ABSTRACT

First year statistics is one of the 'problem' subjects in many institutions. At the University of Queensland in the School of Economics it is a compulsory course with a large enrolment, offered in both first and second semesters, and also across two campuses in semester one. Even though the course content, lecturing staff, mode of delivery, tutorials, PASS and online assessment are essentially the same in the two semesters, the outcomes to 2007 have been different. At the St Lucia campus the failure rate in semester 2 was over 10% higher than in semester 1. This paper explores some possible explanations for the difference as well as assessing the success of some of the changes that were implemented from 2007 to 2009.
1. INTRODUCTION

At the University of Queensland in the Faculty of Business, Economics and Law (BEL) the introductory statistics course – Quantitative Business and Economic Analysis A known as ECON1310 – is a compulsory course which is a prerequisite for later courses and specialisations. Therefore it is important that students finish with a proper understanding of the material. As in a lot of other institutions the course has a large enrolment, is considered ‘hard’ and many students would not have enrolled if it was not required.

The course is taught in the two main semesters and has a fairly high failure rate which of itself is not a problem when standards are to be maintained. On the one hand, a high failure rate may be viewed positively as a sign that academic standards are being rigorously enforced, which is in contrast to what has been reported as happening at some other Australian universities (Sydney Morning Herald, 2005). On the other hand, higher failure rates can have a discouraging impact on teaching staff and students, and as long as the trend towards making universities more reliant on student sources of income continues, there can be no guarantee that current academic standards will survive into the future.

The problems associated with large first year courses have been investigated from various points of view. These include the value that is accorded to student learning from programs such as Peer Assisted Learning (Playford, Miller, & Kelly, 1999; Dancer, Morrison, & Smith, 2007), the style of teaching (Gibbs & Harland, 1987; McKay & Kember, 1997), the type of assessment (Reynolds & Trehan, 2000), previous academic performance (McKenzie & Schweitzer, 2001; Ballard & Johnson, 2004) and the student first-year experience and related attrition (McInnes, 2001; Trotter and Roberts, 2006).

In the School of Economics exceptionally high failure rates are considered ‘not desirable’, and over the years various resources have been provided in order to help the students to properly learn the subject matter and progress to further studies. A few years ago it was observed that the failure rate for the subject was noticeably greater in semester 2 even though the method of teaching and the assessment in the course remained the same. A concerted effort was started in second semester 2007 to reduce the differential between the passing rates for the two semesters. This paper reports the changes and the outcomes.
The paper is organised as follows: Section 2 provides a description of the course as it was prior to 2007, including the methods of assessment and resources available to help students to learn. Some possible reasons for the different outcomes for the two semesters are offered in Section 3. The fourth section explains the changes made within the course to address some of these concerns, and finally some quantitative results are presented and conclusions drawn.

2. GENERAL DESCRIPTION OF COURSE

In semester 1 Econ1310 enrolment is approximately 1000 students across two campuses, St Lucia (approx 900) and Ipswich (approx 100). In semester 2 there are approximately 450 students at the St Lucia campus, so multiple lecture times are required in both semesters at St Lucia. Except for a very small minority, the students are enrolled as full-time internal students. The course is not offered externally.

The lectures are supported by Powerpoint lecture slides available to students prior to the lecture via the course Blackboard site. The solutions to lecture examples are not included in the lecture slides but are hand-written and carefully explained during the lecture time, and students can follow and copy the solution as it is written. Complete solutions are not made available at a later date. The reasons for this are because it is advantageous to students’ understanding to be present for the explanations and clarifications, and offering the benefit of example solutions only to those who attend, is easily recognised by students to be an obvious and practical advantage.

