

ONLINE LEARNING MATERIALS: ARE THEY PUT TO DIFFERENT USES BY ONLINE AND ON CAMPUS STUDENTS?

Glenda Francis

Faculty of Higher Education Lilydale, Swinburne University of Technology, Australia
gfrancis@swin.edu.au

As part of the redesign of our first year introductory statistics course, students were provided with two additional interactive resources: a Java applet which simulates a sampling activity and an extensive series of diagnostic self tests. This paper explores the extent to which online and on campus students made use of these materials and describes the benefits students perceived. Differences in the patterns of use between online and on campus students are also described.

INTRODUCTION

The first year introductory statistics unit under investigation here is unit is taken by students in different disciplines, both on campus and online (through Open Universities Australia). These diverse student backgrounds pose some potential difficulties. In order to cater to a range of different student learning styles, a variety of different types of materials were provided. The diversity of materials is also in line with the suggestion of McMahon & Oliver (2003) that in order to develop self regulation students need to be given choices about the way they learn the material.

Considerable thought went into the assessment for the unit, and how to use this assessment to provide feedback. The role of assessment in the learning process is widely acknowledged. Ellington (2000) for example, suggests that assessing performance is the most important thing that teachers do for their students, and Phillips & Lowe (2002) comments that "Formative assessment is increasingly seen as important in supporting the learning process". Considerable research indicates that some form of continuous assessment and regular formative feedback is conducive to deeper learning (Carless, 2007; Higgins et al. 2002). With this in mind, a large number of online self tests were developed. These online tests are briefly described later in this article.

Ellington (2000) posits that in order to promote deep learning, students need to be actively involved in the learning process. This was encouraged in several ways, two of which will be discussed here. Firstly, an interactive Java applet was provided to help students develop an understanding of sampling theory. A full description of this interactive can be found in Lipson et. al. (2006). This interactive simulation was provided to both face-to-face students and to on campus students via the Blackboard Academic Suite, and students were encouraged to work through all three sections of the sampling simulation. Students were also encouraged to actively participate in their learning through the online self tests. Epstein et.al. (2002) suggest that active student involvement in the assessment process is important and that this can be achieved through the use of multiple choice tests with instant feedback.

In this paper, the focus will be on the students' use and perceptions of the interactive Java applet and of the online self tests. Three questions will be addressed: To what extent do students use the interactive applet and the online tests? What do the students feel they gain from using these resources? Do online and on-campus students use the materials differently?

STUDY DESCRIPTION

Online tests

The online tests fall into four broad categories:

- Tests of mechanical skills, such as identifying relevant statistics in an SPSS output or deciding if a particular test statistics was significant or not.
- Tests of the understanding of theoretical concepts such as identifying populations, understanding sampling and understanding confounding.
- Identifying what statistical test is appropriate for different scenarios.
- Reporting results.

All online tests were administered via the Blackboard website. This imposed some limits on the types of test items which could be used. In addition, we decided that all feedback on the tests needed to be generated automatically. Practical considerations meant that with the large cohorts of students there was not enough time for staff to give individual feedback. Also, the instant feedback provided by automatically generated responses is considered beneficial for students (Epstein et.al. 2002). For this reason no short answer questions were used. All test questions were either closed format or required a numerical answer. Within this constraint, various types of question formats were used: multiple choice questions, calculated formula, fill in the blanks and 'hot spot' questions were all utilized. A future paper will describe these different types of test and how they were implemented in full detail.

These question types work well for testing mechanical skills and for identifying the appropriate analysis, but are rather limited when it comes to testing and providing feedback on reporting of results and testing conceptual understanding. However, it is important to note that the online tests are only one of the means used to give students feedback in this unit. More refined testing and comprehensive feedback of conceptual understanding and reporting skills is given on the mid-semester test, which involves a written assessment.

