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USING SURVEYS OF STUDENT ENGAGEMENT TO UNDERSTAND AND SUPPORT FIRST-TIME ENTERING STUDENTS AT A UNIVERSITY OF TECHNOLOGY

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Surveys of student engagement are receiving increased attention across the whole world, because data generated assist educational institutions in increasing student retention and improving student success. These surveys raise issues worthy of consideration particularly by institutions that might be interested in using survey data to develop their curriculum and to help their students succeed. The purpose of this paper is to demonstrate the significant role of student engagement surveys in the development of mechanisms to understand and effectively respond to the needs of first-year students entering university. Drawing from Astin's involvement theory (1984) and the Inputs-Environments-Outcomes (I-E-O) framework (1991), we argue that a thoughtful and innovative use of student engagement survey data to predict readiness for university has a tremendous potential to improve success through data-informed interventions. The study utilised data on first-time entering students who participated in the Beginning University Survey of Student Engagement (BUSSE). This study used a quantitative research approach. The major findings reveal differences in the frequencies of student-staff interaction and how students' experiences and expected academic difficulties varied across their gender, social class, and first-generation status. The frequencies of the nine subscales or engagement indicators of the BUSSE provide information regarding high school experiences with quantitative reasoning and learning strategies as well as students' expectations of a university. The results also provide an overview of the calibre of incoming first-year students and their perceived level of academic preparedness.

Keywords: student engagement, student retention, student success, first time entering students, university of technology.

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1. Introduction

The concept of student engagement has become popular in higher education and is increasingly being researched, theorised, and debated, with growing evidence of its critical role in student achievement, learning and development [1]. [1] defines student engagement in two ways: firstly, as the amount of time and effort students spend on academic activities and other activities that lead to their success. Secondly, as ways, in which institutions allocate resources and organise learning opportunities and services to induce students to participate in and benefit from such activities.

Research has also identified specific educational practices that are particularly effective in engaging students. Studies using data from the National Survey of Student Engagement (NSSE), developed in the United States of America, for instance, have established a set of practices that have a high impact on student engagement [2]. Such studies have identified ways, in which the level of academic challenge, the presence of active and collaborative learning, frequent student-lecturer interaction and a supportive campus environment contribute to student engagement, but without seeking to

theorise how these elements work together to effect gains of various kinds [2, 3].

Owing to the apartheid education system, many students entering university in South Africa are from low socioeconomic backgrounds, first-generation students, and members of a racial group at high risk of dropping out. As a result, the majority of entering students present with two or more of the risk factors, associated with university dropout [4]. Black African students still constitute many higher education dropouts, frustrating efforts to address equity in the South African workforce as well as the country's critical skills shortage [5]. Given the profile of students entering the system, institutions of higher learning have very little direct influence over the academic preparation of students' pre-university. Just like public higher education institutions elsewhere, South African institutions must cope with very limited resources, while simultaneously having to deal with an increasing number of students from diverse backgrounds and growing pressure for accountability and quality assurance. This is particularly important because the South African Department of Higher and Tertiary Education, in its bid to rigorously steer and transform the public higher

education sector, has adjusted the funding formula for public higher education to include graduation rates with a view to ensuring that student success becomes the primary focus [6].

The South African Survey of Student Engagement (SASSE) has been described as a research-based tool to guide institutions and policymakers, committed to increasing the number of students who survive and thrive in post-secondary education and training institutions [7]. The SASSE is based on the NSSE, developed by American higher education experts, and has been adapted to the South African context. The SASSE has three components, namely the Beginning University Survey of Student Engagement (BUSSE), the Lecturer Survey of Student Engagement (LSSE) and the Classroom Survey of Student Engagement (CLASSE). Statistical analyses show that the SASSE is reliable and valid for the South African higher education context, with reliabilities comparable to those, observed in the NSSE.

The SASSE adopted the twofold purpose of the NSSE, namely to determine the self-reported amount of time and energy that students put into education and related activities, and to evaluate how institutions use resources to encourage students to engage in activities that increase their learning experience [8]. The NSSE is specifically designed to assess the extent, to which students are engaged in empirically derived good educational practices and what they gain from their university experience [9]. Responding to the questionnaire requires that students reflect on what they are putting into and getting out of their university experience. Thus, completing the survey itself is consistent with effective educational practice. The results from the NSSE project have been used to produce a set of national benchmarks of good educational practice that participating institutions are using to estimate the efficacy of their improvement efforts.

