

Developing a learning community to support student learning in a first year statics course

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***Abstract:** Engineering statics is a core first year engineering course which has had a high failure rate and a low level of student satisfaction for several years. It caters to a diverse student cohort which includes a large percentage of distance students.*

Some of the factors that appear to contribute to the poor course outcomes include students' immature study habits, first year isolation issues and variable background knowledge. We are seeking to address these issues by building a collaborative learning community through peer mentoring in both a face to face and virtual (online) environment. Peer leaders will be used to facilitate learning sessions with small groups of on campus students. These sessions will then be replicated in the online mode and extended to more general learning sessions within the university's residential colleges.

This paper discusses the proposed implementation and evaluation strategy for this program in semester 2, 2010 as well as the expected outcomes.

Background

USQ is a regional university with a large percentage of distance students. It has multiple engineering programs with flexible entry requirements and articulated programs. The Engineering Statics course is a core first year course for programs from several engineering disciplines and for different program types. Students from Associate Degree (2 year), Bachelor of Technology (3 year) and full Bachelor of Engineering (4 year) programs are all required to complete this fundamental statics course. The student cohort in this course is very diverse; approximately 75 percent of all students are studying externally and a large proportion, both on campus and externally, study part time. The engineering statics course has approximately 500 student enrolments annually.

Students at USQ, as at many other universities today, have widely varying backgrounds as a result of the 'massification of the sector' (Krause 2005, p.2). They also have diverse entry points to their programs and so tend to have a large range of background knowledge when they enrol in this course. It is possible for students with poor maths and no physics background to enrol in an Associate Diploma program and then articulate through to a full Bachelor of Engineering.

Statics is run in the second semester of first year for all programs and is usually the first highly technical course that students encounter. It often becomes the first test of core maths and physics knowledge (often only acquired by the student the previous semester) in an engineering context. Students often struggle to apply concepts that they believe they understand to an engineering problem.

For many students this course is the first time that they are required to independently learn difficult material. A study by Duff et al (2007, p. 2) of students in the School of Computer and Information Science at the University of South Australia, revealed that approximately one-third of students reported difficulty in meeting the academic demands of their courses and struggled with the

independent learning style required at university. They find that the study habits that had previously worked for them are no longer adequate as a new set of study skills is needed. To succeed in this course the individual must not only master the theory presented but also develop a skill in applying it to a range of engineering problems.

Progression and Retention

Like many engineering faculties, the Faculty of Engineering and Surveying at USQ is concerned about progression and retention rates. An internal review of progression and retention showed that although retention rates are better than average for a regional university (86% annually compared to a national average of 62.85% for regional universities) there is still room for improvement. A recent analysis of the 2003 BEng cohort showed that 21.2% of students left the faculty after their first year, this figure rose to 39.7% by the end of the second year. By the end of 2009 only 39.6% of the original cohort had the potential to graduate (Gibbins, Godfrey, King and Wandel, 2010).

Part of the faculty strategy to improve academic progression and retention rates is to implement initiatives to improve the quality of students' learning journeys at USQ by assisting with the development of transferable academic skills, improving success in key courses, addressing issues of first year isolation and transition and providing a supportive learning experience.

The USQ statics course has become a hurdle course for many students and their performance in statics often determines whether they progress with their engineering programs or not. This makes it a key area of concern when addressing retention and progression.

Engineering statics as a hurdle course

The problems experienced by students in first year engineering mechanics courses are widespread and comprehensively discussed in the literature (Goldfinch et al 2008). Many issues have been identified as contributing to poor student performance in engineering mechanics courses including prior knowledge, student motivation, diverse cognitive styles and teaching methods. Goldfinch et al (2008) conclude that "of all the causes and all the possible solutions to each of them, no single approach can cure all".

This has certainly been the experience at USQ, where changes implemented in recent years have had limited or no effect on student pass rates or satisfaction with the course. The authors are of the opinion that there will be no 'silver bullet' which can solve all the problems with this fundamental course but are cautiously optimistic that over time strategies including the one discussed in this paper can positively affect the course outcomes.

