Get Set for Success: Applications for engineering and applied science students

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Abstract

With increased participation in higher education, student diversity has increased, and many students currently enrolled in applied science and engineering degrees commence their studies without the assumed knowledge. Universities have a duty of care to ensure students successfully transition into the higher education learning context. The Get Set for Success quiz was developed across five Australian institutions to enable commencing first year engineering students to self-test their readiness to study their chosen degree. The quiz comprises two parts. Part 1 measures cognitive abilities (i.e., maths, physics and chemistry) and Part 2 measures non-cognitive factors (i.e., approaches to learning and motivations for study). Both parts have been shown to predict academic success. Individualised feedback was provided to 97 students enrolled in engineering technology and applied science courses at the University of New England, a regional Australian university, that directed students to both on campus and online support to help them develop an individual study plan to address knowledge and skills gaps. This approach helps to empower students to begin their academic journey with confidence – it enables them to reflect on their approaches to learning and to seek support to address any identified gaps. This paper reports on the application of the Get Set for Success quiz to both engineering and applied science students and results show that the quiz is perceived to be a valuable learning tool for commencing students.

Introduction

Over the past two decades there has been a decrease in the percentage of students across Australia studying advanced mathematics in the final years of secondary school (Barrington, 2013). In this paper, we will use the standard developed by Barrington (2009), which classifies the various Australian State based mathematics subjects into either `advanced', being the highest level mathematics subject, then `intermediate' with the lowest known as `elementary' mathematics. In 1995 Barrington (2009) reported that 14.1% of students studied advanced mathematics and 27.2% studied intermediate mathematics in their final year of secondary school. Elementary mathematics, which includes over 73 mathematics related subjects, was studied by 37% of students, whilst 21.7% of the cohort were not studying mathematics at all. By 2004 the percentage of students studying advanced mathematics had decreased to 11.7%, the percentage studying intermediate mathematics increased slightly to 22.6%, but for elementary mathematics the percentage increased to 46% (Barrington, 2009). An update by Barrington (2013) showed that the advanced mathematics cohort had dropped to 9.4%, 19.4% for intermediate mathematics and over 52% of students studied elementary mathematics.

The reason for the decrease in engagement of final year high school students in higher level mathematics subjects is two fold. Firstly, fewer students choose to study mathematics in senior school because universities have removed the prerequisite of mathematics for a number of degrees (Fullerton et al., 2003, as cited in Ainley, Kos & Nicholas 2008). This has led students and career advisors to believe that higher level mathematics is not mandatory for many university degrees. More than 80% of teachers surveyed wanted mathematics prerequisites reintroduced to support students developing a high level of mathematics proficiency (Mathematical Association of NSW, 2014). In Queensland, for example, since universities have awarded 2 bonus points for advanced mathematics (Maths C), there has been an increase in the number of students studying mathematics at higher levels; however, these numbers are still only 9.3% of the cohort, fewer than the 12.6% reported in 1995 (Jennings, 2014).

Secondly, some high school students think that by gaining a higher mark in a lower level mathematics course they will gain a higher university entry score; but this is not necessarily true as courses are scaled by their difficulty (Rylands & Coady, 2009). However, this belief appears to be supported in New South Wales (NSW) where a survey of over 1000 high school mathematics teachers indicated that many capable students were choosing general (elementary) mathematics rather than 2-unit (intermediate) mathematics to maximise their Australian Tertiary Admission Rank (ATAR). Reasons for this choice included difficult final examinations and demanding workloads in advanced and intermediate mathematics subjects, with these factors also impacting on students' performance in other subjects (Mathematical Association of NSW, 2014).

Compounding these factors is the difficulty facing all states and territories in Australia, to recruit and retain well-prepared teachers in rural and regional schools (White & Kline, 2012). In NSW the "shortage of qualified mathematics teachers is particularly alarming in regional areas" (Mathematical Association of NSW, 2014, p.2). As many of these students subsequently attend regional universities, better support needs to be in place to develop commencing students' competencies in mathematics and the sciences.