There are 90-minute tutorials and 1-hour Peer Assisted Study Sessions (PASS) available each week for students to attend. To help the students to learn, we provide a conscientious and dedicated group of tutors\(^1\) who are also rostered for consultation periods each week. This provides, at St Lucia, about 12 consultation hours in second semester\(^2\). Only brief answers for the tutorial questions (which are in addition to text book questions) are provided on the question sheet. Those who attend tutorials will benefit from the discussions and the process

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\(^1\) Tutors are post-graduate students. The exceptions to this are that ex-PASS leaders may be employed as tutors in their 4\(^{th}\) and 5\(^{th}\) undergraduate year of a double degree. Such students are no longer ‘peers’ to first year students so they are no longer eligible to be PASS leaders, but have a wealth of knowledge of the course and of the student difficulties, and so make valuable tutors.

\(^2\) At Ipswich there was a slightly different arrangement whereby the tutor had 30 minutes following each tutorial which students could use for consultation. The lecturer was available for consultation prior to the lectures.
of working through questions and will therefore have full solutions. As with lecture examples, we do not make tutorial solutions available elsewhere as tutorials are considered to be the main learning environment. PASS has been a part of the course since 1996 and adds value for attendees. Since PASS is supplementary, as well as complementary, to the tutorials we usually find that attendance at PASS is less than for tutorials. Attendance at lectures, tutorials and PASS is not compulsory but is highly recommended. About two thirds (only 55.5% in 2009-2 and in 2007-2) of the students attended tutorials regularly whereas around 30% attended PASS regularly.

The method of assessment for many years has been a one-hour midsemester exam, a two-hour final exam and a series of six computer-managed quizzes referred to as CMLs (only the best five of which contribute to their semester grade). At the end of semester students obtain a grade between 1 and 7. A grade of 4 is a pass and 7 is high distinction. The CMLs include a variety of types of questions:– multiple choice, selection, calculation and fill-in-blanks.

Despite the similarities in the two semesters, the outcomes were very different. This was first discussed in Cook (2008). The failure rates for Econ1310 for years prior to 2007 are presented in Table 1. It can be seen that there is a more than 10% higher failure rate in second semester at St Lucia compared with first semester, and the Ipswich failure rate is substantially higher. The reasons for the Ipswich results have been discussed in Cook and Laurenceson (2006).

Table 1: Failure rates for ECON1310 prior to 2007

<table>
<thead>
<tr>
<th>Year</th>
<th>Sem 1</th>
<th>Sem 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>St Lucia</td>
<td>Ipswich</td>
</tr>
<tr>
<td>2004</td>
<td>15.3</td>
<td>40.6</td>
</tr>
<tr>
<td>2005</td>
<td>23.2</td>
<td>37.8</td>
</tr>
<tr>
<td>2006</td>
<td>22.0</td>
<td>41.0</td>
</tr>
</tbody>
</table>

Some reasons for poor grades put forward in the literature have been prior low achievement or low innate ability (Anderson, Benjamin, & Fuss, 1994; Cook & Laurenceson, 2006), maths achievement at high school (Alcock, Cockcroft, & Finn, 2008), rate of attendance (Romer,

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3 This has been true in first semester, but there appears to be less obvious benefits in second semester.
4 The exam papers require students to answers all questions (no choice). Half of each exam requires written answers and half is multiple choice questions.
The levels of commitment and optimism (or expectation of success) were considered by Lecompte et al (1983), hours of paid work for full-time students, adjustment to the university experience, maturity (age) and whether foreign or domestic students have also been studied (McKenzie & Schweitzer, 2001).

**3. FACTORS AFFECTING STUDENT SUCCESS**

In order to assess which reasons are the important or relevant ones for this course, surveys were conducted in second semester in the years 2007 to 2009. Students were encouraged to provide their student numbers on the surveys. This had the double advantage of being able to compare the early survey with the later one in the semester and also able to match attendance and other information with the final grade. Students were clearly assured that no personal identification with results would ever be made public. In the survey at the beginning of the semester in each year over 90% of respondents did supply their student number, but this reduced by 5-10% with the second survey.