2. Literature review

Research into factors that improve student success has a long history, and it has been helpful in creating knowledge about student success. This category of knowledge was first introduced by [10] who focused on the importance of time, spent on academic tasks, and continued much later with [11] research on student involvement. [12] introduced research on integration of social and academic interests and activities, which inspired research by [13] on good practices in undergraduate education. These different aspects of the student experience have informed the emergence of the field of student engagement, led by Kuh since the late 90s. [9] developed a framework to help clarify what mattered to student success from an empirical perspective. The research shows links of student engagement with higher academic achievements, higher first-to-second-year retention, and improved graduation rates [14].

The urgent need for improved student retention, higher graduation rates, and dealing with the challenges facing South African higher education provides a strong rationale for investigation of the various surveys of student engagement as predictors of student success. The current study sought to improve our knowledge base concerning the conditional effects of

surveys by examining different patterns of engagement indicators for various types of student subgroups within a large research population. Specifically, it sought to provide clarity regarding the following objectives of the BUSSE:

- To provide the institution with data that can be used to measure aspects of the undergraduate experience and undergraduates' university expectations.

- To promote student success by stimulating conversations about quality and effective educational practices.

- To contribute to the development of systemic and institutional capacity that will enable data-driven interventions and improvement.

Students entering university for the first time arrive with preconceived notions of what is expected of them to complete their university education successfully. Their previous experiences at secondary school strongly influence what they think university life will be like, which may either help or hinder learning. It is therefore important to understand what the expectations of first-time entering students are to enable institutions to develop initiatives that can help to give students more realistic expectations [15].

Several scholars globally have argued that student engagement and success are affected by several factors. [12] found that intellectual, social, and emotional wellbeing was a vital factor in student engagement and success. In addition, [16] notes that social and economic factors are changing students' motivation and ways of studying and, consequently, their engagement in learning. The above authors further assert that engagement can no longer be assumed but must be negotiated and that students modify their engagement to 'satisfy' their goals in complex times.

The role of the teacher in facilitating student engagement remains critical. In this regard, it is argued, that within the student-focused conception of engagement, teacher actions remain central to facilitating engagement [17]. These scholars have been influential in putting teachers and teaching on stage alongside students. The NSSE uses the principles, synthesised by [13] (cited in [9]). The NSSE, generated from surveys, such as the Australasian University Survey of Student Engagement (AUSSE), probes students' perceptions of student-teacher relationships, students' experiences in class, students' collaboration with peers, active learning, promptness of feedback, time, spent on tasks, teacher expectations, and how diverse talents and ways of learning are respected [18].

Other researchers ascribe similar important roles to teachers. For example, [19] suggest that engaging teachers creates and maintains a stimulating intellectual environment, emphasises the value of academic work and high standards, ensures that expectations are explicit and responsive, fosters social connections, provides targeted self-management strategies and ensures that assessment is used to shape the student experience and to encourage engagement. In addition, [20] found that academic performance was significantly more likely to improve when students had academic support from teachers. This is further supported by [21] and [22], who argue that deep learning experiences promote student engage-

ment, with ‘disengaged’ students taking a more surface approach.

While research on students’ and teachers’ roles in engagement is extensive and informative, in their meta-analysis, [23] claim that teacher behaviour and student learning are positively correlated. These scholars claim that meta-analyses and narrative syntheses show that student perceptions of teacher behaviours and attributes are multidimensional, have reasonable reliability, and have moderate positive correlations with successful learning. The authors cite a study by [24] that found that under appropriate conditions, more than 45 % of the variation in student learning could be explained by student perceptions of teacher effectiveness. In confirmation of the above, [25] state that a synthesis of meta-analyses reveals moderate to average correlations between student success and teacher behaviours, such as clarity of explanations, use of concrete examples, teacher availability and helpfulness, quality and frequency of feedback, and teacher effort to establish rapport. Teacher expressiveness, such as enthusiasm, humour, making eye contact and physical movement, significantly enhances students’ content learning [25].

