Development of student confidence for academic success

Aaron S. Blicblau

1 Swinburne University of Technology, Faculty of Science, Engineering and Technology, School of Engineering, Department of Mechanical Engineering and Product Design Engineering
Corresponding Author Email: ablicblau@swin.edu.au

STRUCTURED ABSTRACT

CONTEXT
The first year in university is a difficult learning curve for many students, even more so for those from diverse cultural and non-English speaking backgrounds (NESB). For lecturers, teaching first year engineering is a difficult enterprise. Student learning during the first few weeks of tertiary education is often compromised by extraneous activities. Student confidence about their academic competence are considered particularly because they impact on student learning and achievement. Current and previous research into how diverse student populations acquire knowledge, process the data and integrate and retrieve relevant academic information has been filtered to develop a comprehensive approach to student confidence in their learning and teaching. As we have a wide range of students from diverse academic and cultural backgrounds, we expect different approaches to learning due to their contextual environment influencing their future work circumstances. The first year student cohort may not fully appreciate, understand and implement the enriched teaching and learning methodology, resulting in different levels of student confidence to achieve successful outcomes.

PURPOSE
The purpose of the work was to “determine the effect of changing a teaching methodology for a first year engineering subject on student confidence and ability to achieve academic success.”

APPROACH
Over the past two years, university wide surveys were conducted to determine student “confidence” of academic success at week four of a 12 week semester. These confidence predictions were correlated with overall academic performance at the end of the semester. Students were informed of the correlations of the survey with the success of the “new” teaching approach – especially in relation to their academic achievements, so giving them confidence in their academic abilities. We will continue with this research to establish whether students’ perceptions of self-confidence change after the initial survey period, and whether those opinions are an indicator of academic success, for a diverse student population.

RESULTS
Our results indicate that although student perceive that the subject “is difficult and I do not have confidence in my success”; their academic performance at the completion of the subject is of a higher average grade than that obtained during the traditional teaching in the previous two years. However, because it is a first year subject attempted by the students, and most are not employed in an engineering environment, we are not able to predict their performance in their (diverse) work environment. At this stage, we will continue with the integrated teaching model and will intermittently inform the students of the different previous success rates, indicating that confidence has to be built up and cannot measured during the first three weeks of the subject delivery.

CONCLUSIONS
It is anticipated that students will understand that confidence is built over a period of time, and cannot be based on a “snap” decision after only three weeks of university enrolment, and so may not be an indicator of academic success.

KEYWORDS
Confidence, success, outcomes
Introduction

The first year in university is a difficult learning curve for many students, even more so for those from diverse cultural and NESB. For lecturers, teaching first year engineering is a difficult enterprise. Student learning during the first few weeks of tertiary education is often compromised by extraneous activities and stress related to employment, career, social interactions and financial situations, resulting in loss of confidence with coping, motivation and academic performance (Struthers, Perry, & Menec, 2000). One vast change from the school environment is the planning and organizing their own learning, including dealing with various forms of academic assessment, especially if their own academic and cultural backgrounds have been different to their current environment.

Student confidence about their academic competence are considered particularly because they impact on a range of outcomes related to student learning and achievement (Nicholson, Putwain, Connors, & Hornby-Atkinson, 2013; Sander & Sanders, 2009; Stankov & Lee, 2008). Traditional school based learning and teaching approaches have been supplemented by developing approaches to improve students’ academic performance. Self-efficacy refers to a “person’s perception that he or she has the skill and capability to undertake a particular activity” and provides a framework for analysing human thought, motivation, and action, in our case student confidence in their ability to successfully complete a subject (Bartimote-Aufflick, Bridgeman, Walker, Sharma, & Smith, 2016). They suggested that to improve students’ academic abilities, they need to believe in their ability to be able to competently perform a task to meet self-determined goals in the future (and was dependent on a number of sources, including perceptions of past accomplishments of themselves and importantly, others). Bandura (1986) asserted that “that efficacy beliefs have both a direct and an indirect impact on achievement” and is applicable to studying and learning, and “affect cognitive and motivational processes as well as the way they influence the activities people choose to involve themselves in, and in the effort and persistence they apply to those activities”, in the student’s case their ability to involve themselves in their learning of a new area. In a recent study Panadero, Jonsson, and Botella (2017) found that gender and some self-assessment components (such as self-monitoring on the basis of on-going assessments) were significant indicators of the effects on self-efficacy and hence self-confidence. These results point to the importance of self-assessment interventions to promote students’ use of learning strategies and its effects on motivational variables such as confidence (self-efficacy in our case).