In order to consider the possible reasons for poorer overall outcomes in semester 2 for ECON1310, two categories are assumed – academic and non-academic.

i) **Academic** category factors include:- Low academic entry level; high percentage of repeating students; lack of adequate prerequisite maths knowledge; students’ approach to learning.

*Low academic entry level:* When seeking to explain the high failure rates, the variable that stands out is the dramatically different entry requirements between Ipswich and St Lucia, even for a given program of study. For example, students entering a federal government-subsidised place in the Bachelor of Business Management program at Ipswich were permitted entry down to an OP15-17 in some years. An OP score is Queensland’s tertiary entrance score measured on a scale of 1 (best) to 25 (worst). At St Lucia, the cut-off for the same program was an OP5-6. The variation in entry requirements is symptomatic of the university funding system in Australia whereby each university campus has an incentive to fill all of the places allocated to it by the federal government or else not only risk losing funding but also having to pay penalties. What this lower entry requirement means is that, on average,

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5 Unfortunately only one survey was conducted in 2008 at the beginning of the semester. In 2007 and 2009 a survey was conducted at both the beginning and the end of semester.
students entering academic programs at Ipswich are considerably less well prepared to excel in tertiary study compared with their St Lucia counterparts.

The Ipswich entry requirements are relevant for ECON1310 because the course is not offered at the Ipswich campus in second semester. Ipswich students may obtain permission to enroll in it at St Lucia. Also an Arts degree program allows for student entry with OP low scores (>10). In 2007-2, 24% of Econ1310 students were enrolled for Arts or Business Management degree programs allowing OP scores ≥10. In 2009-2 the corresponding percentage was 44%. It has been found that university entry scores are significantly related to success at university as measured by GPA (McKenzie and Schweitzer, 2001; Alcock et al, 2008). Thus low academic entry level is especially prominent as an explanation for high failure rates in second semester.

**Repeating students:** It is clear that the cohort of students enrolling in the statistics course in second semester has different characteristics from those in the first semester. The majority of those students who pass semester 1 proceed to the follow-on course in semester 2. Those who do not pass in semester 1 may repeat the course in semester 2. Thus a large proportion (29% in 2007; 23% in 2009) of the students enrolled in second semester has attempted the course before – some more than once.

**Prerequisite maths knowledge:** Many universities in Australia require or recommend intermediate secondary mathematics (called Maths B in Queensland) as a prerequisite to entry to commerce and other degree programs. This was the case at the University of Queensland (UQ). In 1999 however, UQ altered the prerequisite requirements so that a student with a Maths A pass could gain entry (Alcock et al., 2008). A new course, MATH1040, was provided by the mathematics department which covered the syllabus of high school intermediate maths. This change to entry directly affected all courses with a mathematical basis, including ECON1310 especially since it is a compulsory course for all students entering the BEL faculty. In the School of Economics the maths B prerequisite for the Quantitative Analysis courses was maintained. This meant that if a student wished to enrol in ECON1310 and they had not passed maths B at school, they should have completed, or be enrolled in, MATH1040. This is emphasised in the first lecture. In the second semester in each of the years 2007, 2008 and 2009 more than 50 students did not have the required
mathematics background. Some reasons for this may be (i) there is no official check at enrolment whether students have the correct prerequisites for a course; (ii) at Ipswich the Business School has not in the past required students to enrol in Math1040; (iii) some students had specifically been advised that they did not need to do Math1040, but might have to do it later. This was very poor advice and sets these students up for a poor grade even if they work hard.