Past experience suggests that students are far more likely to complete tests if the tests are given some weight in the final marks. With this in mind, each week the students were required to complete an online "Topic Test" covering the previous week's material. These Topic Tests counted for a very small proportion of the overall marks. For on campus students, time was made available to complete these Topic Tests at the end of each tutorial. Online students were given a date by which they were expected to complete each Topic Test. On these Topic Tests students were given instant feedback, which included a mark and comments on their responses. If the correct response was given, feedback included a comment on why the response was correct. For example "Correct, when the sample selection is biased, the sample does not tell us anything about the population we are interested in. Well done". For incorrect responses, some indication of why the response was incorrect was given, students were directed to the relevant section of the notes to revise and were also referred to further self-testing. For example, "Incorrect. When the sample selection is biased, the sample does not tell us anything about the population we are interested in. Revise Topic 1.2 in the notes and try the 'Impact of Bias' self tests in Week 1 of the Interactive Room." The correct response was not given.

Only one attempt was allowed at each Topic Test. In order to provide students with the opportunity to retest their understanding after revising the topic, further sets of self tests were provided in an 'Interactive Room'. The self tests in the Interactive Room were purely formative. The self-tests in the interactive room were organized into weekly folders, with each folder containing a series of tests relevant to that week's topics. There were also two additional folders in the Interactive Room, one containing 18 tests for revision for the mid-semester test and another containing 11 tests for exam revision.

It was anticipated that students would use the weekly Topic Test to identify areas of weakness. They were then encouraged to do further revision and to retest their understanding using the additional tests in the weekly folders in the Interactive Room.

Information Collected

Three sources of information were used in this study—two questionnaires, one at the beginning and one at the end of the semester, and information on test completion available from the Blackboard website. At the beginning of the semester, students were asked to complete a questionnaire which included items on their expectations (what grade they expected to achieve), as well as background information: age, gender, English speaking background, and the amount of high school maths completed.

At the end of the semester, students were asked to complete a further questionnaire on their use of the Java applet and their use of the self tests in the Interactive Room. Students were asked if they had downloaded and used the simulation. They were also asked if they found the simulation useful and what, if anything, they felt they learnt from it. Similarly, students were asked whether they found the self tests in the interactive room useful, and what, if anything they thought they had gained from using the self-tests. In addition, students were asked how they found out about the Interactive Room and what prompted them to use it. Detailed information was also available from

the Blackboard website on which self tests each student completed, how many times each test was attempted and when they were done.

Students

Two different cohorts of students were included in the study: On campus students who were expected to attend face-to-face lectures and tutorials, and online students whose only contact was via a Blackboard website and emails. Of the 192 on campus students who presented for the exam 156 completed the questionnaire at the start of the semester and 113 completed the end of semester questionnaire on use of resources. Of the 112 online students who presented for the exam, 77 completed the initial questionnaire but only 27 completed the end of semester questionnaire on use of resources. The information displayed in table 1 refers to those students who completed the initial questionnaire.

Table 1. Comparison of on campus and online student backgrounds

	On Campus	Online
Median age	19 years	28 years
% female	66%	64%
% English first language	96%	96%
% less than 6 years high school maths	39%	64%
% expecting credit or above	85%	74%

The distribution of gender and English speaking background is very similar for the two cohorts. Online students tend to be older, have weaker maths backgrounds and lower achievement expectations than the on campus students. The same website was used for both groups of students, and all students had access to the same written notes. The only differences in the resources available to the students were that on campus students could attend a face-to-face lecture each week (videoed for the online students) as well as a 90 minute tutorial in a computer laboratory, while the online students had a structured discussion board where they could post questions and interact with other students.

