"P's Get Degrees": Exploring First-Year Engineering Students' Perceptions and Experiences of Failure

Sara Abdulghaffar, Marissa Phoon, Dragon Power Poon, Luke Tan, Jonathan Li, Nicoleta Maynard and James Salamy
Monash University, Victoria, Australia
Corresponding Author Email: drag0001@student.monash.edu

ABSTRACT

CONTEXT

The demanding and technical nature of engineering programs often exposes high-performing secondary school students to their first experiences of "failure", in both academic and personal perspectives. The concept of failure plays a crucial role in shaping academic outcomes within engineering degrees, impacting students' grades, motivation, and perseverance. Students' attitudes towards failure, whether positive or negative, interact with the institutional environment, yielding a combined effect on their personal objectives and academic performance.

PURPOSE OR GOAL

This study aims to understand the expectations and perceptions that engineering students hold towards failure in their first semester of study and examine potential correlations between students' attitudes towards failure and their overall academic performance during the semester. It explores the personal academic goals students set for themselves and the factors they believe affect their ability to succeed academically, including personal, external, and institutional factors.

METHODOLOGY/METHODS

An exploratory mixed methods approach was used, with first-year engineering students completing two questionnaires, one at the start of the year and one at the end. Students were surveyed to gain a broad initial understanding of their attitudes towards failure, personal academic goals, and the factors they believe impact their academic performance. Following the questionnaires, a qualitative study will be employed via focus groups and interviews to gain a richer understanding of the quantitative data.

ACTUAL OR ANTICIPATED OUTCOMES

This paper primarily reports on the results from the first questionnaire, which reveals that time management skills, work commitments and the transition to university are the top factors identified by first-year students that impact their academic outcomes. The grades identified by students as 'acceptable' and 'successful' are also reported. Over half of students also experience a fear of failure and how it impacts their self-esteem and future plans.

CONCLUSIONS/RECOMMENDATIONS/SUMMARY

This study highlights the need for students to develop a healthy perception of failure through first-year programs designed to destigmatise failure. Targeted interventions to address existing negative perceptions of failure and foster a growth mindset will promote a more resilient learning environment. Universities can also better support international students with unique learning difficulties. At a policy level, greater equity support for low-SES students is needed to reduce the financial burdens of pursuing higher education and the stress that comes with failing.

KEYWORDS

Perceptions, Failure, Personal Academic Objectives, First-year Engineering Students

Introduction

"P's get degrees" is a commonly used expression amongst Australian university students, reflecting an attitude of doing the bare minimum to pass and obtain a degree, rather than achieve academic excellence. However, is this attitude just a joke passed around by stressed students, or is this a wider reflection of tertiary students' views on academic achievement? The recent Australian Universities Accord Interim Report forecasts that 55% of all jobs will require higher education qualifications by 2050, with many of these to come from First Nations, low socio-economic, rural and regional backgrounds, who are traditionally at higher risk of failing and are more disadvantaged when they do fail (Department of Education, 2023). As such, understanding student attitudes towards failure would support targeted programs to increase participation, retention and successful outcomes for these key groups.

Existing literature suggests that university students' attitudes towards failure vary widely, and include "success-orientation", "failure-avoidance", and "failure-acceptance" (Martin & Marsh, 2006), which influence students' wellbeing and performance. Students who fear failure may not cope well receiving poor academic results, suggesting that a success-oriented mindset that embraces failure as a learning opportunity can increase motivation and resilience (Martin & Marsh, 2006). Henry et al. (2021) suggest a need to investigate fear of failure amongst students in STEM, especially given that engineering students are highly encouraged to *"embrace failure"*.