Purpose of the study

This national project aimed to identify key characteristics of incoming first year engineering students that influence successful transition to university. This project, funded by the Australian Government Office for Learning and Teaching (OLT), built on recent studies aimed at developing strategies to enhance enrolment, progression, and graduation rates in engineering programs (Burton & Dowling, 2005; Kavanagh, O'Moore, & Samuelowicz, 2009; Lowe and Johnston, 2008). To ensure wide applicability of outcomes, the project team deliberately drew students from five universities that cover the spectrum of Australian universities and engineering programs.

The Get Set for Success quiz included an online battery of tests that allowed commencing students to self-assess their cognitive and non-technical capabilities and readiness to study engineering at university. Many of the questions came from diagnostic pre-testing that already ran at the partner universities. Also included in the battery of tests were cognitive skills including maths, physics and chemistry; and non-cognitive tests including approaches to learning, personality, and a self-report measure of interests and motivation for studying engineering, created specifically for this project.

The Get Set for Success quiz was divided into two parts, a cognitive and a non-cognitive quiz. Previous studies have shown that core cognitive knowledge and previous academic success are important predictors of academic success in the future (McKenzie & Schweitzer, 2001). Therefore the cognitive quiz (Part 1) included 52 questions that are assumed knowledge when entering an engineering degree. Specifically, the online cognitive quiz assessed students' mathematics, physics and chemistry abilities.

Burton and Dowling (2005, 2010) found that non-cognitive factors were also reliable predictors of academic success. Consequently, also included in the quiz (Part 2) were non-cognitive measures including approaches to learning, personality, and a self-report measure of interests and motivation for studying engineering, created specifically for this project. This included the 51-item Approaches to Study Skills Inventory for Students (ASSIST, Tait, Entwistle, & McCune, 1998), where students were identified as having a preference for Deep, Strategic or Surface approach. A Surface approach is where students take a rote-learning approach and struggle to make linkages between subject matter as they see it in isolation. A Deep approach is where students look for meaning themselves by critically analysing the material, drawing together concepts across the unit and apply them to unfamiliar contexts. A Strategic approach is where students focus on maximising their grade by being aware of the expectations of the lecturer, having very good time management and applying themselves consistently. When a Strategic approach is coupled with a Deep approach the student intelligently engages with the unit. Additionally, a 26-item Interest and Motivation for Studying Engineering self-report questionnaire was developed by the research team (see Burton & Albion, 2013). Further information about the Get Set for Success quiz is available via the OLT website (see Burton et al., 2014).

Importantly, students received immediate individualised feedback on their performance in both sections of the quiz. Feedback for the cognitive quiz was adapted at each partner institution involved in the Get Set for Success project to enable individualised feedback and study plans to be created. Each student received a summary table of the questions they got correct and incorrect, and an indication of those units where these skills would be required. In addition there were links to helpful websites for each question, so students could revise or learn the material required before they officially commenced their studies. Being given such individualised feedback allows students to reflect on their prior experiences, knowledge, and skills, and enables them to be better informed of the pre-requisite skill sets and knowledge that underpin entry into their degree.

In the non-cognitive quiz, students were encouraged to reflect on how they learn and their motivations for studying engineering. Students found the personalised feedback on their learning approaches of value. For example, they reflected in class during a practical session on the ways they can direct their study efforts towards a successful and productive learning outcome. Although the self-report measure was primarily developed to measure students' motivations for studying an engineering degree, the questions were also relevant to other related professions, including applied science students.

Students were invited to participate in the Get Set for Success quiz when they enrolled in their engineering technology and applied science studies at the University of New England, a regional Australian university. All 97 students who completed the quiz received individualised feedback on their knowledge, interests and skills. This personalised feedback is important given the diverse nature of the commencing cohort, enabling a plan to be put in place to address identified knowledge and/or skills gaps. As the quiz was designed for engineering students its application to applied science students is unique and in need of further scrutiny.