However, questions have been raised on what is sometimes considered to be an operational and a conservative approach, in which the role of teachers is limited. In this particular regard, [26] suggest that teachers have a responsibility to teach beyond operational principles, strategies, techniques and behaviours, and they further ask for a conception, in which engagement is questioning, participatory and dialogic, leading not only to academic achievement but also to success as an active citizen. [27] expand on this critique by distinguishing between operational and ontological engagement. These scholars argue that ontological engagement reflects a level of commitment, aligned to active citizenship, in which the student commits, seizes opportunities, and tries to extend the boundaries of the curriculum through questioning. This is contrary to what happens within the dominant operational discourse of engagement, in which students find it difficult to engage for active citizenship. Drawing from student surveys in Australia, [15] thus suggest that some students lack the necessary social capital, such as extensive social networks and cultural literacy, to engage critically as active citizens.

The relationship between student-lecturer interaction and student educational outcomes is explained through various theoretical frameworks [14, 18, 23]. However, Astin’s involvement theory [14] and Inputs-Environments-Outcomes (I-E-O) framework [15] are especially relevant to the current study, in both a conceptual and a methodological sense. Astin’s involvement theory stresses ‘behavioural mechanisms or processes that facilitate student development’ (Astin, 14: 301). He suggests that students are more likely to learn and develop when they invest more time and energy in meaningful university experiences. Since his involvement concept is clearly operationalised and mirrors the ‘time-on-task’ construct, it can be measured easily and reliably by quantitative survey items. In addition, Astin’s I-E-O framework accounts for characteristics that vary both within institutions (for example, student background characteristics and university experiences) and between institu-

tions (for example, university environments). Therefore, the I-E-O framework informed the main analytical approach for this study. This framework allows researchers to estimate the unique predictive power of surveys of student engagement for outcome measures, controlling for an extensive set of within- and between-institutional confounding variables. This framework is supported by a variety of literature from various scholars, as indicated in the next section.

This paper therefore explores data, derived from surveys of student engagement in order to provide an understanding of the needs of first-time entering students at a South African university of technology.

3. The purpose and the objective of the article

The aim of the study is to demonstrate the significant role of student engagement surveys in the development of mechanisms to understand and effectively respond to the needs of first-year students entering university.

To achieve the goal, the following tasks are set:

1. To demonstrate how student engagement survey data on students’ experiences and expectations could be used to predict their academic success.
2. To provide an understanding of the needs of first-time entering students at a South African university and suggest or provide necessary support to them.

4. Materials and methods

The BUSSE is a survey instrument, designed to gather information from students on their arrival at the university. The survey explores students’ high school experiences and their first-year expectations. The BUSSE has nine subscales, referred to as engagement indicators, which are grouped as follows: High School Engagement includes the two subscales Quantitative Reasoning (QR) and Learning Strategies (LS), and First-Year Expectations includes the seven subscales Collaborative Learning (CL), Student-Staff Interaction (SSI), Discussions with Diverse Others (EDDO), Expected Academic Perseverance (EAP), Expected Academic Difficulty (EAD), Perceived Academic Preparation (PAP), and Importance of Campus Environment (ICE). The subscales are rated differently depending on the questions, grouped under that theme, namely 1=never; 2=sometimes; 3=often; 4=very often; 5=not at all difficult; and 6=very difficult.

The survey collected data across all nine engagement indicators. However, the results from five indicators, related to student experiences, were the focus of the current study, namely Quantitative Reasoning, Learning Strategies, Expected Academic Difficulty, Perceived Academic Preparation, and Campus Environment. These five selected indicators constitute key clusters of activities, linked to desired outcomes. They were used in this study because they are well supported by not only the findings of the NSSE but also the findings of various other student engagement studies [16, 28]. The engagement indicators were used for predicting students’ level of university readiness and challenges. In most of the impact literature, students’ satisfaction with their university experience has been considered as a student ‘outcome’ of higher education rather than university ‘experience’ [2, 12, 20].

The BUSSE was administered to 421 first-year students in year 2020. The survey targeted first-time entering undergraduate students from three faculties: Management Sciences, Natural Sciences, and Engineering. The sample included more male students (58 %) than female students (42 %). Students who completed the survey were primarily black African (98 %). The remaining 2 % constituted Indian and coloured students. Of the total sample, 87 % were first-generation university students.