“You are not required to take Math1040 if you plan only to take the Real Estate and Development major for the single BBusMan. If you later wish to take a different major, or take a dual program, you may need to take this course.”(extract from email to student from Advisor2008)

**Approach to learning**: Whether a student aims to ‘pass’ or to ‘learn’ has a profound effect on how they approach the course, and at the same time, how the course is assessed has a profound effect on a student’s learning approach. A deep approach to learning is when a student is interested in the task and strives for understanding. A surface approach is used if a student wishes to minimise effort and also minimise the consequences of minimal effort. It is commonly associated with the strategy of rote learning (McKay & Kember, 1997). A third approach, the achieving approach (Biggs, 1987), is based on extrinsic motivation such as gaining high grades. A surface approach to learning is what a student may be forced into if there is a high work load, many reproductive assessment questions (Ramsden & Entwistle, 1981) and formal, didactic transmission of information (Gow & Kember, 1993). Students using this approach try to learn a lot of facts but fail to see how they fit together in the ‘big picture’. The information about which approach was used by each student was not directly obtained, but students were asked what grade they expected to achieve in this course.

ii) **Non-academic category factors** include: How well integrated students are into the university (the first year experience) and what kind of support network/friends they have in the course; proportion of international students; large paid-work commitments; part-time or full-time degree enrolment; poor teaching; desire for spoon feeding – poor study habits/skills; poor attendance (working alone, remote); non-consistent study, in particular not being up-to-date; expectations of success and associated level of commitment.

**Integration in to first year**: The student experience in the first year of tertiary study is often a huge change from their secondary school experience. At university there are fewer rules, fewer compulsory classes, and students must take responsibility for their own learning, planning, commitment and time management. Research into the first year students and their
outcomes, has developed strongly since the inaugural Pacific Rim Conference on the First Year Experience in the 1990s initiated by the Queensland University of Technology. Since universities differ greatly in the diversity of their student intake, their support systems and programs, their strategies and innovations in teaching and learning, it is often difficult and may be impossible to extrapolate the outcomes from a particular course at one institution to another. In other words many papers written on the First Year experience are not written with a view to providing generalisable findings, but they do provide new or innovative ideas from the successful experiences in other places (McInnis, 2001).

Students in their first year may be attending lectures where there are hundreds of students, which is much more impersonal than a school classroom. In such situations the lecturer cannot personally know each student. Success may be correlated with how well a student has integrated into the faculty and course, and whether they have a group of acquaintances or friends within the course with whom they can interact and discuss content. The tutorials and PASS are the best opportunities for students to make friends and find study partners. Attendance and participation in these classes helps to a great extent with students' integration into tertiary study. However, the first year experience is not expected to be a significant problem in this course since it is a second semester course. Most students have already completed at least one semester of tertiary education. In addition Business Management students are all advised to take this course in their second year rather than the first. They do the microeconomics and macroeconomics subjects first. One would expect therefore that some level of maturity exists in their approach to study and that they have already settled into the university and have overcome the initial problems of first year students.

There are growing numbers of international students who start their university study at UQ in second semester. In 2009-2, 16% of students responding to the first survey indicated this was their first semester at university. These students are the ones that could possibly experience the problems of integrating into a large and foreign university situation.

International Students: International students comprised between 25% and 30% of enrolment in Econ1310 in the various years. However, international students cannot be blamed for the high failure rates because they perform considerably better than the domestic students. For example this is illustrated in Figure 1 which indicates the proportions of international and domestic students obtaining the various grades in semester 2, 2007 and 2009. In general it
can be seen that international students gain more of the passing grades and less of the failing grades than domestic students.

**Figure 1: Comparison of international and domestic student grades ECON1310 2007-2 and 2009-2**

**Paid work commitments:** McKenzie and Schweitzer (2001) concluded that full-time students with part-time work commitments had significantly lower GPAs than full time students with no work commitments. Since students need some income in order to live, most students these days work as well as study. In this paper, part-time work is taken as no more than 20 hours per week. Many full-time students are able to fit this in with their studies and also involve themselves with other sport and leisure activities.

