The Evaluation of Learning and Teaching Using Identifiable Returns: An Engineering Case Study

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Abstract: The use of student evaluation of teaching has been a part of university life since the 1920s and is now a significant part of the promotion process in many institutions. Another key component of measuring teacher quality beyond the aspects measured by student experience questionnaires is the learning outcomes of the students. These outcomes are dependent on many facets of a student's education including the assessment process and their understanding of the course material. They can be measured by many means, including end of course examinations, but there are few instances where student experience surveys and student outcomes have been linked. In this study over 700 engineering undergraduates from all four years of a civil engineering program took part in an evaluation of learning and teaching in which they were given the option of adding their student number to the survey form. Results showed that very few measurements made from the student satisfaction survey had a large correlation with learning outcomes as measured by an end of course exam.

Introduction

Academic staff are responsible for many facets of student learning and the assessment of that learning. In many cases staff performance is measured by student satisfaction surveys, such as the Student Experience of Learning and Teaching (SELT) from the University of Adelaide. While it might be assumed that better teaching, as measured by these types of survey, should lead to better learning, it can be argued that these surveys only measure an academic's ability to communicate with students (Abrami et al., 1982). Despite the common inclusion of questions such as "I understand the concepts included in this course", "I receive an appropriate level of feedback to assist my learning in this course" and "the assessment in this course allows me to demonstrate my understanding of key concepts", the argument can be made that these types of surveys do little to determine if students achieve appropriate learning outcomes from a course Feldman, 1976; Eiszler, 2002; Nasser and Fresko, 2006).

The survey of learning and teaching process has been in use since its introduction in 1920 (Bernold, 2007) and is founded on anonymous returns provided by students. The anonymity is important as it is believed to lead to more honest ratings of the aspects under investigation, protects students (James and Fleming, 2004-5) and gives them the opportunity to be free to make comments of a critical nature. There is, however, much that could be learned from identifiable survey returns where it would be possible to link student responses with their final course grades.

The authors had previously reported on factors influencing the identified response to student satisfaction surveys and how students perception of their own understanding influence their learning outcomes (Walker and Palmer, 2009), but other components relating to student satisfaction surveys are also of great interest. The primary aim of this study is to report on the components of student satisfaction surveys that influence student learning outcomes with the benefit of having an identifiable population of students.

Survey Methodology

The study was run in the School of Civil, Environmental and Mining Engineering at the University of Adelaide and involved six courses spread over four years of the undergraduate course. The details of the courses as well as the survey returns are given in Table 1.

Table 1 Details for the courses, student numbers and lecturers in the study.

Course	Year Level	Number of Students
Engineering Planning and Design	1	348
Statics	1	453
Structural Design 2	2	92
Water Engineering and Design3	3	70
Structural Design 3	3	59
Civil Engineering Management	4	45

The students were surveyed using a 15-item Student Experience of Learning and Teaching survey, run as part of the normal evaluation process. The surveys were carried out in class during the last three weeks of the semester at the start of a scheduled lecture. Students had been informed about the survey but no special efforts were made to ensure they took part in the survey. Students who did not attend the session where the survey was run were not given the opportunity to take part in the survey. On the specially modified form, approved by the University of Adelaide ethics committee, students were asked to identify themselves by including their Student ID. This was not compulsory and the students were informed that the survey was being undertaken purely for research purposes although the lecturer would receive the normal feedback and other statistics from the survey.

In the survey each item was scored on a seven-point Likert scale. The survey measured items such as the students' feelings regarding workload, overall satisfaction with the quality of the course, the provision of feedback on their work and their understanding of concepts presented in the course. The full set of questions is listed in Table 2.

Table 2 Questions on the Standard Course SELT form.

1. Overall, how would you rate the workload in this course?
2. Overall, I am satisfied with the quality of this course.
3. This course stimulates my enthusiasm for further learning.
4. I feel part of a group committed to learning.
5. It is made clear what is expected of me.
6. I receive adequate feedback on my work.
7. I am motivated to learn in this course.
8. The assessment allows me to demonstrate what I understand.
9. This course helps me develop my thinking skills (e.g. problem solving, analysis).
10. The learning resources are valuable for my understanding of the course.
11. I am satisfied with the course information provided.
12. The learning environment is free from discrimination.
13. The learning environment takes into account the diversity of students' backgrounds.
14. My ability to work independently is being increased.
15. I understand the concepts presented in this course.

For analysis the survey questions were split into components (Table 3) by the authors, bringing together items that tended to be measuring similar aspects of the learning and teaching environment.

Table 3 Components of learning addressed by the student satisfaction survey

Component	Questions
Workload	1
Overall satisfaction	2
Learning environment	3,4,12,13,14
Clarity of tasks, feedback, assessment and understanding	5,6,7,8,9,15
Course material	10,11

The components in Table 3 may have the following possible impacts on student outcomes.

Workload: The workload question addressed a unique component of the course. It is possible that students who were over or under loaded may have had outcomes different to others.

Overall satisfaction: The overall rating for the course, whilst providing no specific detail, allows the student's overall impressions of the course to be measured against their outcomes.