USE OF THE RESOURCES

The Interactive Java Applet

The Java applet is a fully interactive simulation of sampling based on selecting samples from a jar of red and black jelly beans. The simulation guides students through sampling theory; from sampling variability and the sample distribution through to hypothesis testing and confidence intervals. For the online students, the vast majority (93%) of those who responded to the questionnaire had downloaded the Java applet and of these 92% had worked through all three sections of the simulation at least once. One student had technical difficulties getting the applet to work. The evaluations of the applet were generally positive, with 91% of students saying the activity was helpful. When asked to comment on what they had gained from the simulation they typically talked about an improved understanding of sampling, for example “A better understanding of sampling distributions”. Some comments also indicated that students appreciated the opportunity to interact with the material “I enjoyed the practical side of it where I got to interact” and “They provided some real examples of the information—Generally the problem with correspondence study is a lack of ways to interpret what you read into how it actually works”. Comments like: “it was easier to understand the concept seeing visual examples”. suggest that the java applet fulfilled one of our overall aims, by providing an alternative way of learning about sampling theory.

While the interactive was used extensively by the online students, only 33% of the on campus students said they had downloaded the applet, and of these only 78% actually worked through the simulation. Surprisingly the on-campus students reported more problems with getting the simulations to run. It is not clear exactly where the difficulties lay—whether it was in actually downloading the applet or in getting it to function properly once it was downloaded. Work is

currently underway to improve the interface for the applet and in future more detailed instructions for downloading the applet will be provided.

Nevertheless, for those on campus students who did work through the simulation, the evaluations were again very positive, with 97% saying they found it helpful. In commenting on what they gained from the simulation, as with the online students, many commented on improved understanding, for example “a greater understanding of the topic”. None of the comments by on campus students reflected on the interactive nature of the simulation.

The percentages quoted here should be treated with caution as the samples were self selected. Nevertheless, the substantial difference in usage rates in the two samples is suggestive. It would seem that the simulation fulfils a need for the online students, but is less crucial for the on campus students, who have other opportunities to actively engage with the material on sampling in the face-to-face tutorials.

Awareness of Interactive Room Self Tests

Information about the interactive room was presented to on campus students by the lecturer in the introductory lecture and was presented to online students in the introductory material provided by the tutors. So when students were asked to indicate how they found out about the self tests in the “Interactive Room” we expected that most online students would indicate that their tutor was the source of the information and that on campus students would tend to cite their lecturer. The student responses, displayed in Figure 1, were somewhat surprising.

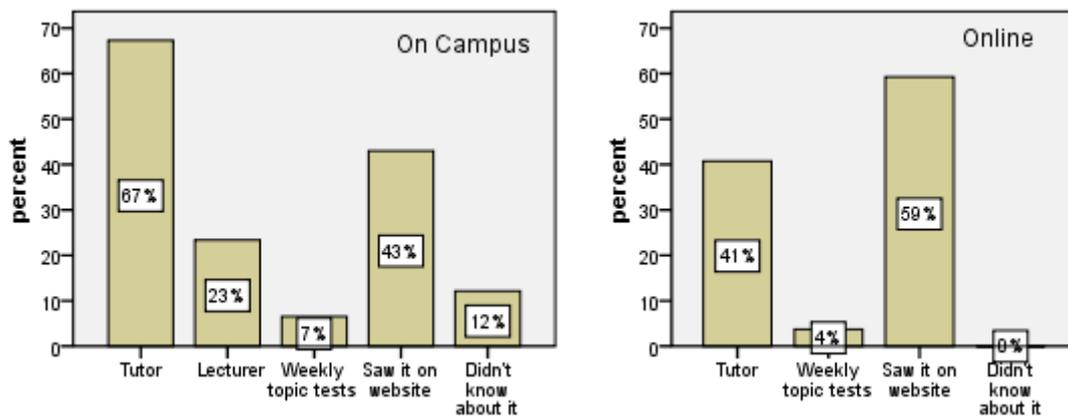


Figure 1. How did students find out about the Interactive Room?