Sampling and data collection procedures

The study used data from a university of technology. The BUSSE, which is a longitudinal survey of first-time entering undergraduate students, was administered at the beginning of the academic year. The study targeted all first-time entering undergraduates and gathered information on students' background characteristics, academic and personal experiences, academic engagement, satisfaction, and university expectations. The survey was administered online, and students were able to use their smartphones to complete it.

The engagement indicators were scored on a 60-point scale. To produce an indicator score, the response set for each item was converted to a 60-point scale, for example never=0; sometimes=20; often=40; and very often=60. Thereafter, rescaled items were averaged. Thus, a score of zero meant that a student responded at the bottom of the scale for every item in the engagement indicator, while a score of 60 indicated responses at the top of the scale on every item. The results included analyses by gender and first-generation status. The data were extracted using pivot tables that were created using an Excel spreadsheet.

Validity and reliability

The NSSE instrument has been tested extensively in the United States of America to ensure acceptable content and face validity. Researchers have identified five conditions, under which the report is likely to be valid, namely (a) when the information requested is known to the respondents; (b) when the questions are phrased clearly and unambiguously; (c) when the questions refer to recent activities; (d) when the respondents think that the questions merit a serious and thoughtful response; and (e) when answering the questions does not threaten, embarrass or violate the privacy of the respondent or encourage the respondent to respond in socially desirable ways. The NSSE, and consequently the SASSE, is designed in such a way that all the above-mentioned criteria are satisfied.

The reliability of a measure reflects the extent, to which an instrument yields the same results across various settings and over various timeframes. Psychometric analyses have been conducted periodically on the NSSE instrument, including pilot/field studies. The NSSE in-

strument asks students to report on behaviours, grouped into broad categories/themes. Each of the item sets for these categories will be examined in terms of internal reliability. The categories are university activity items; reading, writing and educational programme characteristics; time usage; personal growth; and opinions about the student's institution. The NSSE instrument (and therefore the SASSE) was designed to allow institutions to examine group trends and make decisions about how to respond to groups of students. According to [29], reliabilities of 0.65 can be considered acceptable when investigating internal consistency for group decision making.

The informed consent for this study was obtained at one of the University of Technology in KwaZulu Natal province in South Africa in 2020 (reference number F2020/02/09B). All the study participants were requested to fill in the consent form before they complete the survey questionnaire. Participants were not forced to participate in this study and could withdraw at any given time should they wish to. No incentives were given to participants to complete the survey.

5. Results and discussion

The study investigated how the tested students' experiences and expectations varied by gender and first-generation status. Table 1 displays the results of the nine BUSSE indicators regarding student experiences and expectations for various student subgroups. Overall, the differences in the frequency of indicators based on each student characteristic were significant while, along each indicator, differences were modest or small, as reported by the small statistical significance of the effect size. Gender differences were statistically significant in relation to the Learning Strategies indicator, with female students indicating a better experience than male students. According to the Expected Academic Difficulty indicator, non-first-generation students were more likely than first-generation students to succeed because they were aware of how challenging university could be through their family experiences. A better alignment between students' expectations and what higher education is able to provide is critical in building trust and understanding between students, staff, and other stakeholders.

The table also indicates low mean scores for all students irrespective of gender or first-generation status for the Quantitative Reasoning, Student-Staff Interaction and Expected Academic Difficulty indicators. The highest mean scores are shown for the Perceived Academic Preparation, Expected Academic Perseverance, and Importance of Campus Environment indicators. These results could inform the institution on where and how to better align the support initiatives and resources that it provides to students.

Table 1

Overall mean scores of nine indicators for students compared by gender and first-generation status

BUSSE engagement indicators	All students		Gender composition			First-generation comparisons		
	Mean	N	Male	Female	Effect size	FG	Non-FG	Effect size
Quantitative Reasoning	28.22	411	28.30	29.97	0.03	28.22	28.24	0.00
Learning Strategies	41.13	411	40.12	42.26	-0.17	41.05	41.67	-0.05
Collaborative Learning	33.03	414	32.52	33.64	-0.11	33.09	32.60	0.05
Student-Staff Interaction	27.21	414	27.36	27.04	0.02	27.22	27.16	0.00
Expected Discussion with Diverse Others	33.67	411	33.80	33.34	0.03	33.31	36.13	-0.18
Expected Academic Perseverance	45.52	415	44.94	46.34	-0.12	45.56	45.26	0.03
Expected Academic Difficulty	26.89	416	26.53	27.71	-0.07	26.38	30.35	-0.29
Perceived Academic Preparation	48.17	414	47.97	48.48	-0.05	48.28	47.42	0.07
Importance of Campus Environment	43.71	415	43.35	44.17	-0.08	43.55	44.77	-0.10

