
Symposium Presentation

Assessment for learning and motivation

Pauline M. Ross and **Susan L. Siegenthaler,** School of Natural Sciences, University of Western Sydney, Australia
Deidre A. Tronson, Centre for Plant and Food Sciences, University of Western Sydney, Australia
pm.ross@uws.edu.au deidre@bowtie.com.au s.siegenthaler@uws.edu.au

Abstract: *Assessment is a fundamental driver of what and how students learn. Originally assessment tasks were seen as a straightforward measurement tool; in recent times, however, educators have realised the potential to use this tool in more powerful ways and issues of quality assessment and student motivation have been discussed within current pedagogical theories. When assessment tasks are embedded in the teaching and learning framework, there is a greater chance that students will achieve the intended learning outcomes and be enriched by the experience. A diversity of assessment strategies is used in the teaching of Biology at the University of Western Sydney. These strategies include self reflective and self-evaluative exercises, pre and post quizzes for lectures, writing of dialogue, creating cartoons to explain concepts as well as the more traditional strategies of mid term assessments and summative theory and practical assessments. The aims are to encourage deep understanding and knowledge and develop metacognitive skills. A key feature of these assessment tasks has been their design. The setting of explicit quality criteria, and guidelines for marking and feedback, has involved students and teaching assistants. To evaluate the success of these teaching, learning and assessment strategies, focus groups and surveys of students and teaching assistants were done in 2005 and 2006. Students identified that an important feature of the teaching, learning and assessment strategies was the personal investment by lecturers and teaching assistants.*

Introduction

Learning and assessment theory have been co-evolving (Cumming and Maxwell 1999). Initially assessment theory was narrowly focused on psychological theories of measurement (Black and Wiliam 1998), but in recent years there has been heightened awareness of the interactions between assessment, learning, performance and emotion (Newmann, Marks and Gamoran 1996; Black and Wiliam 1998; Cumming and Maxwell 1999; Tronson 2002; Sutton 2005). 'Constructivism' and 'authentic pedagogy' have been the drivers of this change with emphases on active, student-centred learning. With this new paradigm of assessment there have been two major concerns. The first is 'validity' to ensure that assessment tasks are appropriate, and aligned with learning outcomes (Cumming and Maxwell 1999; Biggs 2003), and the second is the need to ensure these new approaches to pedagogy are grounded in high intellectual standards and quality (Newmann et al. 1996). As Black and Wiliam (1998), state "this shift has been coupled with many expressions of hope that improvement in assessment will make a strong contribution to the improvement of learning". Although a vision of authentic pedagogy and assessment is desirable, it can be difficult to know in practice when assessment is genuinely aligned with the teaching and learning objectives. Further, there are few established standards, which assist an evaluation of quality of assessment in higher education. Although useful 'toolkits' are currently available to help reflect on their assessment practices (e.g. Education and Quality Improvement, UNSW 2004), these may not yet be sufficiently developed to indicate how to use the 'tools' to their full potential. If assessment is a driver of teaching and learning, how can we ensure that assessment activities are appropriate, aligned with learning outcomes, have intellectual rigour, quality of feedback and consistency in marking?

In this paper, we describe some of the assessment tasks that were designed to align with the learning and teaching strategies already developed in Biology 1 at the University of Western Sydney (UWS). We report on some of the student responses over several years. These have been gleaned from standard Student Evaluation of Educational Quality (SEEQ), open-ended survey questions, and 'minute quizzes' and triangulated with series of focus interviews. The analysis and discussion of the student evaluations presented in this paper is informed by more general questions we are asking ourselves as part of our current research on the effectiveness of assessment practices. How do we increase context, student motivation and engagement with learning activities associated with

particular assessment tasks to ensure students are connected and develop higher order thinking skills in some assessment tasks? What can we learn from 'authentic pedagogy' and the relationship between this and 'authentic assessment'?