It would appear that students don't always absorb introductory information! Sadly 12% of on campus students did not even know that this resource existed. Given that it was introduced in the lectures, that tutors were asked to encourage students to use it and that weekly Topic Tests referred to the interactive room in the feedback on incorrect answers, it is difficult to know how else to communicate its existence. In contrast, the online students were all aware of the existence of the interactive room. For these students the most common source of information was browsing the Blackboard website. Being dependent on the website for all of their materials and communication, online students are far more likely to explore it for all possible avenues of assistance.

Use of Interactive Room Self Tests

Complete information on the use of the self tests was downloaded from the Blackboard website. These self tests fall into three categories: Tests provided to revise each week's material, tests provided to help revise for the mid-semester test, and revision tests for the exam. Table 2 shows the percentage of online and on campus students who made some use of each of these types of self tests. In all categories the online students were more likely to make some use of the tests. In addition, online students made more extensive use of the tests than their on campus counterparts. For example, when only the students who had made some use of the weekly online tests are considered, half of the students used 27 or more of the 56 available tests. This compares to a median of only 7 for the on campus students.

Table 2. Comparison of on campus and online student usage of self-tests

	On campus	Online
% who used exam revision	49%	46%
% who used mid-sem test revision	28%	31%
% who used weekly self tests	53%	63%

The pattern of usage of the weekly self tests in the Interactive Room was also quite different for online and on campus students. One of the sets of weekly tests is considered in detail here—a set of 4 tests covering the week 4 topics (sampling theory and the Binomial test). Our original intention was that students would first complete the (assessed) weekly Topic Test to identify areas of weakness in their knowledge, and then, after doing some further revision, to use the Interactive Room self tests as a further diagnostic tool. If the tests were being used in this way we would expect a substantial percentage of students to complete the Interactive Room self tests in the week following the Topic Test. This is not what we found. Only 10% of both online and on campus students using these weekly tests did so in the week following the Topic Test.

The online students were predominantly using the Interactive Room tests to prepare for the assessed Topic Test. Of the online student who used this set of Interactive Room self tests, 85% completed the self-tests before the Topic Test. The on campus students however, did not generally use the self tests in this way. Only 15% of on campus students completing this set of tests did so before the Topic Test. It would appear that the weekly self tests in the interactive room are fulfilling a role for the online students, which is met by the tutorial sessions on campus, giving the students the opportunity to get feedback on their skills before being assessed.

The on campus students who use these weekly tests from the Interactive Room predominantly used them in the week before the mid-semester test or in the week before the exam, with 82% of students who used the tests completing them at these times. This suggests that the on campus students tend to study in ‘bursts’, just before the major assessments, while the online students tend to be more self regulated and to spread their study more evenly across the semester.

Student Evaluation of Interactive Room Self Tests

Overall, both on campus and online students commented favorably on the Interactive Room. Of those who made use of the resource, 93% of on campus students and 96% of the online students said that they found it useful.

The responses to ‘what prompted you to use the self tests in the interactive room?’ showed some commonality between the online and on campus students but also indicated some differences. Wanting to improve understanding was mentioned extensively by both online and on campus students, as was the desire to self-test understanding. Some of the students specifically mentioned wanting to identify weak areas that need further practice, for example: “test my knowledge, see what I need to focus on”. All of the comments made by online students focused on internal motivations—benefits they perceived they would gain, but several of the on campus students gave external motivations—the most common being that their tutor recommended it. Several on campus students also mentioned being prompted to use the self-tests because other students recommended them.

Both cohorts mentioned using the self tests to get extra practice but the focus of this practice was different for the two groups. On line students specifically mentioned wanting to practice for the weekly tests while on campus students were focused on preparation for the mid-semester test and exam. This suggests that the online students were working more consistently across the semester while on campus students tended to focus on preparing for the major assessments. This is consistent with the use made of the Interactive tests by the two groups of students as described above, and also with the poor performance of on campus students on weekly Topic Tests in comparison to online students. So whereas weekly tests did tend to encourage online students to work consistently throughout the study period, as was our intention, they did not appear to have the same effect on the on campus students.