Note: Scale scores are expressed in 0 (minimum) to 60 (maximum) point scales; effect size is the mean difference, divided by pooled standard deviation. It indicates the practical significance of the mean difference (effect size .2 is often considered small, .5 is moderate and .8 is large); first generation is defined as no parent or guardian having a university degree

University students improve their learning and retention when they actively engage with their subject material by analysing information as opposed to only memorising information. Effective learning strategies include summarising subject material, reviewing notes after class, and identifying key information in readings. Knowing how frequently students apply effective learning strategies can help universities to target interventions to promote student learning and success and to make a positive difference in many students' qualification attainments. Most students (80 %) reported that they regularly identified important information from reading assignments (replying 'often' and 'very often'). Furthermore, most students reported that they reviewed their notes after class, with a total of 71 % of students replying 'often' or 'very often'. Most students (69 %) reported that they frequently summarised what they had learned in class. Non-first-generation students reported more frequent use of learning strategies than their first-generation counterparts. This might be a result of their supportive social context. Female students also reported slightly more use of learning strategies than male students. The results indicated that the use of these strategies varied based on selected student characteristics. For example, students' use of learning strategies seemed to be higher when their self-reported high school marks were also high. This shows that an increase in the use of learning strategies is positively related to self-reported student performance. Additionally, we found that students living on campus used learning strategies more than those living off campus.

A supportive campus environment indicates that students are likely to perform better and that they are more satisfied with institutions that are committed to their success and that cultivate positive working and social relations among different groups on campus [30,

31]. When students feel involved and develop relationships with other members of the learning community, this is likely to increase both their levels of satisfaction and to increase the likelihood of their finishing their studies successfully. For years, researchers have found that involvement in educationally purposeful activities (such as co-curricular activities) contributes positively to high student performance [32–34]. Overall, students reported a mean of 43.71 for the Importance of Campus Environment indicator. The majority of students (70 %) felt that it was very important for the institution to provide them with support to help them succeed academically as well as learning support services (such as tutoring, mentoring, writing centre and library facilities). Institutions that are dedicated to enhancing student success should aim to provide support for students across a variety of areas that include the cognitive, social, and physical, and should encourage a high level of student performance and satisfaction [18, 35–38]. The Importance of Campus Environment indicator summarised students' perceptions about the institution's efforts regarding their learning and development. Further, it was evident, that several students (31 %) believed the institution assisted them to manage their non-academic responsibilities, which included family and work matters. It is worth noting, that non-first-generation students perceived a higher level of support from the institution than first-generation students. Similarly, female students also expected more institutional support than male students.

Quantitative Reasoning

The ability to use and understand numerical and statistical information in day-to-day life is known as one's quantitative literacy. It has become increasingly important for university students to develop the ability to reason quantitatively by evaluating, supporting, and

critiquing the use of numerical and statistical information in real-lifesituations. There is an overwhelming demand that university students be able to practically implement the knowledge and skills that they have acquired while at

university. Table 2 indicates the responses from students when they were asked about how often they used quantitative reasoning skills during their last year of high school.