The two research questions to be answered in this paper are:

1. How applicable is the Get Set for Success quiz for applied science and engineering technology students at a regional Australian university?
2. Is there a significant correlation between the quiz results and success in first year units?

Methods

Participants were 97 first year students enrolled in engineering technology and applied science including degrees in agriculture, rural science, animal science, zoology, environmental science, ecology and sustainability. Prior to the first week of trimester 1 2013 all 201 students enrolled in first year engineering or a first trimester core unit for applied scientists on sustainability were sent information about the Get Set for Success quiz and told how to access it. Timing of this advice proved to be critical, as students who had access to the quiz prior to commencing their studies were more likely to participate than those who had later access.

The cognitive quiz was completed by 50 of 201 students (25% response rate). These students self-assessed their competencies in maths, physics and chemistry. As this quiz took about one hour to complete, on average, 20 students withdrew before completing all of the questions and 61 students completed only the maths component.

Students were given access to the non-cognitive quiz in week 3 of trimester 1 and 86 of 201 students (43% response rate) completed the online ASSIST questionnaire. The 86 students also completed the Interest and Motivation for Studying Engineering scale using a 5-point Likert scale; where (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, (5) strongly agree. The higher response rate was probably due to the results of the quiz being discussed in class. However, students could choose to complete the Get Set for Success quiz without being included in the research project.

The 201students invited to participate in this research project came from a range of applied science degrees and Bachelor of Engineering Technology. Of the invited students, 97 (48% of the cohort) completed Get Set for Success cognitive quiz and/or non-cognitive quiz and agreed to their data being used for this research project. The cognitive quiz was started by 70 students but only 50 students (25%) completed the quiz. The non-cognitive quiz was started and completed by 86 students (43%), and 39 students completed both quizzes (20%). These students mainly came from the four year Animal Science and Rural Science degrees; with 15% from the three year engineering technology degree (Table 1). In terms of unit enrolment no engineering students were enrolled in biology, and only engineering students were enrolled in pure mathematics and physics.

Table 1. Degrees participants were enrolled in

Degree	Number of participants	Proportion (%)
Environmental Science, Zoology, Sustainability and Ecology	26	27
Engineering Technology	15	15
Agriculture	26	27
Animal Science and Rural Science	30	31
Total	97	100

Academic success was measured as the mark students gained at the end of the trimester of study for individual units, and the mean mark for units studied by the end of trimester 3. Results reported are for first year, first trimester units, except statistics which is offered in trimester 2 and 3. The mean mark for first year (FY) units until the end of trimester 3 2013 was reported as the *FY mean*. This included units ranging from pure science to those with a strong focus on writing; and in some cases elective arts and business units. Also, reported as the first year science (*FY Science*) mean, was the mean mark for first year pure and applied maths, chemistry, physics and statistics. This differentiation between the mean marks was used to determine if the mean FY Science marks linked more closely to the cognitive quiz items. Due to the data being non-normal, non-parametric statistical tests were conducted using IBM SPSS Version 21. A Pearson product-moment correlation coefficient was computed to assess the relationship between both the cognitive and non-cognitive factors and the unit and mean marks. Mann-Whitney U test was used for a comparison between cognitive factors and engineering and applied science students.

Results

Cognitive factors

Table 2 shows that a number of the independent variables (cognitive factors) were significantly correlated with the outcome variables (i.e., results in FY mean units, $r = .429$, $n = 61$, $p = .001$). Student results for the applied maths and statistics units taken by applied science students showed a significant correlation with the maths, chemistry and total Get Set for Success cognitive quiz scores. Blanks in the table show non-significant relationships. Looking at the cognitive quiz in more detail in Table 3, Question 11 is a simple derivative and so students need to have been exposed to calculus which is taught in final year high school intermediate maths or above.