In this course it is not the part-time work commitments that are a problem but those who are full-time students and also work more than 20 hours per week. These are the students who will find it difficult to achieve to their full capabilities. In this course each year, most students
 (>90%) are full-time students. From the respondents to the first survey in 2007-2, 20% of the students stated they were working over 20 hours/week. In 2008-2 and 2009-2, the percentages were 11% and 13% respectively. Students also have time committed each week for activities such as sport, gym, dancing or music rehearsal, church, travel time, movies and socialising. Being overcommitted time-wise means that a student is unlikely to be able to reach the grade expected for his or her innate ability. Sometimes this is realised too late by the students themselves. Part of an email from a student two weeks before the final exam illustrates this:

I'm a 5th year double degree student in my final semester. I started working 4 days a week last year and now whilst taking 5 subjects this final semester, I have started to see my studies suffer.

The average grades obtained and the number of hours of outside work that students undertake are presented in Table 2. In general, as expected, it can be seen that the greater the work commitments the lower the average grade. A couple of anomalies occur for low levels of employment which may be explained by people ‘wasting’ more time when they have a lot of time available, since they are not so good at time-management. It is well known that that ‘if you want a job done then ask a busy person’.

Table 2: Average grade obtained by full time students with hours of paid outside work

<table>
<thead>
<tr>
<th>Hours of paid work per week</th>
<th>Average Grade 2007-2</th>
<th>Average Grade 2009-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;33</td>
<td>3.82</td>
<td>3.36</td>
</tr>
<tr>
<td>20 – 33</td>
<td>3.94</td>
<td>4.41</td>
</tr>
<tr>
<td>10 – 20</td>
<td>4.58</td>
<td>4.44</td>
</tr>
<tr>
<td>1 – 10</td>
<td>4.50</td>
<td>5.06</td>
</tr>
<tr>
<td>zero</td>
<td>5.04</td>
<td>4.66</td>
</tr>
</tbody>
</table>

Expectations: McKenzie and Schweitzer (2001) found support for the hypothesis that a student’s self efficacy (i.e. how well they expect to perform in a course) is positively related to academic performance. This hypothesis was tested for this course by the inclusion of the following question in each survey: What grade do you predict you will achieve for this subject? When a range of grades was given as an answer (e.g. 5 – 6), the lower one was used in the data set. It appears that students in the first lecture each year had an inflated expectation of their results with 60-70% expecting to obtain a credit or better, and approximately 10% expecting a high distinction in all years. It seems reasonable to assume
that those students who expect a high grade would be the ones who are prepared to put in the
required amount of study and time, or in McKenzie and Schweitzer’s words expectation and
performance are positively related.

From the first survey in each year, between 40 and 43% of respondents who supplied their
student numbers and answered the question, did obtain their expected grade or higher. In the
second survey students were able to revise their expectations and it was found that the
corresponding percentage was over 60%. This increase is not surprising since by the end of
the semester the students have an accurate idea of their cumulative progress and can more
accurately assess their own knowledge.

**Poor teaching:** It may be hypothesised that the teaching in second semester is inferior to that
in semester 1. I do not consider that this is true. All tutors had at least one semester of
tutoring experience, and most were very experienced with tutoring this course. Tutor
evaluations were all very good to excellent, reflecting the fact that the tutors were all reliable
and dedicated to helping the students to learn.

**Poor attendance and desire for spoon feeding:** With the great diversity of students and their
degree programs there comes a diversity of learning styles. Some students prefer to study in
isolation whereas others prefer to be stimulated by belonging to study groups and talking with
other students. In many courses there is increased demand for complete solutions to be
provided for all questions, as well as topic summaries. I resist these requests. Such full
provision of everything can give students a false confidence that they know the work. It is
much more beneficial for students to create their own summaries. Some students just attempt
to learn from a summary prepared by someone else, which does not result in the desired
deeper learning. Attending lectures and tutorials is thought to enhance student learning
especially when the subject matter is technical. It gives them the opportunity for interaction
and discussion with a smaller group of other students in a friendly atmosphere, so learning is
‘easy’. Trotter and Roberts (2006) identified attendance as an issue that impacts on retention,
with those gaining a pass having attended more than half the classes. They found those likely
to withdraw from a subject to be the ones with the poorer study skills and less efficient time-
management skills who miss classes more often. These conclusions are also the most
intuitive.
In this course in the various years about 60% of enrolled students attend more than half the tutorials whereas almost 40% attend 10 or more tutorials (out of 12). The corresponding percentages for PASS attendance are about 20% and 10%. It is very clear that many students attend everything since for example in 2007-2 of those who attended 10 or more PASS, the average number of tutorials attended was 9.8.