Table 2

Quantitative Reasoning questions and students' response options

Question	Response options	All students		Gender composition				First generation ^a			
				Male		Female		Yes		No	
		Count	%	Count	%	Count	%	Count	%	Count	%
During your last year of high school, about how often did you do each of the following?											
Reached conclusions based on your own analysis of numerical information (numbers, graphs, statistics, etc.).	Never	38	9 %	21	9 %	16	9 %	33	9 %	5	9 %
	Sometimes	137	33 %	81	35 %	55	32 %	119	33 %	18	34 %
	Often	161	39 %	86	38 %	71	42 %	140	39 %	21	40 %
	Very often	73	18 %	41	18 %	29	17 %	64	18 %	9	17 %
	Total	409	100 %	229	100 %	171	100 %	356	100 %	53	100 %
Used numerical information (numbers, graphs, statistics, etc.) to examine a real-world problem or issue (unemployment, climate change, public health, etc.).	Never	69	17 %	40	17 %	28	16 %	59	17 %	10	19 %
	Sometimes	160	39 %	91	39 %	66	38 %	138	38 %	22	42 %
	Often	131	32 %	71	31 %	56	33 %	116	32 %	15	28 %
	Very often	52	13 %	29	13 %	22	13 %	46	13 %	6	11 %
	Total	412	100 %	231	100 %	172	100 %	359	100 %	53	100 %
Evaluated what others had concluded when they used numerical information (numbers, graphs, statistics, etc.).	Never	79	19 %	45	20 %	33	20 %	71	20 %	8	15 %
	Sometimes	201	50 %	107	47 %	88	53 %	176	50 %	25	48 %
	Often	101	25 %	60	26 %	39	23 %	86	24 %	15	29 %
	Very often	25	6 %	18	8 %	7	4 %	21	6 %	4	8 %
	Total	406	100 %	230	100 %	167	100 %	354	100 %	52	100 %

Note: a. First generation is defined as no parent or guardian having graduated with a university degree

The findings above provide evidence of insufficient familiarity with quantitative reasoning among first-year students. For instance, only 57 % of first-year students were confident (scored as 'often' plus 'very often') of having reached conclusions based on their own analysis of numerical information, such as numbers, graphs, and statistics on a regular basis. Furthermore, less than half of the surveyed students (45 %) reported using numerical information to examine real-world problems or issues. In addition, students reported an even lower rate of examining and evaluating problems. Only approximately a third (31 %) of the students confidently ('often'

plus 'very often') stated that they frequently evaluated what others had concluded when they used numerical information.

Students' mean scores for the Quantitative Reasoning indicator were compared by gender and first-generation status, as presented in Fig. 1. All items showed a similar performance with female students making less use of quantitative reasoning than male students. A comparison by field of study (faculties) showed that students in Science and Engineering engaged in quantitative reasoning activities more often than their counterparts from the Faculty of Management Sciences.

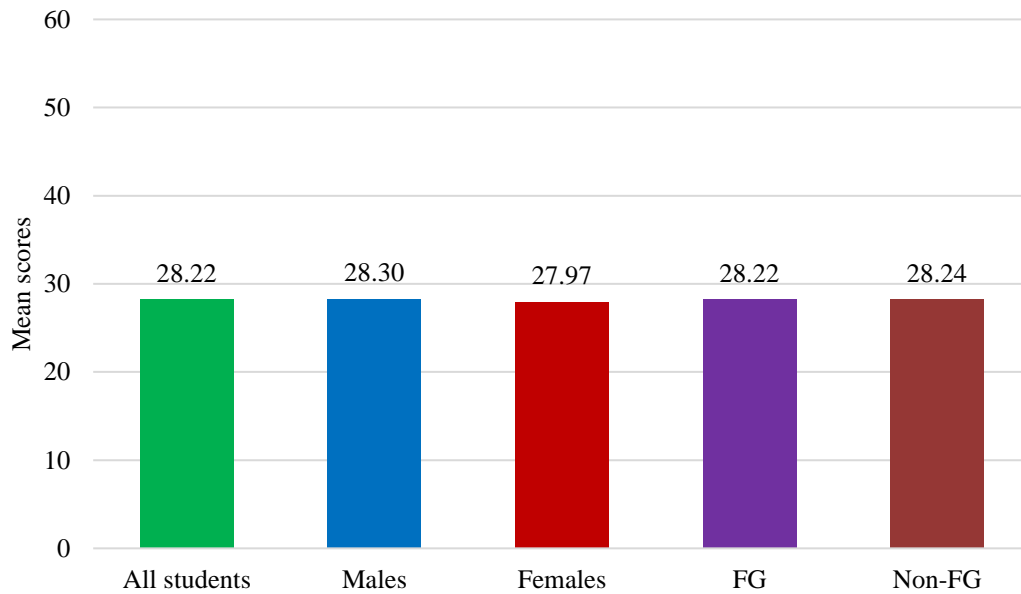


Fig. 1. Quantitative reasoning mean scores for students compared by gender and first-generation status

Expected Academic Difficulty and Perceived Academic Preparation

The preparation levels of students entering the higher education system are a cause for concern at all levels of higher education. Fig. 2 provides important evidence to understand and address these concerns. From this comparative analysis, there is a wide gap between how students conceive the difficulty of university studies and their level of preparedness. The results show that first-generation and male students expected university

studies to be less difficult than other groups. Female students reported the highest levels of preparation.