In contrast, student results in pure maths did not show a significant correlation with the Get Set for Success cognitive measures (maths, physics or chemistry scores). This is probably because this unit only had 10 engineering students enrolled who completed the Get Set for Success quiz, and so the sample size was too small compared to the high variability. In Table 3, pure maths marks only significantly correlated with questions 9 and 15 of the 20 mathematics questions. Question 15 was the product rule which in NSW is taught in Mathematics (2 unit), and Queensland in Maths B in final year of high school (Year 12). Therefore students who have taken elementary mathematics in Year 12 or who have not completed high school would not have been exposed to this rule. Also as it is taught later in the curriculum it is not as consolidated as other mathematics (Jennings 2009).

For the physics unit undertaken by engineering students, the Get Set for Success physics score did not show a significant correlation, but the maths quiz score showed a strong correlation; $r = .730$, $n = 9$, $p = .025$; and very strong correlation with the total cognitive score $r = .825$, $n = 9$, $p = .006$. As students enrolled in these applied science degrees do not study physics, the relevance of the physics questions for the applied science students is questionable; but may also be an artefact of a small sample size in this area (Table 2).

The chemistry unit mark was very strongly correlated with the Get Set for Success scores for chemistry ($r = .664$, $n = 37$, $p = .000$) and maths ($r = .521$, $n = 45$, $p = .000$). Interestingly, there was a correlation with physics quiz score ($r = .394$, $n = 37$, $p = .016$) and this mainly came from the question on units, numbers and ordering by size (Table 3, question 31, $r = .472$, $n = 37$, $p = .003$), which is an essential skill in both physics and chemistry disciplines.

The biology unit mark very significantly correlated with the maths (r = .521), chemistry (r = .664) and total cognitive quiz score (r = .659), respectively (Table 2). Biology requires a basic understanding of maths and science, so this relationship is not unexpected. The sustainability unit mark was significantly correlated with the chemistry and total cognitive quiz score (Table 2). As this unit requires a basic understanding of the environment, including basic chemistry this relationship is expected.

Table 2. Correlations between cognitive factors and academic success –mean mark for first year (FY) units, and individual marks in units

		FY mean	FY Sci. mean	Pure maths marks	Applied maths	Statistics	Physics	Chemistry	Biology	Sustain -ability
Cognitive factors										
Maths	r	.429**	.532**		.666**	.632**	.730*	.521**	.494**	
	p	.001	.000		.001	.003	.025	.000	.001	
	n	61	52		22	20	9	45	42	
Physics	r							.394*		
	p							.016		
	n							37		
Chemistry	r	.465**	.519**		.573*	.602*		.664**	.530**	.346*
	p	.001	.000		.016	.014		.000	.002	.014
	n	50	42		17	16		37	32	50
Total	r	.497**	.579**		.599*	.710**	.825**	.659**	.531**	.289*
	p	.000	.000		.011	.002	.006	.000	.002	.042
	n	50	42		17	16	9	37	32	50

Note: **$p < .01$, *$p < .05$, 2-tailed Pearson Correlation

On further investigation, some of the cognitive questions correlated with measures of academic success, and a snapshot is shown below. Of all the maths questions, numbers 3, 9 and 11 correlated with seven measures of success each.

Question 3, was how to solve an equation, $5 + \frac{x}{2} = 2 + x$, and question 9 was basic trigonometry, requiring an understanding of sine, cos and tan. In question 11 students were asked to determine the first derivative of $f(x) = x^3 + 2x^2 - 7x + 4$.

Table 3. Correlations between cognitive factors and measures of academic success including marks in first year (FY) units