Learning environment: Students who were not comfortable with the learning environment may well have negative outcomes.

Clarity of tasks, feedback, assessment and understanding: These questions appear to be direct measures of a student's appreciation of their own abilities and the structure provided to support and nurture that ability. These questions were deemed to be most likely linked to outcomes as measured by exams.

Course material: The adequate provision of appropriate course materials may be influential on outcomes.

Results

In total 748 students responded to the survey, with a response rate that varied from course to course and year level to year level (Table 4). The SELT data for the engineering students showed a high internal consistency with a reliability of 0.86 (Cronbach's alpha). One of the concerns with student rating of learning and teaching is the fact that paper-based surveys are generally only taken by those who attend the class in which the survey is run. Attendance is therefore an issue and this set of surveys revealed a trend, perhaps one that might have been anticipated, in which the fraction of the enrolled class who undertook the survey increased with year level. Given that including their Student ID was optional a trend also emerged where year level was found to be important. In the final year course, for example, all students who were at the session included their Student ID and this value gradually dropped off as one moved to the earlier year levels. The statistics for the percentage of the class who attended the survey session and those who provided their Student ID are shown in Table 4.

Table 4 Details for the courses, student numbers and lecturers in the study.

Course	Year Level	Number of Students	Response Rate (%)	Provision of ID (%)
Engineering Planning and Design	1	348	61	58
Statics	1	453	78	67
Structural Design 2	2	92	72	81
Water Engineering and Design3	3	70	73	86
Structural Design 3	3	59	66	90
Civil Engineering Management	4	45	91	100

Correlations with Final Mark

As shown in Table 3, the student survey was split into five components. The reliability of these components was determined (see below) and results from the questions comprising the component were combined as one unique scale. The correlation between these scales and the final exam performance of the students was determined. The results are reported below.

Workload

There was no significant correlation between workload and student performance. The students who rated the workload as high (scores of 5 and up), and were presumably applying themselves for a large number of hours each week, did not do better than those who rated the workload as moderate (scores of 4). There was also no correlation between this question and overall satisfaction by students as measured by Question 2. The results for all students who identified themselves are shown in Figure 1.
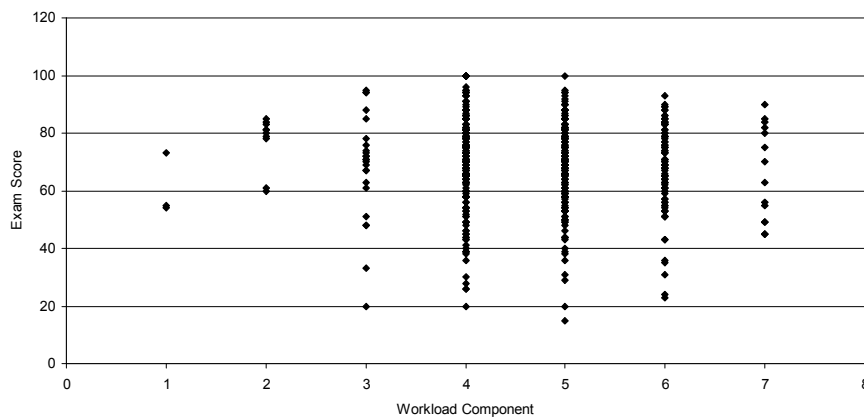
Figure 1 Final exam result and the workload component.

Overall satisfaction

There was no significant correlation between the student rating of the overall quality of the course and the final score. One might have expected that the students who were happy with course would have been the ones who were engaging more and therefore doing better. A scatter plot for the identifiable group is shown in Figure 2. The lack of correlation is evident.
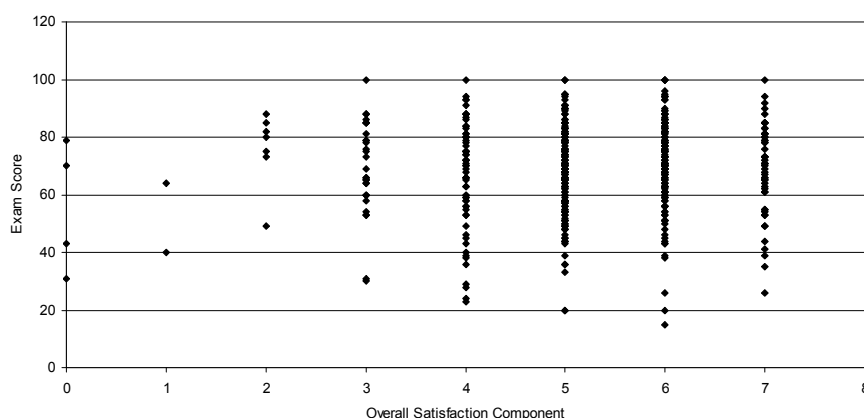

Figure 2 Final exam result and overall satisfaction component.