There appears to be gross overestimation of academic preparedness and underestimation of difficulty among all demographics.

This indicates the importance of sophisticated orientation, early warning, and transition interventions that would help students to become more realistic about their expectations and abilities without any form of demoralisation and demotivation.

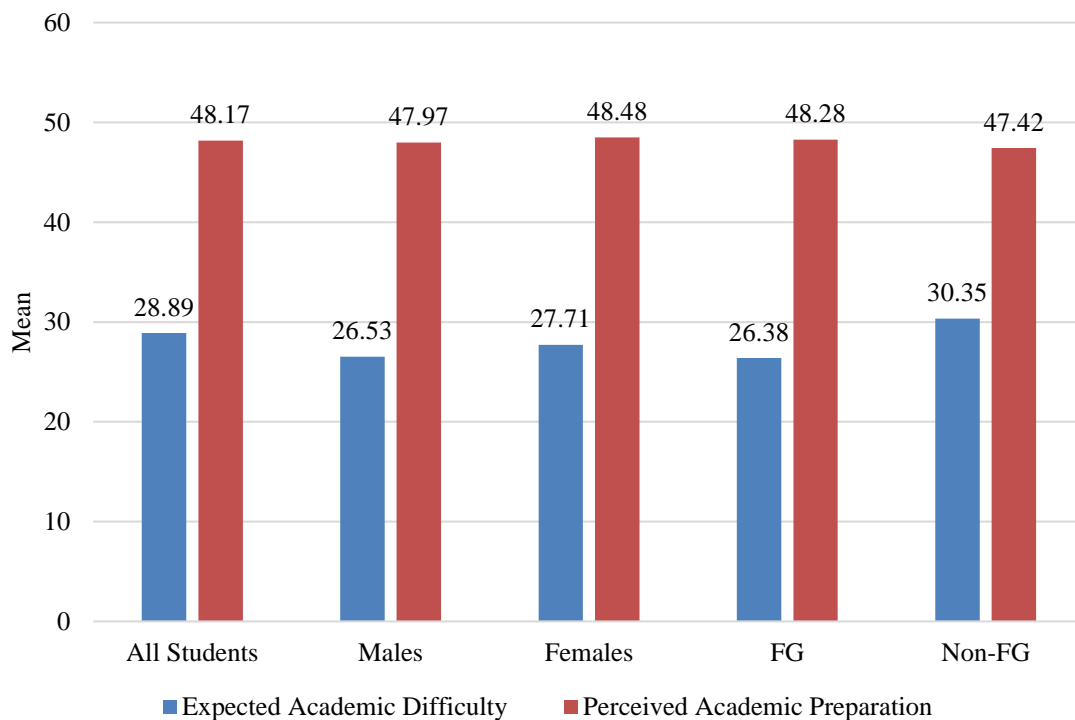


Fig. 2. Expected Academic Difficulty and Perceived Academic Preparation mean scores for students compared by gender and first-generation status

Limitations of the study. This study was only restricted to one university of technology and as such it will be difficult to make generalisations.

This study also used a quantitative method. A mixed method approach can assist in getting deeper insights of the study.

Recommendations. The results have shown that certain types of activities help the institution to understand the general, cognitive, and social skills and the level of academic readiness of the students admitted.

The study has also revealed the various value-adding activities that students can participate in. The study also recommends that the institution develop strategies of early intervention in the promotion of persistent engagement in educationally sound and evidence-based activities.

Furthermore, the study recommends that student engagement surveys, such as the BUSSE and SASSE, be made compulsory and given priority during the registration process of first-time entering students.

Areas of further research. Another area of possible further research may include a comparative study of the same topic across all universities of technology within the country.

6. Conclusions

1. The primary purpose of this study was to demonstrate how student engagement survey data on students' experiences and expectations could be used to predict their academic success and to provide the necessary support at a university. This was achieved through this study.

2. The understanding of the needs of first-time entering students was explored in this study and suggestions for the support were provided.

Conflict of interest

The authors declare that they have no conflict of interest in relation to this research, whether financial, personal, authorship or otherwise, that could affect the research and its results, presented in this article.

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