Description of assessment tasks and methods of student evaluation

To assess students' cognitive outcomes, due to any change that we were effecting during the unit, we developed a series of on-line quizzes in each content area. We asked the students to complete each quiz on at least two occasions: once before, and once after, each content area had been covered in lectures. The students were made aware of this difference in timing so that they could evaluate or assess their level of understanding before engaging with particular topics within the lectures series. This was followed up by a similarly constructed on-line quiz for their mid-semester assessment.

In order to vary the assessment strategies, and in order to assess writing and analytical skills, a take-home experiment on seed germination was used. This assessment task was designed to evaluate several cognitive and practical skill outcomes, and provide meaningful and timely feedback to students. The details of this assignment with an outline of the marking and feedback loop have been described elsewhere (Ross and Tronson 2005). As part of this assessment task, students were provided with the marking scheme and asked to self-evaluate and grade their own assignment.

Other self-evaluative and self-reflective tasks were set for students at the end of each practical class. These involved both a Likert scale to indicate students' recall, understanding or skill development during the practical and an open-ended response. To assess communicative skills of students, students were also asked to complete a variety of different activities such as a paragraph description of how to assist a student who did not know how to set up the microscope was required, an analysis of a murder mystery scenario involving red blood cells to investigate the concept of osmosis and a series of cartoons with dialogue, requiring them to interpret complex biological text into a visual medium. Students were given choice of which concept to develop as a series of cartoons. As well as providing guidelines and explicit and transparent marking schemes, we discussed with students exemplars of anonymous student work from 'below satisfactory' to 'high level of achievement' with each assessment task. To encourage students to complete these tasks and reflect on the value, which the teaching staff placed on them, fifty percent of the total mark was allocated to this in-class formative assessment. There was also a final theory and practical examination worth fifty percent, giving a total of one hundred percent.

Student evaluation of these assessment activities was done by standardised SEEQ, focus groups and a minute paper. In the focus groups, students were asked several questions about assessments, aimed at determining student beliefs and level of connectedness to the assessment task and to the various content areas within this unit. In total, 6 focus groups of approximately six students each, were conducted with diverse groups of students in a manner approved by Human Ethics approval. The participating students were from both 2004 and 2005 Biology 1 cohorts, and were all volunteers. The SEEQ and minute paper questionnaires were offered to the whole class and an average of 48% of students returned these surveys over 2004, 2005 and 2006 (more than 400 students each year). Many students completed the 'open-ended comment' section, and the unprompted responses on this section informed the questions to be asked in the focus groups.

Results

The focus group (2005) and minute paper (2006) results highlight several aspects of the assessment tasks (Tables 1-3). Students identified that they benefited from these assessment tasks by improvement of recall, understanding and higher cognitive outcomes. Some students explicitly stated that the alignment of assessment tasks to the teaching and learning strategies made the assessments

more enjoyable (Table 1). Others identified that some assessment tasks led to metacognitive gains, "knowing what they did not know or understand" (Table 3). Overwhelmingly, 95-98% of students agreed or strongly agreed that multiple opportunities to complete on-line quizzes assisted recall and understanding (Table 2). Students also identified the importance of clear, consistent and unambiguous criteria for assessment tasks. This coupled with timely feedback, was significant in determining the way students viewed their performance (Table 1). Eight-four percent of students indicated that the seed germination assignment assisted them to improve their report writing-skills (Tables 1 and 3). Of the 23 students who chose to respond to the more detailed open-ended question in 2006, there were general positive responses. The responses to the open-ended question were further categorised in those statements specifically associated with the seed germination assessment, feedback, cognitive outcomes and *WebCT* quizzes (Table 3). The one student who thought that the assessment strategies were not helpful qualified this with a statement indicating that there needed to be more assessments as there were not enough to help them to learn! The self-evaluative aspects of the practical were not as well supported by the students (Table 3); 43-45% of students responded that these enhanced understanding, while 47% stated they were not useful (Table 2). This response highlights the importance of using student evaluations, we cannot assume that the students always concur with our views of 'what is useful'. Categories of responses were created after highlighting themes from the minute papers and are presented in Table 3.

