their confidence (certainty) in their answer (see, Gardner-Medwin, 2006). This is being piloted as formative assessment using the rules in Table 3, with the intention of using this for summative assessments at a later time. CBM requires that students engage in meta-cognitive thinking – that they step back and reflect deeply about whether there is good justification for their answer.

The use of EVS in Mechanical Engineering is a powerful example of a highly integrated implementation of the feedback principles and conditions using more than one technology. However, for the sake of analysis we have separated out the implementation of each principle/condition as it applies to this course.

Table 3: Scoring regime for certainty-based marking

Degree of Certainty	C=1 Low	C=2 Medium	C=3 High	No reply
Mark if correct	1	2	3	0
Penalty if wrong	0	-2	-6	0

Relation to the seven feedback principles

- Learning goals in class are clarified through iterative cycles of tutor presentation, testing and re-testing of concepts using MCQs. (Principle 1)
- Opportunities for self-assessment and reflection are available when the teacher provides the correct answer to the concept question at the end of an in-class EVS test sequence. Students also reflect on their answer during confidence-based marking. Reflection is also possible after the bar chart presentation of class response. (Principle 2)
- Teachers normally provide feedback in class in response to students' questions and at the end of each concept test sequence to clear up any misunderstandings. (Principle 3)
- Peer dialogue is integral both to peer instruction and class-wide discussion with specific student-tutor dialogue occurring during class-wide discussion. (Principle 4)
- The EVS class focuses on learning goals rather than performance goals (i.e. grading) and there is step-by-step progression in difficulty of the concept questions – both processes are known to enhance motivation. (Principle 5)
- The continuous cycle of tests, retests and feedback ensures that students have opportunities to 'experience' a closing of the gap between desired and actual performance. (Principle 6)
- A great deal of information is available to the teacher about areas of student difficulty that is deliberately used to shape teaching. The bar chart feedback provides instant feedback about difficult topics and asking students to explain answers during class-wide discussion uncovers misconceptions. The information provided before class through the web-based MCQ tests also informs in-class teaching. (Principle 7)

Relation to the four assessment conditions

- The web-based assessment tasks (MCQs and problem solving exercises) keep students engaged in out of class activities and EVS exercises encourage engagement in class. (Condition 1)
- EVS activity is distributed across topics and weeks. (Condition 2)
- EVS tasks are designed to deepen learning as evidence of students' understanding increases in topic areas. (Condition 3)
- The EVS activities clearly communicate what is required and there is a progressive increase in challenge. (Condition 4)

Commentary

Extensive evaluations have been carried out in this engineering mechanics course showing significant learning gains (Nicol & Boyle, 2003; Boyle & Nicol, 2003). Overall, the changes have been a huge success both in terms of student end of year performance in exams and in terms of retention. There has been a reduction from 20% non-completion to 3%, the largest gain in any course within the University. Also, since the introduction of concept testing using electronic voting, attendance in class remains high throughout the year unlike similar lecture-based classes. Further evaluations of confidence-based marking and intelligent tutoring are now being carried out. While there is a great deal of research on the benefits of using of EVS to support learning (see Banks, 2006), this is the first analysis from a formative feedback perspective. This analysis provides new insights into how the different component processes (self, peer and tutor feedback) interact and reinforce each other. A fuller explanation of the power of EVS interventions in other contexts might also benefit from this kind of analysis.

Discussion

The two case studies reported above show how ICT might be used to support a broad range of assessment processes in large first year classes. A key issue in the literature on formative assessment is how to move students from being dependent on teacher feedback to being able to generate their own feedback on learning. These case studies address this issue in that they both involve elements of self-assessment, peer and teacher feedback, implemented in ways that support the development of learner self-regulation. But what are the potential limitations of these methods? Firstly, it should be pointed out that the Psychology case study is currently in pilot mode and there is a need to scale this up to the complete student cohort of 550 and carry out a full evaluation. A second issue concerns the balance of learner self-regulation and teacher direction. In these case examples, one might argue that it is still the teacher that is directing students' learning by setting the discussion tasks and by determining the timing and nature of learner interactions with subject matter. Hence the approach adopted might not fully address the concerns of researchers who believe that changes in tutor-student power and authority relationships must take place for feedback to impact on learner self-regulation (Higgins, Hartley & Skelton, 2001; Taras, 2002) or that students must actively participate in the construction of assessment criteria if they are to understand the meaning of feedback (Rust, Donovan & Price, 2005)