Current and previous research into how students acquire knowledge, process the data and integrate and retrieve relevant academic information has been filtered to develop a comprehensive approach to student confidence in their learning and teaching. Nicholson et al. (2013) found that “the expectations and academic behavioural confidence of undergraduate students’ results suggested that higher end-of-semester marks are attained by students who hold more realistic expectations of their undergraduate study (that is, to take responsibility for their learning) and are more confident, particularly in relation to studying and attending taught sessions”. Their results suggested that students need to develop an understanding of their subject, and be confident in their abilities and that dips in confidence, occurring mid-semester did not last, although it may have been unsettling for the student.

By self-monitoring their own progress (i.e. investigating semester assessment grades) students identified their own strengths and weaknesses as they related to their academic goals and confidence in achievements, helped them to be confident self-learners (Zimmerman, 2002). In a longitudinal study of student confidence with academic performance, Shoemaker (2010) examined pre- and post-assessment results and compared them with students’ academic grades. In her study she found that although student confidence at the end of semester was lower in first year than in other years, but the change (increase) in student confidence was an indication of their improved learning in later years. The students’ reported confidence at the conclusion of the course was correlated with their academic performance in the last three of the four years of a horticultural science courses that were examined. Further, Putwain and Sander (2014) suggested that “academic behavioural confidence (ABC) referred to students’ belief about their capability of performing those behaviours to successfully learn and achieve at university – i.e. confidence in their own abilities, sometimes referred to as self-efficacy.

Zusho, Pintrich, and Coppola (2003) found that to enhance student confidence in their learning of chemistry it was important that the subject was “indeed learnable” and that it would increase their knowledge (and their confidence) in applying chemistry for their future employment. It was important to identify relevant teaching strategies to enhance students’ learning and about the importance of chemistry for everyday life.

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Sanders, Mair, and James (2016) examined two groups of students (enrolled in BSc and BA) who were only distinguished by their enrolment at the end of the year by their academic performance. Both groups expressed confidence in their ability to complete their studies. They found that non-attendance at some classes decreased those students’ abilities to pass the subject, but not their confidence. In their studies, the attendance factor appeared to be the best predictor of academic success. They also found that “conflicting demands of the academic studies and employment had an adverse effect on their attendance” and often not being aware of this situation early in their studies, despite being confident in their abilities.

Implementing a variety of teaching and learning methodologies was one approach to improving the confidence of students’ academic performance. Making students autonomous learners, being able to deal with a diverse range of academic challenges and being guided less than at school, are just three of the aims of higher education, (Foerst, Klug, Jöstl, Spiel, & Schober, 2017). However, they found that there was a discrepancy between the knowledge they possess and applying it to their learning; the students were not confident in applying what they know to new challenges, such as new subjects (Nicholson et al., 2013; Sanders et al., 2016; Stankov & Lee, 2008).

In our institution, we have a wide range of students from diverse academic and cultural backgrounds, and we expect implementing different learning approaches due to their contextual environment may influence their future work circumstances, and instil confidence their self-efficacy. However, it is recognised that commencing first year students enrolled in our four year engineering degree course may not understand and implement our enriched teaching and learning methodology for their own learning, resulting in different levels of student confidence at various times during the semester to achieve success in their overall academic performance.

The purpose of the work presented here is to investigate the effect of implementing a change in teaching methodology in developing student confidence (and self-efficacy) in their academic achievements for a first year tertiary engineering subject.

