A REVIEW OF THE USE OF ONLINE SELF-ASSESSMENT MODULES TO ENHANCE STUDENT LEARNING OUTCOMES: ARE THEY WORTH THE EFFORT OF PRODUCTION?

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Abstract

Self-Assessment Modules or SAMs were first introduced into First Year Biology courses at the University of Sydney in 1996 to enable students to self-assess understanding of content and concepts in biology. The design incorporated four levels of difficulty, each of increasing cognitive complexity but designed to use the same content. The paper will describe the design of the SAMs and evaluation of their use and perceived usefulness over a three-year period.

Introduction

Courses with flexible structures, that offer choices to learners and provide for the development of self-directed learning, encourage students to develop a student-centred approach to their studies, to adopt deep learning strategies and to develop contextual appreciation of content (Candy, Crebert & O'Leary, 1994). It is recognised that feedback on performance is a valuable tool in the learning process, especially feedback of a formative nature that provides suitable opportunities for students to gain a personal insight into their understanding of course content (e.g. Zakrzewski & Bull, 1998; Macdonald, Mason & Heap, 1999). In addition the use of formative assessment prior to final tests has been shown to increase student performance in the final tests (Clariana, 1993; Zakrzewski & Bull, 1998). In the past early formative feedback was considered a normal component of science-based courses (as in the use of weekly quizzes, paper-based laboratory reports, solutions to questions, etc.) and much of it was followed up with face-to-face encounters between teachers and students. Currently with increasing student numbers and decreasing staff resources it is becoming more problematical to provide this essential resource. We, as teachers in the 21st century, need to come up with ways that help students help themselves and the issue of giving feedback to students needs to be revisited. One way to help solve some of these problems is the judicious use of self-assessment, particularly web-based, which for many teachers is a viable option that can provide valuable information for students about their progress (Butcher, Stefani & Tariq, 1995; Edwards, 1989; Stefani, 1994). This paper will look at a form of web-based self-assessment tool that is in use in large first year classes at the University of Sydney.

Design of Self-Assessment Modules (SAMs)

Our SAMs are designed to draw together related parts of a course to help students make connections between topics in biology and to promote a deeper learning strategy, whilst providing an enjoyable feedback and reinforcement session. They are additional, optional materials designed to let students identify their level of understanding. Whilst the courses are thematic, the SAMs are organised around specific content, thus students are taken down a lateral pathway and so encouraged to see the

relationship between the materials. The development of SAMs in a non-course-specific way allows for their constant re-use even when the course themes change. The first SAM was designed and developed, using tailor-made templates, in 1996. Subsequent to this several SAMs have been produced each year, with content being entered into these question templates. Each SAM tests the student on four levels of increasing difficulty, using Bloom's taxonomy of educational objectives (Bloom, 1956) as the guide to develop the levels. Thus the content of the questions can be re-used (from level to level) but with an increasing cognitive requirement and appropriate question types have been developed for each level of difficulty. Level 1 tests *content and knowledge* with the use of multiple choice questions and drag and drop scenarios, but with the answer always on the screen. Level 2 tests *application* of content using some multiple choice, but mostly with a format that expects text input from the student. Level 3 tests *analysis* and uses question formats as for level 2, but with the addition of two part questions and formats requiring the building up of diagrams, flowcharts, etc. Level 4 tests *synthesis* of information, the most used format being free flow prose, where the student is expected to synthesise information in response to a question. This format is not computer-marked but marked by the student from sample answers, and with the option of self-scoring their own performance. A more detailed description of the educational design of the SAMs is contained in Peat (2000) and on the use of templates in their design from Peat and Franklin (1996). The SAMs appear online in a Virtual Learning Environment (VLE) that can be accessed on the Internet.

Student Instructions for Using a SAM

At the beginning of each SAM students are directed to a statement of educational rationale. Students are informed that each module is presented on four levels of difficulty and what each level is testing. As they finish each SAM, students are asked to think about their performance and compare it with a fictitious student – Mary Rotelearner – who learns content out of context and so performs well at the lower levels of difficulty and badly at the higher levels. In the log-out information students are encouraged to reflect on their performance at each level and to ask themselves what type of learning strategy they are adopting and whether it is appropriate.

Student Use of SAMs

The SAMs have been evaluated on an ongoing basis since their introduction in 1997, using both paper-based and online surveys, utilising both qualitative and quantitative methodology, and focus group discussions. Originally there was no intention to collect usage statistics from students, only formative evaluation information that would help us provide a more easily used product. Our emphasis was on student views about the product. However it is interesting to see the use of the SAMs within the bigger picture of use of our Virtual Learning Environment and this is reflected in Table 1.