Motivation and self-efficacy greatly influence students' persistence in their engineering degree (Bernold, 2007), particularly in the first year due to the academically challenging nature of the degree. Baillie and Fitzgerald (2010) have found that the transition from high school to university carries pre-established notions of what failure is. Budny and Tartt's 2009 study found that many first-year students were not satisfied with a passing grade and felt stressed when they did not meet their personal academic goals. These internal psychological factors, combined with external factors from the institution such as teaching quality and level of student support, compound the overall effect on students' performance (Asikhia, 2010). This study aims to understand the range of attitudes present amongst students enrolled in first-year engineering units at Monash University and identify the factors which students believe impact their academic performance. It seeks to analyse the extent to which their attitudes towards failure affect the academic goals they set for themselves, and whether this leads to a quantitative impact on their performance.

The findings of this study will help develop programs and curriculum to support students in their resilience and problem-solving skills. This is necessary for a successful engineering career and important across many fields of work. Understanding current trends within the first-year engineering cohort of a large Australian university may provide valuable insight for curriculum development in other disciplines. Gaining a richer understanding of engineering students' attitudes and perspectives towards academic failure helps educators reconfigure their curriculums in a way that is academically stimulating for the students. It may also assist in identifying students at risk of failure and developing a personalised approach to support their needs.

Research Objectives

Research Question

What is the influence of first-year engineering students' perceptions of success and failure on their academic performance?

Aims and Objectives

The study aims to explore the students' expectations and perceptions as they commence their engineering degree and how these beliefs influence their academic achievements.

The objectives are as follows:

1. To gather qualitative data on students' attitudes towards failure, using a closed-ended questionnaire in the first semester of their degree;
2. To quantitatively analyse the impact of students' attitudes towards failure on their academic performance during their first semester;
3. To identify the factors that students believe affect their academic performance through focus group sessions in the second semester;
4. To determine how first-year engineering students' views on failure influence the academic objectives they set for themselves, through interviews in the second semester.

Literature review

The literature has identified several institutional factors associated with failure in tertiary engineering courses. These include the curriculum design (Clarke, 2004), practical relevance of the course material (Cheruvalath, 2012), and whether diverse learning needs are accommodated (Bernold et al., 2013). Teaching methods such as group learning, case studies, and smaller class sizes have shown positive impacts on learning including retention, academic achievement and motivation. (Fiechtner & Davis, 1984; Springer et al., 1999; Hoit & Ohland, 1998).

The effects of these institutional factors on a student's intrinsic motivation are also well-researched. Baillie and Fitzgerald (2010) found that active learning methods such as case studies increased student motivation, whereas a lack of creative challenges decreased motivation. In a study by Bodner et al. (2005), first-year engineering students also stated that factors such as a lack of understanding of the material, a lack of motivation to succeed, and a lack of interest in the course made them less confident in their ability to succeed.

Motivation is also affected by how students perceive failure, and whether or not they have a fear of failure. Fear of failure is a psychological state characterised by a strong aversion to the possibility of failing, and it plays an important role in a student's performance. Conroy (2002) models the fear of failure into five dimensions: "fear of shame or embarrassment", "fear of devaluing one's self-esteem", "fear of having an uncertain future", "fear of losing social influence", and "fear of upsetting important others."

Of particular relevance is the quadripolar model of need achievement posited by Martin and Marsh (2003). Their model positions a student's orientation towards failure on two axes: failure avoidance and success orientation. They suggest that as a student's failure avoidance increases, this results in a cascade through several stages from success orientation to eventual failure acceptance. They measure these qualities based on indicators of cognitive and behavioural engagement with fear and success (perceived control, self-belief, etc.), and the associated outcomes (achievement, persistence, self-regulation, etc.). This results in categories such as the "over-striver", who aims to avoid failure by succeeding, and the "self-protector", who aims to protect themselves by externalising their reasons for failure. This study aims to investigate the proportion of students who fall into these categories, and how that is linked to their perception of how institutional and external factors influence their academic outcomes.

Perceptions of failure are often shaped before students begin their engineering degree. Preconceived academic expectations from high school can leave first-year students unprepared for university-level courses, and programs designed to destigmatise failure have had success in American universities (Budny & Tartt, 2009). This may contribute to higher attrition rates later in the degree (Ahmed et al., 2014). This study explores whether discouragement due to poor academic performance or failing units not only affects retention but also impacts future academic success. Additionally, it examines whether first-year failure influences students' orientation towards success or failure in Martin and Marsh's (2006) model. Existing literature suggests that realistic expectations of the difficulty of engineering courses can enhance students' motivation to succeed in engineering.