**Approach**

This paper investigates the development of student confidence by the implementation of a holistic practical approach to teaching first year materials science and engineering over the past two years. Our approach involved adopting a blended learning strategy where required students were required to be autonomous (Clifford, 1999) and self-learners, and encouraged them to cultivate lifelong autonomous learning skills (Lau, 2017). Surveys were conducted to determine student “confidence” at week four of a 12 week semester, and then correlated with overall academic performance at the end of the semester. A comparison was made of academic performance in the previous “traditional” approach to teaching. In particular, for the new methodology of helping students learn, we describe the integration and implementation of various teaching approaches incorporating Learning Management systems (LMS), hands-on laboratory work, weekly on-line quizzes (both assessable and non-assessable), fortnightly practical activities, oral presentations (including debates) and final summary and formative assessments. We utilised two university designed surveys and distributed them among students, and then analyse students’ opinions in relation to different academic concepts. Using two years of results, we will give the students confidence in their abilities by informing them of the success of the “new” teaching approach – especially in relation to their academic achievements, and where necessary modify our teaching and learning processes to gain improvements. We will continue with this research to establish whether students’ perceptions of self-confidence change after the initial survey period, and whether those opinions are an indicator of academic success, for a diverse student population. We collated data over three years from the implementation of the integrated teaching methodology.

**Method**

**Instrument**

A check-in survey was developed by the institution “quality assurance and evaluation services” targeted specifically for first year students. The aim of the survey was to check-in on students’ “experience of the unit so far” and ask for improvement suggestions.

The survey questions were based on a modified Likert-like 10-point scale (Preston & Colman, 2000) where, 0-strongly disagree to 10-strongly disagree, for two items:
I am satisfied with the unit so far, and, I am confident that I can successfully manage the academic requirements of this unit’, with a third open-ended question requiring a written response to the question, ‘what is one thing that this institution could do to improve the unit?’

Access to the survey was individualised to students via the institution’s LMS and each response was anonymous. Feedback from the survey was available for staff to disseminate to students during teaching week six and seven. The instructions items in the check-in instrument prompted students to respond in the context of their experience in the current unit (subject) rather than the overall degree program which comprised four distinct units.

Measures
A two-item check-in approach, employing a 10-point Likert scale response (Preston & Colman, 2000), was used to measure first year undergraduate students’ confidence in three domains: their management of academic requirements (i.e. submission of assessable material, completion of learning activities, and success in the final exam); their satisfaction with the unit (which included all forms teaching, timetabling, the LMS, any ancillary activities associated with the unit), and a third free-from response written item concerned with ways to improve the unit.

Participants
The participants were drawn from the one institution and were enrolled in the same first year undergraduate program, Bachelor of Engineering. Over three years, a total of 870 students enrolled in a single first year undergraduate engineering program participated in this study. The sample contained three successive cohorts of students enrolled in the same first-year unit of study, ‘Materials Science’ at our institute, which was first introduced in 2016. For the 2106 survey, there were 98 students responding from a cohort of 231 (42.4%). In 2017 there were 304 students responding from a cohort of 415 (73.2%) and in 2018 there were 224 students responding from a cohort of 324 (69.1%).

Data Collection
Data were collected during teaching week four of the first semester of the first year of undergraduate studies, to establish students’ confidence, satisfaction and allowing for general comments. As some students were still enrolling in week two of semester, and becoming familiar with the methods of teaching involving self-learning, blended learning, and utilization of a LMS, some of the student responses were not available due to their very chaotic schedule. All the data was collected from the LMS was anonymous and student identification was not possible.

Results and Discussion.
During the years 2015 and 2016, the current first year subject, Engineering Materials (ENG10002) (which was known by a different code and name) was only compulsory for a select student engineering intake, approximately half of the first year intake. From 2017, the first year subject was compulsory for all first year enrolments (including civil, mechanical, IT engineering, and various electrical/electronic engineering related disciplines).