In recent years lectures at UQ were able to be recorded via Lectopia. The students could view or download the file and be able to see whatever was on the screen together with the voice recording. The ready availability of Lectopia, I feel, discourages students from attending and some students only focus on the lecture without doing their study from the textbook or other resources. However, the Lectopia recordings can be a valuable tool when revising for the exams. In this course the Lectopia recordings are not released and made available for students each week. The first four lectures are tested in the midsemester exam and these are available for students from the end of week 4, a few weeks before the exam. The remaining lectures are made available at the midsemester break and then at the end of the semester.

Non-consistent study: Since this course is totally cumulative, the students are advised right from the beginning that the only way to succeed is to keep up-to-date with all the work. Students who allow themselves to fall behind, find it extremely difficult to catch up as well as learn the new topics with a proper understanding. Students therefore need to manage their time well and plan their study periods and be strong enough to keep to their plan. We encourage continuous timely work by having the CML assessment when the tutorials for each topic have been completed.

4. CHANGES AND INNOVATIONS MADE TO THE COURSE

What could be done to improve the students’ outcomes in the second semester? A number of changes were made in 2007, most of which have been continued. The change which has not been continued was the homework question. This was set for students in the lecture and they prepared their answer for the tutorial. It was marked, according to a marking guide, by other students in the class then collected for the tutor to record. Although this proved to be a good learning experience some students did not perceive the marking to be overtly ‘fair’ and due to logistical reasons it was not continued in later years.
Changes to lecture notes

It was thought that a movement away from the teacher-centred expository style of lecture to a more inductive or discovery style would enable students to better grasp relationships between the new concepts and those already known. Since student involvement is an integral part of the learning process (Gorman, 1974; McKay and Kember, 1997), and our university is not involved with distance education, the lecture notes do not have to be a complete summary of the text book. I tried to engage the students early in each lecture in thinking and considering what the next step could be, by asking questions and setting a relevant scenario. Establishing relevance has been shown to be important to students’ learning (Kember, Ho, & Hong, 2008) (Ballantyne, Bain, & Packer, 1999)

Instead of providing more solutions and more lecture notes and thereby providing encouragement to those who want to be spoon fed, my aim was to promote better learning and lecture attendance by having less in the lecture notes rather than more. I rewrote the lecture slides so that the lecture began by extending previous knowledge by asking What if? and Why? questions, asking students to think a bit beyond what they knew already. In this way the students could often be led into an understanding of the new work without it being taught in a didactic manner. Some spaces were left in the lecture notes for students to fill in during the lecture time and extra explanations were provided. Answers for the examples were always hand written at the visualiser during the lecture.

Some positive comments from the students were:

- Like the idea of having to come to lectures to get answers to examples - they are a great way to understand content (also extra material provided at lectures provides good incentive to come)
- Very good how the examples are done with the visualiser, that helped me a lot to know how to do the questions and how to set them out.
- Well written in that it is advantageous for people to attend lectures to fill in blanks on lecture notes, but still detailed enough so that if you miss the lecture you aren’t severely disadvantaged.

On the other hand some students were not satisfied:

- The gaps are bad, everything should be written including answers to examples.
- Missed lectures were hard to follow without notes filled in the blanks.
- They are good, however it is annoying that you can only obtain the working to questions if you attend the lecture.

6 The words to fill in the gaps were readily obtained from the text book for those students who missed a lecture.
It may be surmised that the dissatisfied comments are from students who do not seem to be collaborating or interacting with others within the lectures or tutorials. It is quite easy to ask a friend to share their lecture notes. These students are missing out on the student involvement part of university and maybe have not integrated so well into the tertiary situation.

