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ASSESSMENT FOR LEARNER SELF-REGULATION: ENHANCING THE FIRST YEAR EXPERIENCE USING LEARNING TECHNOLOGIES

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Assessment for Learner Self-regulation: Enhancing the First Year Experience Using Learning Technologies

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Abstract

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 and 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. It then shows, through two case studies, drawn from the Re-engineering Assessment Practices (REAP) project, how ICT might support formative assessment processes and the development of self-regulation in large first year classes. Finally, the paper presents a set of principles for the effective design and evaluation of formative assessment and feedback processes in relation to learner self-regulation.

Introduction

Across the higher education sector there is a growing interest in the quality of student learning experience in the first years of undergraduate study. This interest is fuelled by statistics showing poor course non-completion rates and by a 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 self-regulated learning and academic success are central to this paper.

Formative assessment and academic failure

There is a considerable body of evidence showing that the number of opportunities available for formative assessment and feedback is an important variable in non-completion by students in the early years of study, even though a direct causal connection has been difficult to prove (Yorke, 1999). Yorke (2004) has argued that where students are uncertain about their ability to succeed formative assessment and 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 and 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. These changes have also been shown to impact on the students' sense of self and on their motivation and self-confidence.

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 and Simpson (2004) was directed at addressing this question. 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) was based on two over-riding principles. 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, of high quality and actually used by students to make improvements in their work.

Although Gibbs and Simpson (2004) offer sound advice for anyone wishing to improve formative assessment, their eleven conditions are largely teacher-driven. It is the teachers who are expected to ensure that students spend time on task and that they receive appropriate feedback. While what the teacher does is an important determiner of academic success there are other

perspectives. For example, Yorke and Longden's (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 practices in this paper is based on developing learner self-regulation (see, Nicol and Macfarlane-Dick, 2006).

Alongside the need to rethink the purposes of formative assessment there is also a need to rethink the methods by which formative assessment is delivered. Recent advances in information and communication technologies (ICT) are having a large impact on the organisation and delivery of student learning in HE. There is also a growing interest in the use of computers to streamline the delivery of formative assessment tests and of teacher feedback. While the implementation of some of Gibbs and Simpson's eleven conditions could be supported using computer-assisted assessment (e.g. the provision of rapid feedback through online tests), Gibbs (2006) is less convinced about the value of CAA. He maintains that:

There is very little evidence that the increase in the use of computer-based assessment has a beneficial impact on the quality of student learning, though there is some evidence that it has increased its quantity. [Gibbs, p18]

This paper demonstrates ways in which ICT can be used to support the development of learner self-regulation and the delivery of teacher 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, p77). 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 autonomy in learning. Each of these principles is defined in detail in the earlier paper with the supporting research and example their implementation. Table 1 presents the seven principles.

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 peformance
7. provides information to teachers that can be used to help shape teaching.

Nicol and Macfarlane-Dick (2006)

Table 1: Seven Principles of Good Feedback Practice

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 and Yorke, 2003; Boud, 2000). However, it departs from the work of others in one important respect. In the model it is assumed that students are always 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 (Nicol and Macfarlane-Dick, 2006). There are at least three reasons for this argument. Firstly, students are always informally engaged in the self-regulation of learning when they engage in academic tasks (e.g. writing an essay). Indeed self-regulation is logically implied by active and constructivist thinking (Winne, 2006). In constructing meaning students are already assumed to be active agents of their own learning.

Secondly, 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. Thirdly, students in some 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 how ICT can support the development of learner self-regulation. Also provided are some illustrative examples of how learner self-regulation might be supported using multiple-choice tests. Each of the case examples uses different technologies (discussion board, electronic voting systems, and multiple choice 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 initiative.

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 the Nicol and Milligan, 2006 research in that a key objective of assessment re-engineering is to lay a foundation for autonomy and self-regulation in learning during the first year.

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 continuing students with 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 3 essays from eight (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 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. The discussion board within the institutional virtual learning environment (WebCT) is the technology in use.

Seventy-eight students were invited to participate in the pilot study (15% of 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 number of weeks. For the first question they were asked to post an individual 50 word response to a

private submission area in WebCT: this response could not be seen by other students. They were then directed to engage in an online discussion about their answer; the instructions were to debate/argue what they believed the correct answer to be. For the second question they are asked to engage in online discussion in their groups and 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 posted a 300 word 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.

Relation to seven feedback principles

Key features of this pilot are that the task questions are progressively more difficult, that responses move from an individual to a group that there is a model answer for comparison at each stage. Tutors provide no feedback neither do they moderate the discussion. What is important here however is how this course design implements the seven principles of good feedback and helps develop learner self-regulation:

- Providing a model answer is one way of progressively clarifying expectations and helps clarify what good performance is (Principle 1)

- Students engage in self-assessment (reflection) by comparing their own responses against the model answers (Principle 2)

- There is online peer discussion around the learning task with the goal of reaching consensus about each group's submitted responses (Principle 4)

- The increasing complexity of the questions scaffolds and stages learning development and the focus on learning goals rather than marks should enhance students' motivation (Principle 5)

- The repeat and progressive nature of the task provides some opportunities to close the gap between desired and actual learning (Principle 6)

Commentary

Preliminary findings from focus groups and questionnaires show that that the students were positive about this learning experience. They reported that working collaboratively has 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*". Another finding was that the early induction task where students introduced themselves helped create more supportive social interaction in the first year as evidenced by the discussion board postings. Being part of a

large first year class does not guarantee, and may even inhibit the, establishment of social contact with others.

