The use of formative assessment and support materials to assist students in taking control of their own online learning.

Richard F. Brightwell and **David Buchannan**, School of Nursing Midwifery and Postgraduate Medicine, Edith Cowan University, Perth, Australia
r.brightwell@ecu.edu.au d.buchanan@ecu.edu.au

Abstract: *Traditionally, science instruction has focused on creating an interactive, intrinsically motivational approach to teaching, i.e., 'delivery', but there is a need to be paying just as much attention to empower students with the ability to 'receive' the science. Some of the keys to this recipe include the use of self-assessment tests; activities that require the interpretation of case studies; peer instruction interactions; online and multimedia lessons which encourage top-down/bottom up science processing strategies to decipher meaning; and simulations that test all of the science skills in action. Online materials foster autonomous learners in a science practice. The end goal progresses students to function outside a passive classroom environment so they may, without the aid of an external evaluator, shift the process of learning from the teacher to the student.*

This paper addresses critical issues in Anatomy and Physiology education; how to better motivate students and help them make the connection to what is important to learn; how to get students to see the whole topic rather than minute details; how to help students who lack study skills and how to instill critical thinking skills from entry to the course so as to succeed in learning attribution to efficacy. Within this philosophical framework, formative assessment techniques provide students with the knowledge and detail that is needed to move forward in their careers, through an emphasis on critical thinking, conceptual understanding, and relevant application of knowledge.

In doing so the resources provided help students to:
- *come to class better prepared for lectures*
- *get immediate feedback and context-sensitive help on assignments and quizzes; and*
- *track their progress throughout the course*

Introduction

In recent times the availability of new technology has changed student expectations of teaching in science units at University. At Edith Cowan University (ECU) there are many alternate ways for a student to access information and many different student expectations. The variety of students means that there is a great variety of learning styles, from Confucian to Socratic. These variations cause a number of problems for educators servicing large first year science courses. This report considers the approaches made by educators in first year Anatomy and Physiology classes across a range of disciplines and evaluates the interventions introduced to encourage the students' ability to receive science rather than just to receive delivery.

The significant challenges of teaching and assessing large classes of undergraduate students are acknowledged in 'Assessing Learning in Australian Universities' (James, McInnis and Devlin 2002). Between 1984 and 2004 the average staff student ratio in Australian universities rose from 1:13 to 1:21 (DEST 2005) and, in many Australian universities, the move to consolidate discipline areas resulted in large first year enrolments for core units such as Biology (Peat and Franklin 2002) and Human Biology (Fyfe and Fyfe 1999).

Teaching and assessment strategies are not only constrained by high student numbers, but are also complicated by the diversity of students found in large undergraduate classes. Students may have differing background knowledge, skills, life experiences, expectations, academic sophistication and intellectual maturity. Their approaches to different assessment tasks and their ability to reflect on their performance, and their response to the feedback they receive may vary considerably. This was seen in a comparative report of student and teacher experiences in higher education in Australia in 1994 and 2004 the students in 2004 were more likely to agree that their teachers were enthusiastic,

good at explaining things, approachable, took an interest in their progress, than a similar group ten years earlier (Krause, Hartley, James and McInnis 2005).

Peat and Franklin's 2002 study of Australian undergraduate Biology students failed to show that better formative assessment improved student learning in the short term. However, in revisiting the data they found that while students who used extra resources in their first semester did not gain higher marks than other students, the experience had a positive influence on their results in second semester. Even students who had not used the resources in semester one, but did so in semester two, showed a significant improvement in their learning (Peat, Franklin, Devlin and Charles 2005). Their findings support Ramsden's earlier suggestion that previous experience influences a student's approach to learning (Ramsden 1992). Krause et al. (2005) found that while mature age students might be new to study, they generally have a clear purpose motivating their study, and are more likely to seek assistance from tutors. Thus, there is evidence that age and/or experience of learning influence the behaviour of these students.

The self-confidence of students plays an important role in the success or failure of a student in the learning process. Several studies indicate that the major factors in determining whether a student passes or fails are self-confidence, motivation and willingness to engage in the range of learning activities provided for them (Black and William, 1998; Robey, Konsky, Ivins, Susan, Loh and Cooper 2006). Students high in self esteem evaluate their own performance favourably and are likely to be more successful as a result relative to students with low self-esteem (Jussim, Coleman and Nassau 1987; Lane and Lane 2001).