Throughout lectures I ask questions and expect answers from the group. This is often through a show of hands and then follows a discussion of how to think clearly through to the answer.

• *I like the lectures because we get taught the theory first and then we get to put it into practice in the examples. They're more interactive than any other lectures I go to.*
• *I like the participation, it does help keep me awake, unlike some other lectures where the lecturer just talks the whole time. I like the examples a lot*

**Changes to CML attempts**

Once the tutorial work for the topic was completed a CML quiz was made available\(^7\). In previous semesters only one attempt was allowed but since 2007 students have been allowed the option of a second attempt if they wished to improve their mark. The first attempt is generally available for one week, then the students have a few days to check answers, learn from their errors and then a second attempt is available for 3-5 days. If students did poorly on the first attempt they could improve their mark by doing the second. If they were satisfied with their mark for the first attempt then they could choose not to do the second attempt. In 2007 the maximum of the two attempts was recorded, but in other years the second attempt (if generated) was the one that was recorded. The best five out of six quiz marks contributed 20% to the semester grade. There was strong support (>90%) for the opportunity to have a second attempt for each CML quiz\(^8\). Many students were able to better learn the subject matter and then improve their mark on the second attempt, whereas a few students were able to utilise the second attempt strategically and chose not to do the first attempt especially if they were having lots of assessment in other courses during that week. This strategic use of the CML quiz second attempt allowed for a reduction in stress levels of students when they were faced with many assessment items all due at the same time.

\(^7\) Each student’s quiz is unique. The computer selects each question from a pool of questions, and for each calculation question the values for the variables are selected from a specified range.

\(^8\) The questions in the second attempt were not a repeat of those in the original quiz. They were from different pools of theory questions and a variety of similar calculation questions.
Since the questions in the CML were not presented in exactly the same order as the lecture notes or textbook, students had to identify the type of question and the technique required for the solution. They had to apply their knowledge rather than just simply substitute into a formula in a rote manner. Some questions in the CML were therefore considered hard by approximately 60% of respondents in various years. The second attempt average mark for each quiz in the various years showed an average improvement of between 2% and 10% over the first attempt.

- I haven't had to re-do any of my CML's thus far, but I do think it is a good change to the assessment, as it allows students to go back over the work again after seeing the answers for 1st attempt. 'Practice makes perfect' really is a truth for this course.
- 2007: Yes, I think both the second attempt CML and the weekly homework are excellent. I have not done Maths B and I was overwhelmed at first with the subject. The ‘incentive’ of having to do your homework, to gain the extra marks is a big plus – not that I wouldn’t do it normally, but I definitely get a ‘push’ to do it (and thus keep up to date). Also, I have reattempted both my CML’s so far – the second time I did so much better and I was able to learn where I went wrong, which also helped. ..... I work full time and find there is a lot of work to do done with ECON1310, and I can’t get to consult, however ‘breaking it up’ a bit, e.g. with the homework and second attempt CML is helpful. I find if you can take it in smaller chunks, you can manage. I also find your lectures indispensable and ### is a fabulous tutor.

Changes to Tutorial and PASS timing

The common practice in the first semester has been to have the tutorials cover the work presented in the lecture of the previous week and then PASS cover that same work in the following week. When the lectures are at the start of the week this means that two other lectures have already been given before the students cover the work in PASS. This was able to be changed in second semester because of fewer classes and fewer students. In 2007, tutorials and PASS held in the same week covered the lectures from the previous week. The tutorials were offered Monday to Wednesday and PASS was offered Wednesday and Thursday. In 2008 and 2009 the tutorials were moved to the same week (Wednesday to Friday) as the lecture and PASS was the following Monday and Tuesday. This meant the work for the topic was less spread out and not overlapping so much with other topics. It also allowed for a revision tutorial (as well as revision lecture) in the final week of semester, and allowed time for a second attempt for CML quiz 6, all of which were felt to be advantageous.