Methodology and Methods

An exploratory mixed methods approach has been adopted for this study to allow for a comprehensive understanding of complex educational phenomena that cannot be fully explored using a single research method. This approach combines both qualitative and quantitative data collection and analysis techniques, allowing for leveraging of the strengths of each method to address the research question more effectively. Quantitative data was collected through two questionnaires, the first being distributed in the first semester of the 2023 academic year, while the second was distributed following the release of the first semester results. Subsequently, focus groups and one-on-one interviews will be conducted to conceptualise the information collected from the quantitative data (Borrego et al., 2009). The qualitative data from the focus groups and interviews will allow for students to reflect on their personal experiences and provide a more in-depth understanding of their attitudes towards success and failure in engineering. The qualitative data is a separate dataset and is not presented in this paper. It is intended, however, that the mixed methods approach will strengthen the validity and reliability of the research findings via triangulation, and explore causality between the research phenomena.

Questionnaires

Questionnaire 1

The first questionnaire aimed to explore students' views of failure, their personal academic objectives in the first semester of their degree, as well as the factors which they believe influence their academic performance.

Students' views of failure were examined using similar techniques built upon a study previously conducted by Martin and Marsh (2006). A series of closed-ended questions were used, where the students indicated their level of agreement or disagreement with the presented statements. Subsequently, their responses helped to classify the type of student that they are according to Martin and Marsh's framework - success-oriented, failure-avoidant or failure-accepting - using a subscale indicating each student's cognitive engagement with fear and success.

The questionnaire also served to identify the different factors that students believed contributed to their overall academic performance. An open-ended question was presented where several factors, including external work commitments, learning difficulties, and time management skills, were pre-identified based on the literature. Students were asked to choose the factors that they believed affected them, as well as identify any other factors that were not listed.

Finally, the first questionnaire was used to establish the personal academic goals of the first-year engineering students. Students were asked to provide a numeric response stating the lowest percentage grade that they would consider 'acceptable' in their end-of-semester results, and conversely, the lowest grade that they would consider to be 'successful'. Ultimately, these questions were used to explore how each student's views towards failure have influenced their personal academic objectives.

Questionnaire 2

The second questionnaire served as a follow-up to the first, and was distributed to students following the release of their first-semester grades. It served to determine to what extent students' views of failure impacted their academic performance. Students were asked to identify whether or not they failed any units, and to briefly reflect on their academic performance by identifying if they performed better or worse than they originally anticipated and if they were satisfied with their overall results.

Findings and Discussion

From the initial quantitative dataset, three key findings (further discussed below) have emerged:

- A disparity is shown between the personal academic goals of international and domestic students, with a slight discrepancy also observed between female and male students.
- Time management skills, external work commitments and challenges in adjusting to university life were identified as the top factors affecting students' ability to pass their units. In this context, international students appear to encounter more difficulties related to learning, while being less affected by work commitments compared to domestic students.
- Over half of students experience a fear of failure, which can manifest as apprehensions regarding embarrassment, disappointing important others, or disrupting their future plans.

The sample consisted of 406 first-semester engineering students, with 74.4% male, 23.6% female, and 2% non-binary/gender diverse or undisclosed. Among them, 93.8% were domestic students, and 6.2% were international students. High school backgrounds were diverse, with 46.8% from government-run schools, 31.0% from independent non-Catholic schools, 17.7% from Catholic schools, and 4.4% from schools overseas.