Responses to the question “what, if anything, did you gain from using the self tests in the Interactive Room?” were also analysed. The themes evident in the responses from the two cohorts were very similar with both groups mentioning improved understanding, the opportunity for

additional practice and greater confidence. Some comments appreciative of the automatic feedback were also made in both groups. The most interesting comment on feedback came from one of the on campus students: "If I made a mistake it didn't matter, I just learnt from it. I was scared of doing statistics on the computer at the start so these really helped". This suggests that the anonymity provided by automatically generated feedback, and the fact that the tests received no marks, relieved some of the student's concerns about making a mistake. This was an aspect of the automatic feedback which we had not previously considered.

CONCLUSION

The interactive Java applet was used by the vast majority of online students who responded to the survey, but by a much smaller proportion of the on campus students. Those students who used the applet overwhelmingly reported that it was useful, and the online students in particular appreciated the interactive nature of the simulation. Students also appreciated the visual component of the interactive, suggesting that it fulfilled one of our aims—to provide learning materials in a variety of styles.

The Interactive Room self tests were also used far more extensively by the online students than the on campus students. Both cohorts of students valued the automatic feedback provided and the opportunity to assess their own progress. Those who used the self tests valued the additional practice they provided and felt that the tests helped them to improve their understanding and gave them greater confidence.

The greater use of these two interactive resources by the online students suggests that they are fulfilling a specific need for these students. On campus students receive a lot of feedback and the opportunity to actively engage with the course material through their tutorials. This study suggests that providing a variety of interactive resources is particularly helpful to online students.

There were several indications in this study that the online students were more self directed than the on campus students. They were more likely to locate the Interactive Room simply by exploring the website, their comments about what prompted them to use the Interactive Room were all internal motivations, rather than acting on an external prompt from the tutor, and they tended to work more consistently throughout the semester than the on campus students. This suggests that simply providing a range of resources is sufficient for the online students. They will use the resources in ways that suit their needs, regardless of the original intentions of the academic staff. The on campus students, on the other hand, need to be encouraged to explore the options available, rather than to rely on explicit directions from others.

REFERENCES

- Carless, D. (2007). Learning-oriented Assessment: Conceptual Bases and Practical Implications. *Innovations in Education and Teaching International*, 44(1), 57-66.
- Ellington, H. (2000). How to Become an Excellent Tertiary-level Teacher. Seven Golden Rules for University and College Lecturers. *Journal of Further and Higher Education*, 24(3), 311-321.
- Epstein, M., Lazarus, A., Calvano, T., Matthews, K., Hendel, R., Epstein, B., & Brosvic, G. (2002). Immediate Feedback Assessment Technique Promotes Learning and Corrects Inaccurate First Responses. *The Psychological Record*, 52, 187-201.
- Higgins, R., Hartley, P., & Skelton, A. (2002). The Conscientious Consumer: Reconsidering the Role of Assessment Feedback in Student Learning. *Studies in Higher Education*, 27(1), 53-64.
- Lipson, K., Francis, G., & Kokonis, S. (2006). Developing a Computer Interaction to Enhance Student Understanding in Statistical Inference. *Proceedings of the Seventh International Conference on Teaching Statistics: Working cooperatively in statistic education, Salvador, Brazil, July 2006. [CD-ROM]*. Voorburg, The Netherlands: International Statistical Institute.
- McMahon, M., & Oliver, R. (2003). Promoting Self-regulated Learning in an On-line Environment. *Proceedings of ED-Media 2001 World Conference on Educational Multimedia, Hypermedia and Telecommunications, Tampere, Finland*.
- Phillips & Lowe (2002). Issues Associated with the Equivalence of Traditional and Online Assessment. *Proceedings of the 20th Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education (ASCILITE), Adelaide, Australia, Dec 2003*.