In addressing this issue, it is important to note that there is considerably more autonomy built into these classes than in traditional teaching approaches. For example, in the psychology course the students collectively construct their understanding of criteria as well as their responses through group participation and dialogue. In addition, the proposed use of student created model answers (to replace the teacher model answers) as the basis of self-assessment will take this a step further (see below). A second point is that these are first year classes and a clear structure for learning might be appropriate at this level. Yorke and Longden (2004) suggest that regular and structured tasks help students appreciate the kinds of learning expected and provide early opportunities for feedback and guidance from tutors. However, it would be possible to strengthen learner autonomy within these case studies and relax teacher control. For example, one criticism of the EVS procedure might be that student learning is driven by MCQ tests formulated by the teacher. But this could be addressed by having students construct MCQs themselves for use in the classroom as was done by Fellenz (2004). This would actively engage them in generating assessment criteria and example questions within their own subject discipline (strengthening the enactment of principle 1). Similarly, in the psychology case study it would be possible to have students actively formulate the discussion questions. What these examples show is how each of the seven principles might be used as a reference point when trying to strengthen support for self-regulation in the course design.

Two pedagogic issues have been raised about the Psychology case study. Firstly, the use of model answers written by teachers has led some researchers to suggest that this will encourage in students the belief that there is a right answer and that this is counter-productive in the first year. The psychology department intends to address this issue by replacing the teacher answers with two or three selected model answers from those posted by students. This will not only help address the single answer issue but should also be motivational to the student group (principle 5). Another issue is free-rider effect where individual students might contribute little to the group response posted on the discussion board. This is being addressed in the redesign where the students will now be required to make an individual contribution before the group discussion for each response type (50, 100 and 300 word responses not just for the 50-word response). Also, once a final group response has been agreed through peer discussion, each student will be required to submit a copy of that response to the virtual learning environment. While individual and group responses will not be marked they will be a course requirement (compulsory) and graduate teaching assistants will monitor contributions. These refinements should help minimise free-rider effects.

A key consideration from the REAP project perspective is that the psychology and mechanical engineering redesigns do not increase staff workload. In psychology, the proposal to half the lecturing workload and the use of graduate teaching assistants to monitor student contributions points to similar overall costs. However, there has been a significant increase in feedback opportunities. Before the project began students received almost no feedback. Now the learning environment is rich in opportunities for self and peer feedback. Overall, the psychology case study is an excellent example of an elegant and efficient learning design. Moreover, the design plan is easily transferable to other courses and is simple to implement: it only involves a standard tool available in every virtual learning environment (discussion board). Similar arguments could be made for mechanical engineering.

One interesting observation from the Mechanical Engineering case study is the role played by MCQs. Many writers have noted the limitations of MCQs, for example, that they encourage surface low-level learning (e.g. Scouller, 1998). Yet, the Mechanical Engineering example provided here shows that it is not the test itself that is important but the context of its use. Considerable power is gained when MCQs are linked to peer discussion in the EVS classroom and when the implementation includes a blend of online and offline interactions (as with the just-in-time-teaching scenario).

A key outcome of the REAP project is the value of having robust assessment and feedback principles (and conditions) derived from research, when thinking about the design of assessment practices. In this paper, Nicol and Macfarlane-Dick's (2006) seven feedback principles and Gibbs and Simpson's (2004) four assessment conditions have been brought together to provide a broad framework for examining course design and the balance between learner self-regulation and teacher direction. As well as being important in learning design, such principles are also valuable in the evaluation of changes in assessment practice.

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