Year	Used VLE	Used SAMs
1998	70%	41%
1999	94%	41%
2000(Semester 1)*	98%	-
2000(Semester 2)*	98%	60%
2000(S2)**Course 1	-	42%
2000(S2)***Course 2	-	85%

* email survey to 400 students chosen at random (25% response rate)
** paper-based survey to students in laboratory class time in Course 1
*** paper-based survey to students in laboratory class time in Course 2

Table 1: Usage figures for the VLE and SAMs (1998 – 2000)

There has been an increase in the usage of the VLE from 70% accessing it in 1998 to 98% accessing it in 2000; this is probably associated with both an increase in student access of the Internet and the provision of lecture notes on the Web through the VLE. Since their introduction in 1997, the percentage of students using the SAMs has gradually increased. In both 1998 and 1999, less than half the cohort of 1300 students (41%) had used the SAMs. By semester 2, 2000 this had

increased to 60% of the cohort. Interestingly the usage varied between the two courses offered in semester 2, with an increased usage (85%) in one course but a decrease in usage (42%) in the other course. This difference in usage may reflect the way in which the SAMs are marketed (in lab notes, on the course website, by word of mouth), and the perceptions of their usefulness by students. There is no differentiation, in the data, between one-time users and repeated use by an individual. Students were asked if they had used the SAMs, not how many times and for how long, etc. When the SAMs were introduced it was decided not to build in any tracking.

An early paper-based survey in 1997 on how students were using the first SAM developed (i.e. the prototype) showed that most students using this type of resource did so alone and were not very likely to complete it (Table 2). More SAMs were introduced in 1998, 1999 and 2000 and it was decided to evaluate them electronically as the students logged out from each individual module and thus these data are from students who actually used the SAMs. Comparison across these three years, using these online surveys and asking the same questions for all SAMs, show a correlation with the 1997 preliminary data (Table 2). It is clear that the majority of students using the SAMs do so on their own, probably at home, they do not complete the entire module in one sitting and value being able to choose a level of difficulty when self-assessing. This is consistent with the design of this type of learning resource, in that it offers flexibility both for access and order of use, and that a student can quit from the module at any time during its use but still get formative feedback on performance. The data for 1998 and 1999 show the students did not enjoy the modules as much as in the other years and that they were even less likely to complete the module. During this time there were ongoing technological changes to delivery systems as more first year biology materials were being made available via the Internet which resulted in some teething problems associated with the downloading of some of the modules.

Year	Used alone	Used in a group	% completing the module	% enjoyed using the module	% like choosing level to do
1997	81%	19%	50%	100%	—
1998	96%	4%	26%	87%	96%
1999	99%	1%	22%	87%	94%
2000	96%	4%	45%	100%	96%

Table 2: How SAMs are used by students (1997 – 2000)

In 2000 the students were asked open-ended questions about how the SAMs helped them in their understanding of content, and their learning generally. There were 107 responses and, when categorised, help in revising, help in understanding the material and help in indicating the areas that need improvement rated most highly with 15% of the total responses for each. Giving feedback, offering useful diagrams and diagrammatic representation of ideas and being a different approach from the textbook rated 12% of the total responses for each.

In a structured set of survey questions, the students indicated that they found the SAMs useful to their understanding of the content (47% useful, 30% very useful/essential, on a 5-point Likert scale), and to helping them develop an independent approach to learning (34% useful, 42% very useful/essential). Comments from the students included: *"Make studying easier and a little more exciting"; "The interaction makes study ... more enjoyable"; "Explain the material in a different way to the textbook".*

Two focus groups were asked, late in semester 2, about their use of SAMs. Those that had used them indicated that the SAMs had helped them to sort out detail in content areas where the textbook was not very useful and the lecturer had not given the detail but indicated it needed to be covered. Because the lower levels of a SAM focus on content, the students felt it helped them concentrate on the content and the linkages between the details of the content. Interestingly, most students indicated that they had used the SAMs firstly as a learning tool on the way through the semester and that they would be using them again as a self-assessment activity before the final examination.

Open-ended question methodology was used to ask students, who had not used the SAMs, the question "Why not?" The main reasons appear to be lack of time (29% of all responses) and lack of knowing the SAMs were available (27% of all responses). It is apparent to us that there is a need for better communication to the students about the types of resources available and the purpose of these resources.

A lot of time and money has been invested in the development of a learning aid that is being used by a considerable number of students (approximately 800 per year) and the data also indicate that the number using the resource is gradually increasing from year to year, supporting an argument to continue to offer these resources. The student reported use of the resources as a tutorial, to help understand and learn the content, adds to the argument.

We should address the lack of use by some students by more focused marketing (to students) and through staff training so that the teaching staff recommend the use of the resources at every relevant opportunity. However we need to ask the question "Is the lack of use due to poor communication or because there are (some) students for whom this type of learning opportunity does not suit their learning style?"

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