Table 1. Summary of comments from students to a variety of questions regarding assessment from the focus group sessions in Biology 1 conducted in 2005 at UWS with 2004 and 2005 student cohorts (n=36)

Effectiveness of Assessments
Students' self-evaluation showed that they benefitted from knowing the purpose and format of the assessment beforehand; a typical comment was: "this helped me to figure out what was required of me".
Students appreciated consistent, clear and unambiguous instructions about what they were supposed to do in the assessable work, what was expected of them and what they could expect as a result of their input.
Students said that they felt the assessments were aligned with the teaching style and that this made learning more interesting and relevant. Many mentioned the seed germination report in this context.
Mini-quizzes during lectures helped students to link that lecture topic with the others in a sequence. They also provided feedback to the lecturer about student understanding and knowledge retention; from this, student input determined what needed to be revised.
Students liked the way assessments were spread throughout the semester. Representative comments indicated that this enabled them to keep the concepts they had learned 'fresh in their minds for longer' and prompted them 'to study on a more regular basis'.
The ability to re-submit the seed germination report was appreciated by students because the feedback from the first submission enabled students to learn about and rectify any misunderstandings they had about how to present a scientific analysis and report of this type.
Students felt that the feedback they received from their assessments was excellent; a typical comment was "feedback really helped me learn the topic in question".
Students appreciated having access to demonstrators and tutors outside set teaching times to discuss and clarify aspects of assessments.
Students said that the role-plays (e.g. cellular respiration) helped them during examinations because they could recall what they did and remember 'how things went'. This was a common theme; students from the 2004 cohort were amazed they could still remember fine details 12 months later. They contrasted this with other topics/subjects where they had attempted rote-learning and now could not remember details.
Students reported that receiving summaries with blank spaces that needed to be completed within the lecture helped them to focus on the lecture rather than trying to write copious notes and listen at the same time.
Interactive learning strategies prompted students to use self-assessment and study approaches that were different from those they habitually used in the past, e.g. using games and computer quizzes more often.
Having a variety of many 'memory links and triggers' helped students to recall information in examinations
Students reported that the examination results they got were better than expected, or as expected. No students in the focus groups reported being disappointed with their final result.

Table 2. The percentage responses from students (n=60) regarding assessment from the minute quiz in Biology 1 at UWS in 2006 (SD, strongly disagree, D, disagree, UD, Undecided, A, agree, SA, strongly agree).

Statement	Blank	SD	D	UD	A	SA
The WEB CT quizzes assisted my recall and understanding of Biology concepts		0	2	3	37	58
It assisted my understanding to have several attempts in the Web CT quizzes		0	2	0	33	65
The seed germination exercises enabled me to improve my report writing skills	7	2	2	5	48	36
The self-evaluation exercises at the end of each practical assisted me to focus on the main points of the practical	2	0	15	38	25	20
The self-evaluation exercises at the end of each practical assisted me to reflect on my understanding of the practical	7	0	15	35	32	11
The self-evaluation exercises at the end of the each practical were not useful	7	5	25	20	37	7

Table 3. The statements made by students (n=23) in Biology 1 at UWS, in response to an open-ended question on the minute paper, 2006. "Overall did you find the assessment strategies used in Biology 1 assisted your understanding of the concepts? Please give a reason for the answer".

Category n=23	Statements, a representative selection (in students' own words)
Cognitive (n=11)	Yes assessments allowed us to see what thing were understood and which needed more learning to do They were fair not too demanding and gave me a more positive attitude towards biology Yes they provided a means of knowing what you do and do not know Yes because applying myself and making myself look more into the topics help my individual learning process.
Quizzes (n=3)	Yes practising quizzes allowed to view mistakes and acknowledge the concepts allowing for corrections and better understanding Yes quizzes help inform what you are supposed to be learning and what is expected
Feedback (n=2)	Yes they gave feedback on what needs improvement
Seed Assessment and Research (n=7)	Assessment could be resubmitted in order to improve the way of writing, which was helpful I like that you can give in your report twice, more comfort Assessment of seed germination very inconsistent each workshop told different things to do and not do.