		FY mean	FY Sci. mean	Pure maths	Applied maths	Statistics	Physics	Chem-istry	Biology	Sustain-ability
Maths										
Question 3	Solve an equation									
	r	.464**	.415**		.424*	.558**		.339*	.432**	.343**
	p	.000	.001		.031	.007		.017	.003	.005
	n	66	57		26	22		49	46	66
Question 9	Understanding of basic trigonometry									
	r	.432**	.539**	.644*	.493*	.552*		.493**	.424*	
	p	.001	.000	.045	.045	.027		.002	.014	
	n	61	50	10	17	16		38	33	
Question 11	Simple derivative									
	r	.387**	.517**		.627**	.513*	.703*	.466**	.451**	
	p	.005	.000		.007	.042	.035	.004	.010	
	n	61	50		17	16	9	37	32	
Question15	Product rule									
	r	.394**		.757*			.717*			.472**
	p	.004		.011			.030			.000
	n	51		10			9			51
Physics										
Question 31	Units, numbers and ordering by size									
	r	.355*	.475**			.638**		.472**	.412*	
	p	.011	.001			.008		.003	.019	
	n	50	49			16		37	32	
Chemistry										
Question 37	Intermolecular forces in a gas									
	r	.384**	.382*					.471**	.440*	.305*
	p	.006	.013					.003	.012	.031
	n	50	49					37	32	50

Note: $^{**}p < .01$, $^{*}p < .05$, 2 tailed Pearson Correlation

Results for students enrolled in engineering and applied science degrees were compared. The groups showed a significant difference on the cognitive scores of maths and physics, respectively. As the engineering students are the only students in this cohort that enrol in pure maths and physics it is expected their scores on these factors will be significantly higher (Table 4).

Table 4. Comparison of cognitive factors for engineering and applied science students

Cognitive factors	Engineers vs applied scientists
Maths	.001**
Physics	.000**
Total	.003**

Note: $^{**}p < .01$, Mann-Whitney U test

Non-cognitive factors

Consistent with previous research (Burton & Sztaroszta, 2007), there was a significant negative correlation between items that measure Surface approaches to learning and student success. Specifically there was a negative correlation with the FY Science unit mean mark ($r = -.224$, $n = 77$, $p = .050$), biology mark ($r = -.262$, $n = 65$, $p = .035$) and the chemistry mark ($r = .325$, $n = 68$, $p = .007$; Table 5).

Previous research has shown a significant, positive correlation between Deep and Strategic approaches to learning and overall grades, respectively. Although trending in the right directions, these significant relationships were not replicated with the current sample of science and engineering students. It was therefore decided to drill down at the individual item level of these scales and examine the nature of the relationships among the key variables (Table 5). Many of the questions regarding a surface approach correlated, such as where students panicked if they got behind in their work there was a significant ($p < .05$) negative correlation with their pure maths mark. Only two strategic questions correlated with any of the marks, and they were both for physics. The most strongly correlated ($r = -.851$, $n = 8$, $p = .007$) was working steadily through the trimester with the physics mark (Table 5). No marks positively correlated with the Deep approach.

Table 5. Correlations between specific approaches to learning questions, and measures of academic success including marks in first year (FY) units

Question		FY mean	FY Sci. mean	Pure maths	Applied maths	Statistics	Physics	Chemistry	Biology	Sustain-ability
Approaches to learning										
Surface	r		-.224*					-.325**	-.262*	
	p		.050					.007	.035	
	n		77					68	65	
ASSIST	**Approaches to Study Skills Inventory for Students**									
ASSIST 35	I often seem to panic if I get behind with my work.									
(surface)	r			-.810*						
	p			.015						
	n			8						
ASSIST 31	I work steadily through the term or trimester, rather than leave it all until the last minute									
(strategic)	r						.851**			
	p						.007			
	n						8			

Note: **$p < .01$, *$p < .05$, r – 2 tailed Pearson Correlation

The Interest and Motivations for Studying Engineering scale (Table 6) for ambition showed significant correlations ($p < .05$) to the marks achieved in FY mean marks ($r = .298$), biology unit ($r = .276$), and sustainability unit ($r = .236$). This included the two units that had a weighting of 40% or more on written assessments such as essays, and the mean mark for all units, that could include other more writing based units too. An enthusiasm for science such as a love of maths and fascination with chemistry correlated with biology and chemistry unit marks.