Factors that impact strongly on self-confidence include prior performance and success at previous learning institutions (Nicol and McFarlane-Dick 2006). Research from Australian and overseas universities consistently indicate that secondary school results are very strong direct predictors of tertiary performance (Pargetter, McInnis, James, Evans, Peel and Dobson 1998; Krause et al., 2005).

Prior results and experiences also influence students' choice of tertiary institution in Western Australia; admission to Western Australian tertiary institutions is determined according to an academic performance index. Alternatively students may be ranked according to a combination of indices, such as the score of some form of scholastic aptitude test, school recommendations, and other relevant experience or submitted folio of work. Students with alternate entrance qualifications or lower Tertiary Entrance Ranks (TER) tend to choose or be chosen by ECU rather than any of the other Western Australian Universities (TISC 2006).

The implication of such studies for teaching practice is that motivation and self esteem are more likely to be enhanced when a course has many low-stakes tasks with feedback geared to providing information about progress and achievement, rather than high stakes summative assessment tasks where information is only about success or failure or about how students compare with peers (Perrenoud 1991; Farrell and Leung 2004).

Developing and managing multiple formative assessments for these large classes requires an enormous effort on the part of the educators as they must design consistent effective feedback and evaluate its effectiveness while taking all student needs into account (Sadler 1998; Peat and Franklin 2002; Yorke 2003). However the role of online assessment in easing the burden of managing large volumes of marking and assessment-related administration is accepted (James, McInnis and Devlin 2002) along with the potential of on-line assessment to allow for increasing flexibility of delivery, diversification of assessment tasks and broadening of the range of skills assessed. Students with lower confidence in their learning may find online assessment less intimidating and all students could be expected to benefit from instructive feedback on multiple formative assessments (Shannon 2004). With this in mind the performance of a large cohort of interdisciplinary students of Anatomy and

Physiology, was investigated with respect to their experience of online resources. Students and educators are faced with a number of on going problems in these courses. A lack of:

- technique in how to study;
- knowledge about what to study;
- feedback on the efficiency of study;
- ability to attend all lectures; and
- understanding on the importance of practicals.

Methodology

The effectiveness of a number of innovations to the teaching of first year Anatomy and Physiology classes are examined by direct comparison of student activities before and after the introduction of innovations, by logging the number of visits each week on the respective *Coursecompass*^{TM} sites. The ECU students in this study tend to be older; are less likely to be school-leavers; are more likely to be in paid employment for more than 20 hours per week and to be studying part-time, than their counterparts in other WA Universities. They also tend to have had more experience in the university system, 41% of these first year students were in other university programs. (Ziman, Meyer, Plastow, Fyfe, Fyfe, Sanders, Hill and Brightwell 2007).

The problems that have been identified were approached by the following innovations. The innovations to counteract a lack of technique in how to study were that students were given revision notes on each subject on the syllabus and asked to complete a learning portfolio on these notes. The learning portfolio consists of weekly sheets that are distributed to the students at the end of their laboratory classes. Each sheet has ten boxes on it and in the following week each student has to fill in the boxes with the topics they find most difficult in the weeks work. Students are instructed to open the revision notes file and delete everything that they already know from the file. This establishes what they don't know. They are then to attempt to learn what they don't know by using the resources available to them. Having done this they return to their amended revision file and again delete that which they know. This establishes what they find difficult and that is what they put on their 10 point sheet. Each week at the start of their laboratory the sheet is collected and marked for accuracy before being filed, in the learning portfolio.

The revision notes themselves serve to counteract a lack of knowledge about what to study, however the reading and analysis of those notes starts the study process. Once the students have mastered the content to at least some extent they can access a number of multiple choice tests on each weeks work. These tests are formative and can be repeated but they have extensive feedback on every answer both correct and incorrect, which overcomes the lack of feedback on the efficiency of their study. Because such a high proportion of students are in employment. All lectures are made available online and on a server in *.ppt; *.jar; *Quicktime*^{TM}; *.avi; *.wav and MP4 formats which should cover any requirement.

To emphasise the importance of practicals, the mechanism of sheet distribution and collection ensures that the students attend the laboratory sessions. If the student is not present for the start of a laboratory they cannot hand in their sheet, if they are not present at the end they cannot collect their next sheet. The motivation to produce the sheets is that at the end of semester examination they are allowed to use their learning portfolios as an open book source.