Discussion

It is now widely acknowledged that quality assessment should be aligned with the learning and teaching strategies used and be authentic (Newmann et al. 1996; Cumming and Maxwell 1999; Biggs 2003), but it also should be iterative so that the students can use assessment tasks as a stepwise guide to their own progression, and are able to go back to some tasks over again to improve either their performance and/ or their understanding of the topic. If we have chosen assessment strategies that have goaded students into relying on short-term memory, information recall and surface learning (Biggs 2003), then we should not be surprised if our assessments do not appear to have produced any deep understanding of the overall picture of our subject. Although is it undeniable that assessment can drive learning and perhaps teaching, it really should be seen to be more like the gear stick or blinkers of the car, not the steering wheel or controls. The blinkers would highlight to the students where they are headed and the gear stick would enable them to drive at the appropriate speed and not to drift along in neutral gear. Although it is reported in the literature that students often start in a unit

by looking at assessment and then determining an appropriate learning strategy, we have not seen evidence of this trend in the student comments reported here (James et al. 2002). By anticipating their attitudes, we have been 'joining' them instead of repositioning the assessment at the front and building the content around it. This is one aspect of aligning assessment with student learning that we hope to study more explicitly in future projects.

The aims of the assessment tasks reported here in Biology 1 are to encourage metacognitive skills and deep understanding and knowledge of biological concepts. Key features of these assessment tasks have been their iterative design, contexulatisation, setting of explicit quality criteria, consistency in marking and feedback which has involved students and teaching assistants. (Ross and Tronson, 2005). We have also ensured we have maintained a diversity of assessment tasks within Biology 1 to cater for different student learning modes (Tronson 2002). In this paper, we have argued that a key feature in these assessment practices is the interaction between learning and performance. We believe that we have encouraged more students to regard aspects of their assessment as part of the total teaching and learning strategy, instead of an exercise in ranking. From a range of evaluation techniques over several years, we have noted students commenting that they have enjoyed their learning experiences, with many identifying assessment tasks that have enhanced their long-term memory and overall understanding of some topics.

Aspects of our assessment tasks meet with a high level of student approval when compared to more traditional assessments. Some students spontaneously contrasted their positive experiences in Biology 1 with other subjects where they resorted to short-term memorisation in order to fulfill assessment criteria. The reflective nature of 2004 students who joined the 2005 focus groups was particularly noticeable on this point, although current students also appreciated the innovative teaching and assessment strategies. We believe that this indicates our integrated, diverse assessment strategies, along with explicit criteria and marking schemes that are discussed with students and tutors, are helping students to find a connectedness with Biology 1. This is consistent with what students identified as 'emotional investment' by the lecturer and/or the teaching assistants, which was also highly valued by the students. Many students reported that the more personal aspects of the learning experience, such as feeling that the teaching staff genuinely cared about their academic achievement, made them feel secure and contributed a strong motivational impetus to learning. We intend to follow up these aspects of student learning in future projects. When aspects of assessment tasks did not meet the outcomes which we had hoped would be delivered, we have always changed aspects of the design and evaluated again. Since students have highlighted that the self-evaluation and self-reflective tasks at the end of the practical sessions are neither effective nor ineffective, this will be one area where we need to make changes. Perhaps we need to involve tutors in the next round of reflection, re-planning, redesigning and re-evaluating these particular tasks. It may also be appropriate to involve students by planning a focus group for 2007, based on how students would see appropriate tasks to aid their reflection, metacognition and self-assessment.