Table 6. Correlations between Interest and Motivation for Studying Engineering (IMSE), and measures of academic success including marks in first year (FY) units

Question		FY mean	FY Sci. mean	Pure maths	Applied maths	Statistics	Physics	Chem-istry	Biology	Sustain-ability
Interest and Motivation for Studying Engineering (IMSE)										
Ambition	r	.298**							.276*	.236*
	p	.005							.026	.029
	n	86							65	86
IMSE	**Some Interest and Motivation Scale in Engineering questions**									
IMSE 4	I love maths									
	r	.245*				.394*		.315**	.249*	
	r	.245*				.394*		.315**	.249*	
	p	.023				.016		.009	.046	
	n	86				37		68	65	
IMSE 18	Chemistry is fascinating									
	r	.216*	.252*					.426**	.258*	
	p	.045	.027					.000	.038	
	n	86	77					68	65	

Note: **$p < .01$, *$p < .05$, r – 2 tailed Pearson Correlation

Discussion

In the following, how the cognitive and non-cognitive quizzes in Get Set for Success correlated with success overall and in individual units will be discussed.

Predictions of success overall

The Get Set for Success cognitive quiz score in this study was significantly positively correlated with mean first year science (mean of applied maths, physics and chemistry) marks and the overall mean first year mark, respectively. This replicates previous research based on the performance of commencing engineering students (Burton, Albion, Shepherd, McBride, & Kavanagh, 2013; Shepherd, McLennan, Kavanagh, & O'Moore, 2011). But in this case 85% of participants were applied science students, and only 15% engineering students, and so it has been shown in this study that the Get Set for Success cognitive quiz is applicable to applied science students.

As expected from previous research (Burton & Sztaroszta, 2007) a Surface approach to learning was significantly negatively correlated with student grades. In this study a Surface approach showed a significant ($p < .05$) negative correlation with the mean mark for the first year science units (r = -.224). Although not significant in this study, Deep and Strategic approaches to learning should still be encouraged, as they have been positively linked to students' grade point average (Burton et al., 2013).

Predictions of success in maths and statistics

The Get Set for Success maths and chemistry quiz results showed significant positive relationships with the applied maths unit and statistics unit marks, respectively. In more detail for example, Cognitive Question 11 is a simple derivative and so students need to have been exposed to calculus which is taught in Year 12 intermediate maths or above. This question showed a significant correlation with applied maths (r = .627, n = 17, p = .007) and statistics (r = .513, n = 16, p = .042). In a Queensland study, Jennings (2009) found that for students who had studied 2 units of maths, differentiation and integration were not strongly consolidated, as students had not developed fluency and automaticity. Therefore academic staff need to ensure they revise this material with students to ensure the students understand the concepts before building on this. This is also applicable to physics.

Engineering students who panic when they get behind with their work showed a significant ($p < .05$) negative correlation (r = .810) with the mark in pure maths (Table 4). Panic can be linked to maths anxiety which is of concern as pure maths was only taken by engineering students, but their confidence can be increased. In an Irish study where university students attended a drop-in mathematics support centre their confidence increased. In general, those students identified as the most at risk of failing due to their mathematical background who attended the drop-in centre increased their grade (Mac an Bhaird, Morgan, & O'Shea, 2009).

Predictors of success in chemistry and physics

The number of students studying physics in the sample was small (n = 9) and so there was high variability, similar to the pure maths sample (n = 10). But the Get Set for Success maths quiz score and total cognitive quiz score was significantly correlated with the physics unit mark, respectively. Similarly to the applied maths and statistics score discussed above, Cognitive Question 11 (simple derivative) had a strong correlation with physics unit marks (r = .70, n = 9, p = .035). It showed students who understood how to do a simple derivative scored higher marks in the unit. This links back to assumed knowledge where students are expected to have studied Year 12 Physics and at a minimum Intermediate mathematics at high school to enrol in this Physics unit, but many do not have this assumed knowledge. Interestingly, the Get Set for Success physics quiz score did not significantly correlate with the physics unit mark, which is probably due to the small sample size. As the cognitive quiz was started by 70 students, and only 50 completed it, there is a need to reduce the number of questions. It is proposed the physics component is removed in future as applied science students do not enrol in physics, and as the maths cognitive score showed a significant correlation with physics score (r = .73). But it is suggested question 31 on units, numbers and ordering by size is added to the chemistry battery of questions.