Results

The results are drawn from an analysis of the web site statistics before and after the innovations were introduced. The website was modified in semester 1, 2005 so the results collected in the previous semester are compared with those in the same semester in 2007 when the changes had become embedded in the units. The modifications to the web site were not to its content but to the way in which the content was used. Table 1 shows the frequency with which the web site was used and which areas were used most. Table 1 shows that before the introduction of innovations the web site generated an average of 3 visits per person, this increased to 218 visits per person after the introduction. In 2004 those visits to the web site which did occur were mostly to use the discussion boards. In 2007 while the discussion boards were still the most frequently used area the content area was also popular with students accessing lecture and revision notes. It can also be seen that in 2004 feedback centred visits (6) focused on the gradebook which only gives scores for the formative tests.

Table 1. A comparison between the web site usage before and after the introduction of innovations

	2004	2007
Content Area	0	13312
Collaboration	0	49
Communications Area	15	1515
Email	2	319
Roster	4	75
Tools Area	13	86
Discussion Board	607	75762
Groups	116	715
Gradebook	6	419
Messages	0	213
Staff Information	19	9
My Grades	0	1714
Other site areas	1833	49812
Total visits	2615	144000
n	828	661
visits/person	3	218

However the 2007 cohort visited the grade book (419) but also went to the My Grades section (1714) to review their answers and the feedback given. The only area visited more frequently by the 2004 cohort (19 vs. 9) was the staff information area showing that the 2007 group there were fewer students dependant upon personal contact and more students taking responsibility for their own learning by accessing the resources of the web site.

Another effect of the attention students are giving to the web site resources is seen in a change in their study habits. Figure 1 shows that during the 2004 semester web site visits were extremely limited until the impending approach of examinations. This shows a both typical and worrying pattern of student behaviour.

The 2007 students however show a pattern working consistently throughout the semester with a peak of activity in the final week approaching examination. This may show an increase in activity for each student or it may show that the regular users are being joined by recalcitrant students who are in a last minute panic, an aspect which requires further analysis.
The increased usage of the web site appears to have resulted in an improved examination performance since the 2004 failure rate was 11.4% and the 2007 failure rate was 3.3%. It is expected that this reflects an increased performance but requires further investigation since it may be that the weaker students did not make it to the examination in 2007.

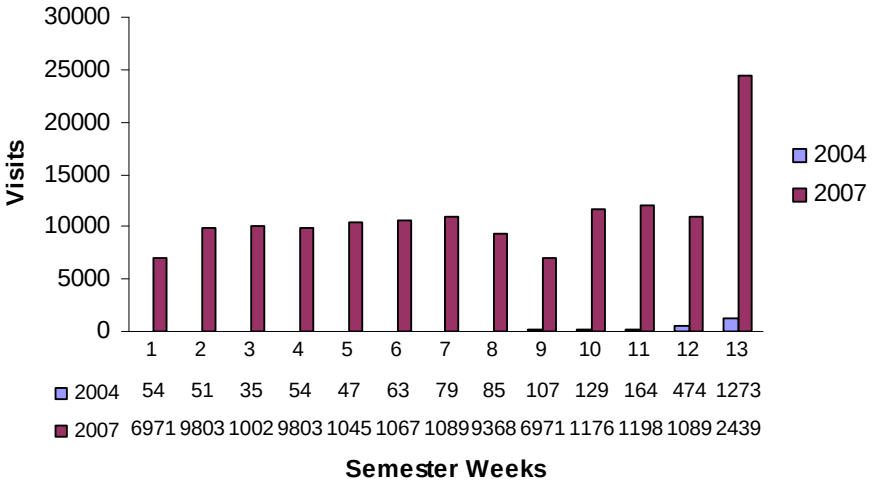

Figure 1. A Comparison of web site visits per week of semester in 2004 and 2007

Conclusion

The students studying, first year Anatomy and Physiology in semester 2 of 2007, show an increased ability to use the resources supplied to them on the ECU/*Coursecompass*^{TM} web site, when compared to their 2004 equivalents. They

- come to class better prepared for lectures, because they have the prerecorded lectures to listen to before and after lecture.
- get immediate feedback and context-sensitive help on assignments and quizzes, because they have access to the review questions on the web site.
- track their progress throughout the course, by progressively collecting a learning portfolio based upon web resources.

They have been seen to study consistently throughout the semester using a variety of aspects of the web site but particularly the online tests with feedback, the revision notes and the lecture recordings. The students are taking responsibility for their own learning by selecting formative resources that are appropriate to them as individuals. Future analysis of the usage of the web site will concentrate upon the distribution of student attention with time through the semester.

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