Introduction

During the second semester of 2010 we will attempt to address some of the issues discussed above by using peer assisted learning to begin the development of learning communities within engineering. Peer led programs (known in many universities as PASS) have been designed to assist with transitions to first year and student engagement issues and have been used to begin development of learning communities. These are generally well-regarded as they have been found to enhance the student experience and improve retention rates. (Rogan, 2008) A study of the impact of peer led study sessions by lecturers in the Business School at the University of Western Australia, revealed the following:

Enrolment in a PASS program was found to have a positive impact on students' academic success. This relationship was found to be stronger for students participating in PASS programs for quantitative subjects. It was also found to be stronger for students on the lower end of the mark distribution. ... Furthermore, given the fact that PASS programs have a larger impact on the academic performance of most students at the lower end of the marks distribution, it is possible to suggest that PASS programs are also of more benefit to students at the cusp of failing university (Birch & Li 2009).

We will be implementing a peer assisted learning concept to two engineering courses via a program already in existence at USQ called Meet- Up. We intend to extend this program to the online

environment and establish learning communities in virtual space. We will also extend the program to support the development of learning communities in the university's residential colleges.

This will be done by implementing and extending the existing model of the Meet-Up program. This program, coordinated by the Learning and Teaching Support Unit of the university, has been used with success in other faculties on campus. For example: the table below illustrates the reduced failure rate enjoyed by a finance course that implemented Meet-Up, firstly as add-on sessions in 2009 and then as timetabled workshops in 2010.

On Campus Students	2008	Other Fails	2009	Other Fails	2010	Other Fails
	Total enrolments	(% of Students)	Total enrolments	(% of Students)	Total enrolments	(% of Students)
	89	15.85%	99	6.12%	88	4.54%

Figure 1: Failure rates for a finance course before and after the adoption of Meet-Up in 2009, Phillips, P (personal communication, July 22 2010)

Meet-Up is generally course based, where students who have successfully completed a course, usually within the previous year, are selected and trained by the Meet-Up co-ordinator to be student leaders. These student leaders then facilitate learning sessions with students who are currently enrolled in the course. The aim of these sessions is to create a supportive, peer led learning environment in which students can address issues that they might be having with these particular courses as well as develop academic skills. This is important at USQ which has many non-traditional students. Evaluation of the Meet-Up program in other faculties indicates that students do feel supported and encouraged to persist in their studies by attending Meet-Up sessions.

So far it seems that all I am doing is studying. The intense need and push to study really drives you because of the fear of falling behind in everything and failing miserably. It was good to know that this first year is also filled with many students with the same family commitments as me, but who are also feeling like they are drowning in studies... One thing [Meet-Up leader] said really put me at ease, it was along the lines of 'last year I had absolutely no idea what I was doing and I got through it and you will too.' It's such a relief to know that I will be at that same level as [the Meet-Up leaders] next year, that I will be full of the knowledge and understanding that it takes to move through BNUR confidently. It was a great session and I really appreciated the chance to talk to [Meet-Up leaders]. (Comments in a reflective exercise by first year nursing students in CMS1000 in Semester 1 2010).

The learning sessions are open to all students enrolled in the course for which Meet-Up is offered, and they attend on a voluntary basis. The sessions are run in both face to face and online modes to help current students learn both course content and study techniques. The concepts to be addressed in each session are developed by the course examiner in conjunction with the student leaders. The delivery of these concepts is then designed and undertaken during the Meet-Up sessions by the student leaders. Each session is dedicated to a fundamental concept for a particular course and/or general academic skills.

Meet-Up is promoted to all students enrolled in a course from the beginning of the semester. The program is promoted as an additional tool for use in the study of a course and usually attracts a range of students of differing abilities. Student leaders attend lectures early in the semester to talk about the Meet-Up program and encourage students to attend. The program is also promoted on the course website and with posters in the faculty buildings.

A feature of Meet-Up is regular, formal feedback to examiners by the student leaders regarding student concerns and areas of difficulty. This allows the examiner to tailor course delivery as required and to develop additional targeted learning objects for both on campus and distance students based on need.