Personal Academic Objectives

Questions were posed regarding what the students would consider an 'acceptable' grade and what they would consider to be a 'successful' grade. Figure 1 shows a positively skewed distribution for 'acceptable' grades, with a mean of 57.8%. (It should be noted that the 4% of responses in the 40-50% range may have been selected due to first-year students misunderstanding the minimum requirement to pass units at Monash University). There was a slightly negatively skewed distribution for 'successful' grades, with a mean of 72.8%. Interestingly, several students selected 50% as a 'successful' grade, while also selecting grades in the 40-50% range as an 'acceptable' grade.
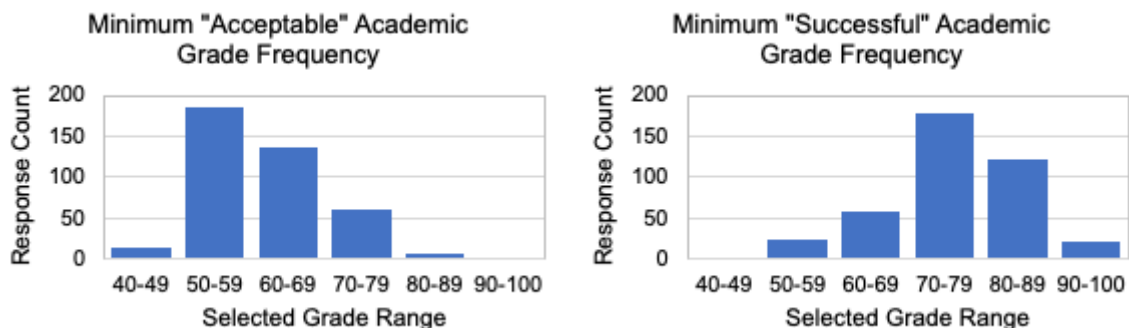

Figure 1: Personal Academic Objectives for First-Year Engineering Students

The results also concluded that students of differing high school backgrounds did not have different academic expectations. This suggests how minimal a student's previous academic history has on their perceptions of success. As seen in Table 1, the means and standard deviations between domestic school types are similar. Thus, the results suggest that personal academic objectives remain comparable across different school types for domestic students. Female students were also found to have slightly higher academic expectations in comparison to male students. This aligns with a previous study that found female undergraduates consistently rated themselves higher in terms of their academic achievements than male students (Grebennikov & Skaines, 2009).

Table 1: Means and Standard Deviations for Personal Academic Objectives Based on School Type

School Type	'Acceptable' Mean	'Acceptable' Standard Deviation	'Successful' Mean	'Successful' Standard Deviation
Government	57.78	8.55	72.31	10.34
Independent	58.13	8.87	72.83	9.58
Catholic	55.97	8.50	73.55	9.91

Factors Impacting Academic Performance
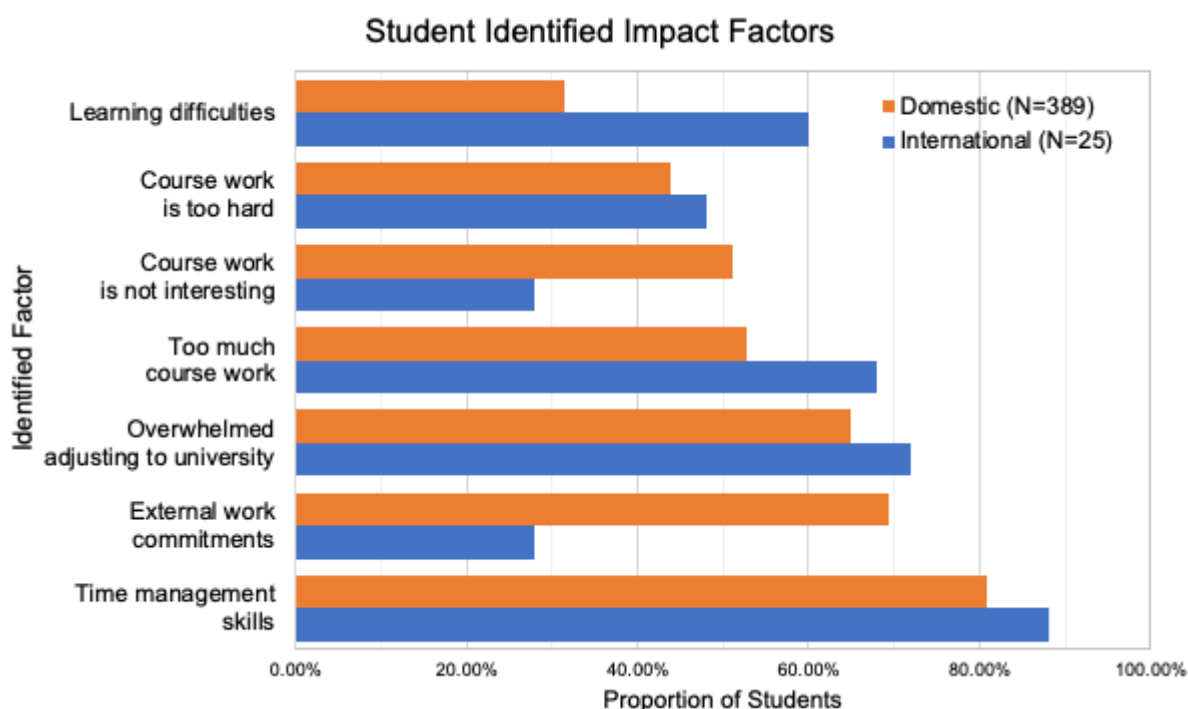
Figure 2: International vs Domestic Students' Identified Factors Affecting Their Ability to Pass