Learning environment

While the reliability of this scale was moderate ($\alpha = 0.66$) there was no significant correlation between them and the final score. This is shown in Figure 3. These questions relate to the learning and teaching environment and take in the lack of discrimination in the teaching as well as the students enthusiasm

and ability to work independently. Again, it might have been expected that they would be correlated to final performance but this was not the case.
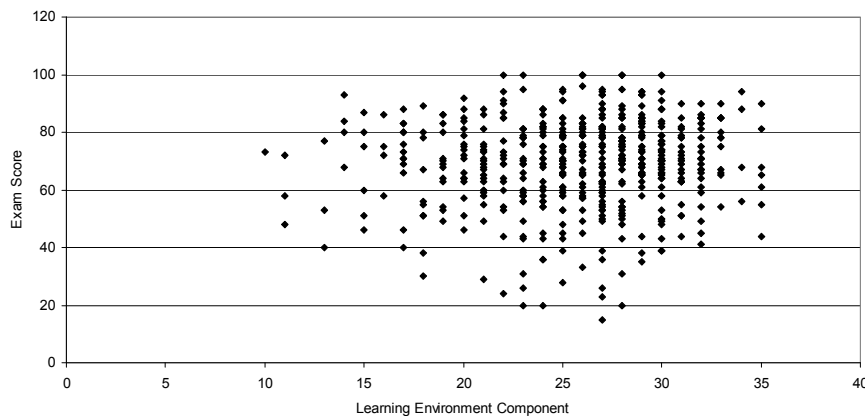
Figure 3 Final exam result and learning environment component.

Clarity of tasks, feedback, assessment and understanding

The reliability of this scale of questions was good ($\alpha = 0.80$) and there was a small but significant correlation (0.14) between this measure and the final score. These survey items are at the core of the learning and teaching and related to how well the students believed they understood the concepts as well as their rating of issues such as feedback. Figure 4 shows the results for this component. There was a lack of correlation between Question 15, which measured the student's belief in their own understanding of the course material, and their final performance, which has been reported in detail in (Walker and Palmer, 2009).
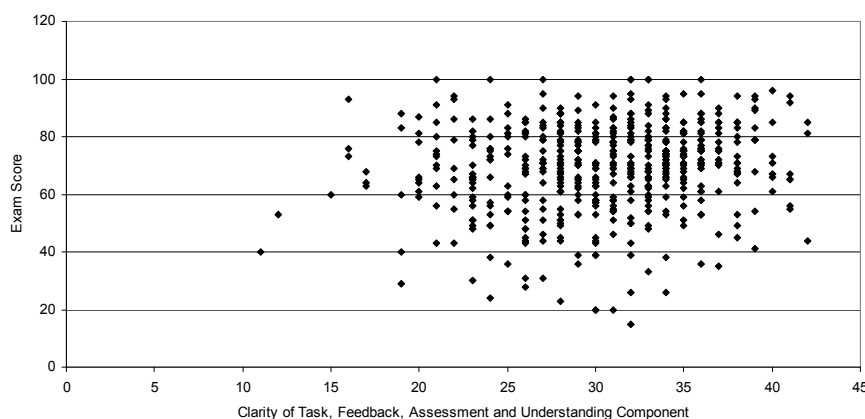

Figure 4 Final exam result and clarity of tasks, feedback, assessment and understanding.

Course material

The reliability of grouping these two quantities together was moderate ($\alpha = 0.67$) but there was no correlation with final score. The results are shown in Figure 5.

Conclusion

Overall, the authors have found no large correlations between any aspect of the student satisfaction survey and the students individual learning outcomes as measured by the final exam. In some cases, this was not entirely surprising, but it is noteworthy that even questions relating directly to student understanding and thus presumably directly linked to their performance in examinations showed very little influence.
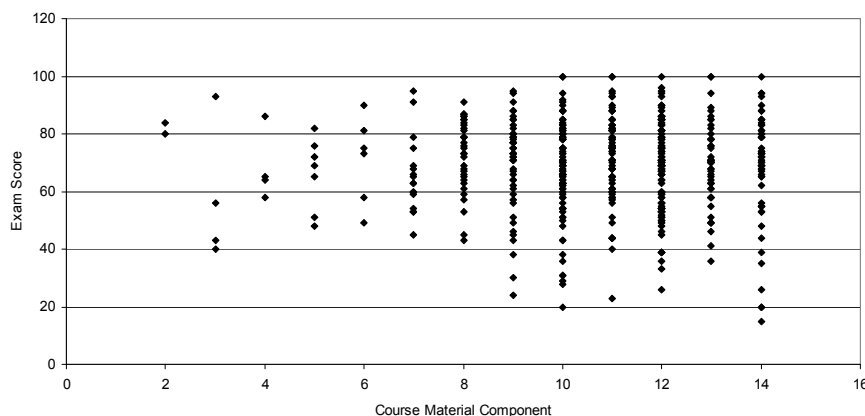
Figure 5 Final exam result and course material components.

The survey results, with the general lack of correlation between the factors that are considered as the mark of good teaching, lead to an interesting conclusion: if the results of student surveys are used to promote and reward good teaching then this may not be leading to better student performance. Rewards for good teaching need to be based on a wider set of criteria than just student surveys and actual student performance should be included as a separate and important measure in any evaluation of a teacher's performance.

Finally, although not promoting the use of identifiable surveys in general, it is important to stress that there are benefits that come with being able to link survey returns to the candidates and their performance.

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