The Meet-Up program evolved originally from the US based Supplemental Instruction program. It was developed and tailored to suit USQ's student profile and was known as PALS for a number of years.

The PALS program enjoyed a degree of success. Three articles have been published about this program that were co-written by the co-author of this article.

Program plan for statics

In semester 2 2010 we intend to trial Meet-Up for two key first year engineering courses: statics which has long been a problematic course, and another newly developed first year course. Meet-Up will be implemented in both face to face (on-campus) mode and within the online environment. As a further extension of the program, academic support for extended general learning sessions (not course specific) within the residential colleges will also be trialled by leveraging the experience and facilities of the Meet-Up program.

Meet-Up Structure

A series of one hour Meet-Up sessions will be run throughout the semester for the statics course. On campus sessions will be run twice a week, once during the day and a second evening session will be run located in the residential colleges. Both sessions will be open to all students enrolled in statics.

Student leaders will then replicate these face to face Meet-Up sessions in the online environment by facilitating real time discussions, using Wimba classroom technology, supported by a-synchronous online tools. The real time discussions will follow the on campus sessions to assist leaders to more easily facilitate online discussions by being able to refer back to their experiences with students tackling the same concepts in the on campus sessions. Some of the a-synchronous tools used in conjunction with Wimba classroom include an online Q&A forum monitored by student leaders, recordings of the real time online discussions, tips, explanations and exercises posted by the leaders and pod-casts of interviews with the student leaders.

The evening Meet-Up sessions located within the residential colleges will be followed by a two hour general engineering study session supported by the faculty. This session will be open to engineering students of all levels and will be facilitated by senior student leaders trained under the Meet-Up guidelines. Students attending the sessions will bring material to the sessions that they wish to work through and will be assisted by the leaders with this material. (This excludes assistance with assignments!) Senior students selected as study session leaders will be both academically high achievers and good role models for younger students in terms of study habits, leadership and ethical judgement.

The faculty will financially support the general study sessions in the colleges on the proviso that leaders are selected and trained using Meet-Up criteria. The faculty will then have regular contact with student leaders and receive reports on areas of difficulty and the issues being faced by engineering students. Academic input into the program delivery within colleges is aimed at ensuring the academic rigour of course content and the integrity of the assistance given to students.

With all sessions the atmosphere will be relaxed and informal with an emphasis on the sharing of knowledge, social networking is expected to be an important by product of the sessions.

Recruiting and training leaders

Leaders for the statics Meet-Up sessions have been nominated by the course examiner based on their results in statics and their apparent communication skills and willingness to assist other students. Nominations for the general session student leaders were sought from the residential colleges as they were already running tutoring sessions for students within the colleges.

All leaders will undertake a one day training program run by the Meet-Up coordinator. This training focuses on techniques that facilitate collaboration, develop learning skills that students will need and promote an understanding of course concepts. Leaders are given strategies to avoid falling into a lecturing or tutoring role and how to handle requests for help with assignment work. Leaders will help a Meet-Up group unpack the concepts required to complete an assignment and advise on the general areas of study that will be needed, but avoid directly helping with or proof reading assessment work.

Leaders are paid for their work in the Meet-Up program but also receive less tangible benefits such as enhanced leadership and communication skills and the opportunity to reflect on and revise concepts

previously learned, which can provide clarity to their own studies in more advanced courses. Leaders can also receive an insight into the priorities and preoccupations of academics and a sense of satisfaction from contributing to the success of others as suggested by this Meet-Up leader's comments. 'It definitely increased my confidence and my understanding of the content. I think it has also given me more uni contacts and built new friendships with students and with course leaders and other staff members' (Meet-Up leader in Faculty of Business, S1 2010).

Expected Outcomes

If the Meet-Up program is successfully implemented for the engineering statics course both on campus and online we will be expecting to see some improvement in student success in statics and improved student satisfaction with the course and course resources. This should in turn lead to improved progression and retention of students.