In addition, a variety teaching and learning methodology were implemented. These included the changing of the text book at the beginning of 2017 and the implementation of a comprehensive blended learning methodology of teaching incorporating extensive implementation of a learning management system (LMS). To enhance student learning and understanding weekly online quizzes were introduced using the LMS, as well as autonomous learning activities, both to be completed outside of classroom time.

The four-week check in survey was introduced in 2016. The degree of student confidence was taken from the four week check in survey questions I am confident that I can successfully manage the academic requirements of this unit, and I am satisfied with this unit so far completed after three weeks of enrolment, and, from the end of semester survey Overall, I am satisfied with this unit so far. The check in survey “What is the one thing that this institution could do to improve this unit” whilst the End of Semester Survey asked for “- In my opinion, aspects of this unit that could be improved were...” and “In my opinion, the best aspects of this unit were...”
Analysis of inherent confidence

Shown in Table 1 is a summary of the results of both the check in survey and the end of semester survey (utilising Likert-like responses) and a comparison with the overall subject pass rate (a percentage total).

<table>
<thead>
<tr>
<th>Year</th>
<th>Subject percent Pass rate, (no. of students)</th>
<th>I am confident that I can successfully manage the academic requirements of this unit (S.D.)</th>
<th>I am satisfied with this unit so far (S.D.)</th>
<th>Overall, I am satisfied with this unit so far (S.D.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>84.9 (198)</td>
<td>Survey not undertaken</td>
<td>Survey not undertaken</td>
<td>6.94(2.13)</td>
</tr>
<tr>
<td>2016</td>
<td>83.9(212)</td>
<td>7.07 (1.73)</td>
<td>7.31 (1.90)</td>
<td>7.47 (2.03)</td>
</tr>
<tr>
<td>2017</td>
<td>89.5(382)</td>
<td>6.51 (2.02)</td>
<td>6.77 (2.10)</td>
<td>6.75 (2.09)</td>
</tr>
<tr>
<td>2018</td>
<td>87.6(315)</td>
<td>6.84 (1.87)</td>
<td>7.03 (1.89)</td>
<td>6.27 (2.22)</td>
</tr>
</tbody>
</table>

1 Check-in survey during week four of the first semester
2 Student feedback survey at the completion of the first semester
3 Student pass rate at the completion of the first semester
4 Employing a 10-point Likert-like scale (Preston & Colman, 2000)

The first confidence question at the end of week four, I am confident that I can successfully manage the academic requirements of this unit, showed an increase in subject pass rate from 2016 to the following two succeeding years, despite a seeming early lack of confidence.

The second confidence question I am satisfied with this unit so far, also showed an early decrease in confidence which was not borne out by a higher success rate in overall passing rates. It is interesting to note that the end of year survey, the question Overall, I am satisfied with this unit so far, had no apparent relation to the overall subject pass rate.

From an analysis of the student free-form answers to the check in survey and end of semester survey a number of reasons related to the students’ lack of confidence becomes apparent where the written answers were grouped according to theme and summarised as being related to some changes to the teaching methodology introduced after 2016. These changes included; a change to the textbook (it being of a more concise nature than the previous textbook; having less worked examples and end of chapter problems); a requirement of students that they complete out of class study (as part of the blended learning activities), use of the LMS as a learning and assessment resource; and “compulsory” group work in tutorial and laboratory actions.

Free-form answers

During 2017 there were three important changes to the pedagogy of first year engineering course: the first being a generic set of units for all first year, the second being a comprehensive integration of blended learning for the Engineering Materials (ENG10002) unit, and the third, being a change in text books.