Figure 2 presents the prominent factors that students perceive as influencing their academic success or failure in engineering units. Time management skills emerged as the most prevalent response, chosen by 81% of students. Notably, students frequently selected multiple external factors (work/extracurricular commitments), coursework-related factors, and internal factors (learning difficulties, time management skills, feeling overwhelmed on adjusting to university). This suggests that universities can enhance student support by directly addressing certain aspects, like incorporating time management strategies into the curriculum. External and internal factors may, however, pose greater challenges to address effectively.

Students have identified having to balance their academic studies with their external work commitments as one of the major contributing factors affecting their academic performance. According to a previous study conducted at the University of Canberra, minimal negative impact has been found on students' academic grades as a result of them working while studying full-time. However, it was identified that working students have reduced levels of satisfaction with their lives due to feeling overwhelmed by having to balance their studies, work commitments and maintaining their social lives. (Applegate & Daly, 2006). This study suggests a possible link between students' morale and their consequential outlooks of academic success and failure.

According to Figure 2, the third most common factor students identified was feeling overwhelmed adjusting to university. A study conducted by Dingle et al. (2022) substantiated the increasing difficulties that students are facing with the social transition in university and lacking a sense of belonging. Aspects included meeting new and different people, being mentally stimulated by new experiences and generally having fun. A larger number of students indicated that less than half of their expectations were met. This suggests that attention is needed towards creating quality teaching and learning experiences for students and sharing intellectual controls with students as a means of encouraging them to enhance their independent learning skills. Another study revealed that although students are provided with numerous resources to help them, they still feel overwhelmed due to a lack of how to utilise these resources (Husman & Reynolds, 2018). This reiterates that institutions need to enhance the way in which they provide students with resources to help them adjust to university life.

Among the factors influencing academic performance, time management skills emerged as the most common concern highlighted by students. It is worth noting that time management often correlates closely with external work commitments. Specifically, 78.5% of students who identified time management as a significant factor also indicated having external work commitments. This correlation indicates that the increasing number of external commitments for students can present challenges in effectively managing their time. As their commitments outside of academia grow, striking a balance between academic responsibilities and external work obligations becomes progressively more challenging.

Overall, the three main factors students identified are heavily linked as they all leave students struggling to find a balance between their academic commitments and other aspects of their lives.

Students did identify that their learning skills improved significantly after the first semester, as stated by a participant from the subsequent focus group: *"Semester two. So far, I've found a better balance. I've figured out where to cap myself on certain things, where to increase my time on certain things".* This suggests that with time, students learn to adapt to the faster pace and rigorous requirements of university life.