Spencer (1996) found that students with higher mathematical scores on entry to university were likely to achieve higher grades and were less likely to fail chemistry. So alongside chemistry knowledge, mathematics is a strong predictor of chemistry success. This is supported in the current study as the Get Set for Success chemistry (r = .664) and maths scores (r = .521) correlated significantly ($p < .001$) with chemistry unit mark, respectively. With the increase in students entering university without the assumed knowledge in mathematics, and often also without the chemistry, extra support is required. To ensure success in chemistry perhaps the advice of Mathematical Association of NSW, (2014) to reintroduce prerequisites for degrees is required.

Predictors of success in biology and sustainability

Similarly to chemistry, there was a very significant ($p < .01$) correlation between biology unit marks and Get Set for Success maths, chemistry and total cognitive quiz scores, respectively. As no engineering students were enrolled in biology; they were all applied science students, this shows the Get Set for Success quiz is relevant not just for engineering students. In a study in the USA, SAT II Maths scores were a relatively strong predictor of cumulative college grades for biological science students (Geiser & Santelices, 2007). This was supported in the current study, and so students again should be encouraged to study mathematics at Intermediate or above in final year of high school.

The unit in sustainability develops students' understanding of Australia's soil, geology, hydrology, climate, flora, fauna and land-use. Similarly to biology, knowledge of chemical processes in the environment is an undercurrent of this unit. Get Set for Success chemistry quiz score (r = .346) and total cognitive quiz scores (r = .289) have shown a significant ($p <$ .05) positive correlation with the mark in the sustainability unit, respectively. But the correlation shows there are other factors that also need to be taken into account as over 40% of the assessment includes written assessments.

Future

Due to the length and division of the Get Set for Success quiz the number of students completing the whole quiz could be higher. For applied science students an approach may be to reduce the length by removing the physics section for the cognitive section. As students knew the non-cognitive part would be discussed in class the response rate was much higher. This also allowed students to reflect with peers on their motivations for learning and approaches to learning. The same encouragement could be given by the academics teaching the mathematics and chemistry units, and time taken to revise the questions that the majority struggled with. In future, other measures of success such as persistence, i.e. if they are still enrolled in their chosen degree, and grade point average (GPA) could also be used.

Conclusion

It has been well documented that students commencing university have a diverse range of backgrounds and skills, and often do not have the required assumed knowledge. Previous studies using the Get Set for Success cognitive quiz with first year engineering students have found a positive correlation between the quiz score and student academic success. This result has been replicated in the current study showing the applicability of the Get Set for Success quiz for applied science and engineering technology students at a regional Australian university. There was a significant correlation between the quiz results and student academic success in the first year of study. The personalised feedback on the cognitive quiz showed students their gaps in knowledge and skills. This encouraged students to revise material or to start a dialogue with their degree coordinator about enrolling in bridging or foundation units before attempting units that require assumed knowledge in final year high school level, intermediate or above mathematics, chemistry, and/or physics. Indeed, by understanding the cognitive level of the cohort, academic staff can tailor extra support to students to encourage their successful transition to higher education.

The Get Set for Success quizzes were designed and delivered in a manner that encouraged students to take responsibility for their independent learning and to self-reflect on their knowledge, skills and interests, and focus on their career goals. In the Get Set for Success non-cognitive quiz, for example, the surface learning approach was shown to be negatively related to academic performance. The measure of ambition in the Interest and Motivation for Studying Engineering self-report questionnaire showed a positive relationship with applied science students' overall performance in first year. The current findings therefore indicate that the non-cognitive quiz allowed students to self-reflect on their motivations and approaches to learning. Thus, by academic staff better understanding the non-cognitive factors such as their motivations and approaches to learning, activities and examples can be included that help inspire students to learn.

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