The results of the survey indicate that although student perceive that the subject “is difficult and I do not have confidence in my success”; their academic performance at the completion of the subject is of a higher average grade than that obtained during the traditional teaching in previous years. In both cases the student confidence in “passing” was low. However, because it is a first year subject attempted by all the students from different disciplines, we are not able to predict their performance in a diverse work environment. At this stage, we will continue with the integrated teaching model and will intermittently inform the students of the different success rates over the previous approach, indicating that confidence has to be built up and cannot measured during the first three weeks of the subject delivery. This subject delivery approach will provide the students with a better understanding of their own learning and confidence.
Because the first year subject Engineering Materials (ENG10002) was a compulsory first year subject taken by all engineering students, their report of “slight” confidence or satisfaction at the end of one quarter of a full semester may be realistic. The student cohort is composed of approximately 35% who see themselves as IT/Computer/or electrical related engineers and so cannot understand the relevance of the subject to their future career. However, the remaining 65% of students see their career in civil/mechanical/ or similar profession and so their confidence and satisfaction may be higher. Because of the generic intake of first year students, there was no ability to distinguish or categorize these students.

From an analysis of the free-from answers from the “confidence survey”, grouping of comment: ‘why are we doing this’;
‘I will never use materials’;
‘what relevance is materials to programming?’
‘not sure why I am doing this unit’ and
‘hmmm I see why materials are used in structures; steel is important for civil’,
The relevance of the subject to the students’ intended discipline was difficult for them to comprehend as the subject was of a general nature. Many students reported that they were being asked questions on content not specifically taught in class, or that tutorials and laboratory exercises and activities were not directly or chronologically associated with the lecture content. The concept of blended learning, where students contributed to their own learning and were being asked to be self-learners was not well understood by these first year students.

When discussing the learning management system LMS, approach for knowledge dissemination, a number of students reported difficulties with both accessing and manipulating the: LMS, especially where they had many different “devices” e.g., tablets, smart computers, different operating systems (Android, IOS, Windows or Safari etc.). And students reported that the ‘new’ textbook was difficult to understand, did not have sufficient examples or worked problems, and the ancillary material available on the LMS was not sufficiently comprehensive, especially when compared with their first year subject in mathematics and physics related subjects.

With regard to the style of blended teaching employing a LMS, many students responded that they wanted “more questions in the tutorials - more worked solutions”, a “mid-year test”, “2 hour tutorials instead of a third lecture”, and “having the online assignment related to the stuff over the current week and not weeks ago or the weeks to come”.

The introduction of the ‘autonomous’ learning methodology and making students self-learners did not appear to be well understood by the first year students. Many had only completed high school a few months previously and appeared to want to be taught in the “school small class ‘based system. In this approach, self-managed learning is not always actively encouraged or implemented, and employing a LMS for learning was often a novelty.

Concluding remarks
It is suggested that a variety of minor reasons contributed to the students’ comments at the end of one quarter of the semester that they had a slight confidence in their ability to “successfully manage the academic requirements of this unit and their satisfaction with this unit so far, which was carried over to the end of semester slight confidence comment that Overall, I am satisfied with this unit so far. However, an inspection of academic results from before the introduction of the new first year intake and the change in pedagogy, the pass rate had increased slightly. A statistical analysis is difficult to make at this stage, and further longitudinal studies will be followed to determine the effectiveness of the academic grades and confidence in the students’ own abilities at different stages of their studies in their first year subject of engineering materials.

Based on the end of quarter semester-week check-in survey and the end-of semester survey, the change in student satisfaction was not an indicator of confidence as a predictor of academic performance. The confidence rating at the end of week three had little or no correlation with students achieving a high mastery of their subject. Changing the approach to our teaching strategy does not appear to have influenced the students’ academic performance. Nor have the changes have had an effect on student confidence and overall satisfaction. There was no investigation as to how the teaching approach influenced the future work circumstances of students- it was too early in the students’ learning career. So the new research question to investigate follows: “is it worthwhile to implement new teaching technologies and strategies for teaching first year engineering materials

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science if there appear to be only minor changes in student satisfaction or confidence without associated improvements in academic performance?"

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References


Lau, K. (2017). ‘The most important thing is to learn the way to learn’: evaluating the effectiveness of independent learning by perceptual changes. Assessment & Evaluation in Higher Education, 42(3), 415-430. doi:10.1080/02602938.2015.1118434