The results of the study revealed a significant disparity between international and domestic students in factors affecting their academic success. Notably, a substantially higher proportion of international students identified learning difficulties as a significant factor influencing their academic performance. This outcome aligns with existing research, which highlights that many international students have English as their second or third language (Medved et. al, 2013). Since coursework is primarily conducted in English at universities, a certain level of language proficiency is expected for students to comprehend and engage effectively. Moreover, the study revealed that some international students had only recently acquired English proficiency within the past one or two years, making it challenging for them to adapt to the fast-paced academic environment (Sawir, 2005). This language barrier could hinder their ability to fully grasp complex subject matter which ultimately impacts their overall academic success: *"I'm not really that good with communicating between people because I'm still a bit wobbling on the English"* (focus group participant from subsequent study).

Conversely, a higher proportion of domestic students reported external work commitments as a significant factor impacting their academic performance. This unforeseen result differs from previous studies that have shown that international students often work more hours to support themselves financially (Thamrin et al., 2019). Additionally, other studies support the notion that students who take on multiple roles, attempting to manage both external work responsibilities and academic pursuits, often find themselves overwhelmed and struggling to maintain a balance between these commitments (Creed et al., 2015). This juggling act can have detrimental effects on their academic performance, hindering their ability to fully engage with their studies and excel in their coursework: *"I usually work the whole day. But then when I come back, if I have energy, then I'll do [university work]"* (focus group participant from subsequent study).

Views of Failure

Preliminary observations regarding the distribution of students' orientation towards failure indicate over half of the students experience a fear of failure, with 53% responding 'Agree' or 'Strongly Agree' to statements such as *'If I received an unacceptable grade this semester, my future would seem uncertain'*, *'Important people in my life would be disappointed'* or *'I would be embarrassed if other people found out'*. 56% of students also linked their self-esteem and public-esteem (others' view of them) to feeling academically competent, and not feeling academically incompetent.

A significant number of students attribute their academic results to their levels of ability and effort in a subject, rather than external factors such as how interesting the teacher makes the subject matter. Students also appear to possess a growth mindset, with a significant number agreeing that '*a student who works hard could be one of the smartest in class*' and feeling more successful when what they learn '*really makes sense*'.

A follow-up questionnaire was sent to all respondents shortly after they had received their grades for semester one, which asked whether students had failed any units and how satisfied they were with their performance in semester one. Given the time limitations due to Monash University's academic calendar, data collection and analysis is still underway for these results.

Recommendations and Limitations

The initial dataset reveals that first-year students at Monash University feel all the pressures of the transition to university, including managing their own time and not knowing how to deal with failure. The fear of failure and how it affects one's self-esteem and future plans has negative impacts on their mindset. This supports the introduction of first-year programs designed to destigmatise failure and reduce its emotional impacts on students. It is also noted that the numeric approach to examining students' academic objectives is limited in providing insights for pedagogy, and a more detailed examination of how they approach goal-setting is needed. More in-depth demographic data would also lead to richer conclusions about the unique challenges faced by underrepresented groups. Ultimately, this study suggests that students recognise that "P's get degrees", but this is not what they are aiming for. Students work towards achieving higher grades but would still be content if they fall short of this goal.

We recommend that universities should increase the quality of the educational experience for international students by improving support for learning difficulties, and ensuring students know how to access these resources. Finally, given that students feel juggling external work commitments impacts their grades, and with cost of living on the rise, there is a need for greater equity support for low-SES students with the goal of increasing participation and retention for underrepresented groups. Ensuring the affordability of higher education for all students will reduce the stress many students feel and improve associated academic outcomes.

The findings of this research study ultimately align with several current recommendations of the Australian Universities Accord Interim Report to prioritise a learner-centred pedagogy, international engagement, and support for students from equity backgrounds. Given the time limitations of this study due to the academic calendar of Monash University, it is anticipated that the forthcoming focus groups and interviews will enrich the initial findings of this study, and provide powerful insights into the aforementioned phenomena in students' own words.

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