One question raised by the pilot is whether these peer discussion tasks should be compulsory or voluntary. Not all students participated in the online discussions and although refinements in instructions are possible this might always be the case. However, making the peer discussion compulsory would have significant implications for teachers' time as they would have to monitor contributions. An argument for leaving this task voluntary is that the feedback is an extra resource to support the first year experience; it can be used by students if they wish. This type of resource would support a movement to more flexible learning scenario.

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 and peer feedback core components of the class. This methodology is easily transferable to other courses and is simple to implement and only involves a standard tool in any VLE (discussion board).

Example 2: Mechanical Engineering

The second example explores how a range of technologies including electronic voting systems 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 and Boyle, 2003; Boyle and Nicol, 2003). The aim of the New Approaches to Teaching and Learning in Engineering (NATALIE) 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 (1992) 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 and Boyle, 2003). After the discussion the teacher usually retests the students' understanding of the same concept test. Another strategy is for the teacher to facilitate 'class-wide discussion' on the topic by asking students to explain the thinking behind their answers. 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 and EVS have been used across a range of disciplines. 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 MCQs before the interactive lecture sessions (EVS). 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 et al., 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 rate their confidence (certainty) in their answer. This is being piloted as formative assessment using the rules in Table 2 with the intention of using this for summative assessments at a later time. CBM requires that students engage in metacognitive thinking – to step back and reflect deeply about whether there is good justification for their answer.

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

Table 2: Scoring regime for Certainty-based marking

Relation to the seven feedback principles

The use of EVS in Mechanical Engineering is a powerful example of an integrated implementation of the seven principles. However, for the sake of analysis we have separated out the implementation of each principle as it applies to the EVS class:

- Learning goals are clarified through iterative cycles of tutor presentation, test and re-tests of concepts using MCQs (Principle 1)

- Opportunities for self-assessment and reflection are available when the teacher provides the concept answer at the end of the EVS test

sequence and when students 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 during 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 to peer instruction and class-wide discussion and student-tutor dialogue occurs during class-wide discussion. (Principle 4)

- The EVS class is focused on learning goals rather than performance goals and the step-by-step progression in difficulty of the concept questions both help maintain 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. This is used to shape in-class teaching. The bar chart feedback also gives the teacher instant feedback about areas of difficulty and asking students to explain answers during class-wide discussion uncovers conceptual misconceptions. The information provided before class through the web-based MCQs links out of class (homework) with in-class activities: this feedback can be also inform in-class teaching (Principle 7)

Commentary

Extensive evaluations have been carried out in engineering mechanics 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 tests with electronic voting, attendance at 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.

Discussion

The two case studies reported above show how ICT can be used to support a broad range of formative 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 learner self-regulation.

But what are the potential limitations of these methods? Firstly, it should be pointed out that the Psychology 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 is the balance of learner self-regulation and teacher direction. Taking a purely self-regulated learning perspective one might argue that it is still the teacher that is directing students' learning and, in particular, their interactions with the subject matter.

In addressing this issue, it is important to note that there is considerably more autonomy built into these classes than in traditional teaching approaches. A second point, is that these are first year classes and a clear structure for learning is perhaps appropriate at this level, although this argument might not be appropriate in later years. However, it would be possible to extend learner autonomy by re-examining the case studies in the light of the seven principles. For example, one criticism of the EVS procedure might be that students are always engaged in tests formulated by the teacher. But this could be changed by having students construct tests for use in the class themselves. This would ensure that they are actively engaged in generating assessment criteria and example questions from their subject discipline (principle 1). This strategy might be more appropriate with experienced students.

One interesting observation from one of these case studies is the role played by objective multiple choice tests. Earlier in the paper attention was drawn to Gibbs' (2006) comments about the weaknesses of MCQ tests. Yet, the Mechanical Engineering example shows that it is not the test itself that is important but the context of its use. Considerable power is gained when assessment principles underpin the implementation of these tests as occurs in the EVS classroom and when the implementation includes a blend of online and offline interactions (as with just-in-time-teaching).

In the introduction, this paper also outlined Gibbs and Simpson's approach to enhancing formative assessment and feedback processes. Their concern was with the nature of the feedback provided by the teacher (its timeliness, quality, quantity and use), and that students spend their study time in productive ways. Their eleven conditions (based on these two broad principles) are important and in fact complement the seven principles advocated in this paper. Indeed, if the two case studies presented in this paper had been analysed in terms of these eleven conditions it would have been evident that many of them were satisfied.

A key outcome of the REAP project is the value of having robust formative assessment principles derived from research when thinking about the design of assessment practices. As well as being important in design such principles are also valuable in the evaluation of changes in practice. Both the Gibbs and Simpson (2004) framework and the Nicol and Macfarlane-Dick (2006) principles are a first step in this regard. Future research might see some merging of these frameworks. Indeed, this work is already underway at least in relation to written feedback (see, Brown and Glover, 2006). The

development of this research will not just help enhance the first year experience but should also benefit students in later years.

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