A key outcome that we hope to achieve is the development of enhanced academic skills for the students who participate in Meet-Up. These transferable skills will then assist them with their successive studies.

Direct feedback from student leaders to the course academic, regarding areas of difficulty will allow course staff to identify and give additional assistance in key areas of need. This may include the creation or sourcing of targeted learning objects, additional lecture / website explanation or materials.

The insight into student difficulties and the reasons behind them will allow greater staff responsiveness to student needs and enhancement of the course offer which should benefit all course students, not only the Meet-Up participants.

Faculty support for the development of residential college student learning communities is expected to yield similar but non course specific results as participants will include students from all levels of engineering. Improved academic skills leading to improved success in the wider engineering content areas will be expected for students participating in these learning sessions.

Although the faculty supported student learning communities will be open to all engineering students it is expected that the majority of participants will be on campus residential students, who represent only a small portion of the total engineering student cohort. Nevertheless, direct feedback from student leaders to the faculty will enhance understanding of student academic concerns and areas of difficulty. The identification of other key engineering content areas that require particular attention will allow for wider assistance initiatives to be developed as needed.

Peer assisted learning sessions in the colleges are part of a project to begin the development of a learning community within the colleges.

A rigorous evaluation plan will be applied to link any perceived outcomes to the implementation of the program and hence to evaluate the worth of the program.

Program Evaluation

The evaluation of the Meet-Up implementation within the statics course will be done in two stages. The first stage will centre around the effectiveness of the initial implementation during semester 2, 2010. Qualitative feedback will be gathered in student focus groups, to be run by an independent evaluation expert with Meet-Up participants, leaders and course staff at the end of semester. This feedback will be complemented by surveys currently used by the Meet-Up co-ordinator in other faculties. These surveys are tailored to all stakeholders: students, leaders and lecturing staff.

Final student results and retention rates in Engineering Statics will be correlated against Meet-Up attendance records. O'Brien (2006) found that the students who attend P.A.S.S. programs in engineering tend to be those who are weaker in their maths backgrounds. Thus a direct comparison of results tends to underestimate the effectiveness of P.A.S.S. programs unless a correction for self selection is made. We will investigate methods of correcting for self selection as a part of the development of the evaluation framework.

Identification of 'at risk' students will be undertaken early in the semester. There are a number of accepted ways of defining and identifying at risk students but for the purposes of this project, we are defining them as those demonstrating academic underachievement (Grebennikov & Skaines 2009) and so will identify them based on past performance (previous attempts at Engineering Statics) and performance in the initial course assessments. The performance of at risk students who participate in Meet-Up will be compared to others in the 'at risk' category who choose not to participate.

In addition to these straightforward measures a Program Logic approach to building an evaluation framework will be taken. Jolly et al (2009) define the Program Logic approach as one which specifies and investigates the inputs and activities or components of a program as well as the outputs and outcomes and the links between these elements in addition to the theory of how an intervention causes an intended or observed result.

Building the evaluation framework will be undertaken as a three stage process as follows;

1. Identification of factors that may be impacting on program results including assumptions about how the program works
2. Developing a monitoring framework within which to collect relevant data deemed to give a good indication of the performance of aspects of the program identified as being important
3. Implementation of an evaluation framework which is essentially a set of questions based mostly on the monitoring data collected.

(Jolly 2010)

The evaluation strategy used over this first semester of implementation will then provide a template for ongoing monitoring of the program and investigation into its long term sustainability. This will ultimately lead to an integrated evaluation platform for investigating the sustainability of the course as a whole, including the investigation of the effectiveness and sustainability of learning supports such as online forums, quizzes, recorded lectures, and other course resources.

Conclusions

Use of a program logic approach to evaluate the implementation of Meet-Up in a first year engineering statics course will assist to establish whether the expected outcomes of improved student success, satisfaction and retention are achieved.

Online peer led study sessions will cater for the growing demand from distance students for extra resources and support. The question to be asked is will they use them or will time management prerogatives mean that they find other uses for their study time?

Evaluation of the cost effectiveness of the program will determine whether it is sustainable and will continue to be supported by the faculty.

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