5. REGRESSION MODEL

In addition to the statistics already presented, a regression model was able to be estimated for 2007 to assess the relationship between a student’s semester mark and various impacting
factors. The variables attendance at PASS and the dummy variables for full/part-time and repeating were not significant even at the 10% level. The non-significance of the attendance at PASS is supportive of the original observation that PASS in second semester has not worked as successfully as in first semester. In fact for the domestic students approximately 68% did not attend PASS at all\footnote{The format of PASS has, from 2009, changed direction to re-emphasising the facilitating role of the leaders.}.

When the non-significant variables were omitted the explanatory power of the model was still reasonable ($r^2 = 0.36$) and no statistical problems of heteroskedasticity or autocorrelation were detected. The estimated equation (with $p$-values in parentheses) was found to be

$$\%\text{mark} = 46.38 + 1.96Tut - 1.55OP + 5.04Prereq$$

where $Tut$ = number of tutorials attended

$OP$ = students overall performance score for entering university

$prereq$ = dummy variable for whether or not the student had the maths B prerequisite.

The negative coefficient for OP score is expected as it indicates that the higher the OP value (i.e. the weaker the student) and the lower the % semester mark expected. The coefficient of Prereq indicates that students with the correct maths prerequisite knowledge are expected to obtain 5% higher marks than those without (when other factors are held constant).

In 2009, the tutorial attendance data was incomplete because one of the tutors lost the attendance data when moving house. The reported attendances from the respondents in the survey therefore did not match closely with the recorded attendances and so a similar regression was not possible.

6. CONCLUSION

Some aspects of the course cannot be measured. The human interaction between the lecturer and the students, the casual and not-so-casual reminders about keeping up to date, the interest shown in students' progress, the types of encouragement provided, are all variables that affect students' interest and commitment but cannot be quantified easily. Similarly a regular and close communication between the lecturer and the tutors, as well as the lecturer and the PASS
leaders, contributes much to the overall positive attitude and a supportive, smooth running of the whole course.

Have the changes that were made to the course been worthwhile? This can be judged by observing Table 3 which lists the failing rates for all the semester to the end of 2009.

**Table 3: Failure rates for ECON1310**

| Year | Sem 1         | Sem 2         |
|------|---------------|---------------|----------------|
|      | St Lucia | Ipswich | St Lucia | St Lucia |
| 2004 | 15.3     | 40.6    | 32.5     | 32.5 |
| 2005 | 23.2     | 37.8    | 37.5     | 37.5 |
| 2006 | 22.0     | 41.0    | 34.2     | 34.2 |
| 2007 | 23.5     | 34.6    | 29.5     | 29.5 |
| 2008 | 25.1     | 40.0    | 21.8     | 21.8 |
| 2009 | 17.1     | 47.6    | 19.4     | 19.4 |

It is pleasing to see that the various improvements and innovations within the course in second semester appear to have achieved their objective of improving the failure rate. The second semester failure rate has definitely decreased to a more acceptable level. Various factors have been considered to be important in affecting students’ success. We have endeavoured to influence students’ approach to learning by encouraging timely work with the offer of tutorials and PASS closely following the lecture. The CML assessment immediately following the tutorial work on the topic also encourages appropriate and well-timed learning. The instigation of a second attempt at the quiz has proven to be appreciated and has enabled students to improve their progressive total marks. I have not acquiesced to requests for all solutions to be put on Blackboard but have emphasized the need for the students to do their own summaries and exercises.

I believe that the increased student interaction in lectures, and the requirement that students annotate their lecture notes and write the solutions to the examples, means that the *level of engagement* with the subject matter has been enhanced, providing a good foundation for further learning in the tutorial time. The rate of attendance at lectures has been high from the beginning right through to the end of the semester and students have appreciated the inductive style of lecturing.
References