Although, like many science educationalists, we would like to show a one-to-one correspondence between improved student results and our efforts in improving teaching and assessment practices, it is acknowledged within pedagogical and social research communities that, even if such a correspondence shown, it is not a valid 'proof' that this 'effect' is 'caused' by one factor because there are too many variables inherent in studying people. Comparing grades from different sets of students is usually not regarded as a valid way to undertake pedagogical research, and it is not usually considered ethical to deny one group of students the help that we are prepared to give a 'matched group'. To compound this problem, our unit, Biology 1, is taught across several campuses by a variety of lecturers, with a common final examinationworth 50% of the marks. We know that our spread of marks at Hawkesbury is as good as, those at other campuses, and that average scores are not decreasing year by year, and that this study has indicated students report getting final grades better than expected or as expected, so the best we can conclude is that we appear to be 'first doing

no harm'. Because of these issues, this type of comparative research study would need to be carefully planned from the beginning, and is not within the scope of the paper presented here.

New work on teachers' emotions and classroom effectiveness has highlighted the important role that emotion has on learning and on teaching strategies (Sutton and Wheatley 2003; Liljegahl 2005; Sutton 2005). It is likely that if students experience satisfaction and achievement through an assessment task, a positive feedback cycle will occur. This may be enhanced by providing a context, or an emotional link between the topic and the students' everyday lives, or by linking the criteria of particular assignments (such as a writing task or particular practical exercise) to the Biology topic being studied. Although we have designed assessment tasks to enhance these learning experiences, we are also concerned that we design a way to ensure our assessment is of appropriate quality. This will be the subject of ongoing review. As with other assessment tools developed for this purpose (Newmann et al., 1996; Ladwig 2004) we will build on the student responses and use these criteria of 'context' and "intellectual quality to further evaluate our 'authentic assessment' tasks.

Acknowledgments

We wish to thank our students who participated so enthusiastically in Biology 1 and the staff at the Educational Development Center for advice in the evaluative methods used in this study. This project is supported by UWS Human Ethics Approval.

References

Biggs, J. (2003) *Teaching for Quality Learning at University.* Second Edition. The Society for Research into Higher Education and Open University Press.

Black, P. and Wiliam, D. (1998) Assessment and classroom learning. *Assessment in Education,* **5**(1), 7–75.

Cumming, J.J. and Maxwell, G.S. (1999) Contextualising Authentic Assessment. *Assessment in Education* ,**6**(2), 177–194.

Education and Quality Improvement, UNSW (2004) Guidelines on Learning that inform teaching at UNSW. http://www.guidelinesonlearning.unsw.edu.au/about_bg.cfm [Accessed 9 June 2006)].

Harlan, W. and Crick, R.D. (2003) Testing and Motivation for Learning. *Assessment in Education,* **10**(2), 169–207.

James, R. McInnis, C. and Devlin, M. (2002) Assessing Learning in Australian Universities. http://www.cshe.unimelb.edu.au/assessinglearning/01/index.html [accessed June 28, 2006].

Ladwig, J. (2004) Quality Teaching in NSW public schools: An Assessment Practice Guide. NSW Department of Education and Training.

Liljegahl, P.G. (2005) Mathematical discovery and affect: the effect of AHA! Experiences on undergraduate mathematics students. *International Journal of Mathematical Education in Science and Technology,* **36**(2-3), 219–235.

Newmann, F.M., Marks, H.M. and Gamoran, A. (1996) Authentic Pedagogy and Student Performance. *American Journal of Education,* **104,** 280–312.

Ross, P.M. and Tronson, D.A. (2005) Providing Quality Feedback. Where to from Here? *Proceedings of Scholarly Inquiry into Science Teaching and Learning Symposium*, UniServe Science, Sydney, Australia

Sutton, R.E. (2005) Teachers' emotions and classroom effectiveness Implication from recent research. *The Clearing House* **78**(5), 229–234.

Sutton, R.E. and Wheatley, K.F. (2003) Teachers' emotions and teaching: A review of the literature and directions for future research. *Educational Psychology Review,* **15**(4), 327–358.

Tronson, D. (2002) Variety is the Spice of First-year Chemistry in Centre for the Study of Higher Education, University of Melbourne web site, Assessing Learning in Australian Universities http://www.cshe.unimelb.edu.au/assessinglearning/04/case16.html [accessed 9 June 2006].