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MATHEMATICS: A GOOD PREDICTOR FOR SUCCESS IN A HEALTH SCIENCE DEGREE

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ABSTRACT

Research-based literature indicates that secondary school mathematics performance is highly predictive of university performance Moreover, scholars suggest that success in secondary mathematics courses translates into success in tertiary degrees where mathematics is required. This paper examines the extent to which the completion of secondary school mathematics courses is predictive of academic success for 57 first-year students enrolled in a Health Science degree at The University of Notre Dame Australia (UNDA) (Fremantle Campus). Using the University's databases, the level of mathematics completed at secondary school was examined against gender, Tertiary Entrance Ranking (TER) and Grade Point Average (GPA). A statistical analysis of collected data revealed that irrespective of gender, students who completed 3C3D mathematics at secondary school had a significantly ($p = .00$) higher GPA, than those students who had studied level 2C2D mathematics. These findings are discussed briefly in light of the current literature presented.

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Introduction

The mathematical competency of the current generation of Australian undergraduate students is declining (Belward et al., 2011a; Brown, 2009; McNaught & Hoyne, 2011; Nicholas et al., 2015). This decline may be the result of the expansion of the Australian tertiary sector which has seen a greater diversity of university entrants accepted into undergraduate degrees through a multitude of pathways (Belward et al., 2011b; Brown, 2009; Harris & Ashton, 2011). Mathematical competency is an integral component of many scientific and clinical undergraduate degrees (Hall & Ponton, 2005; Koenig et al., 2012), and the ability to apply mathematical and statistical thinking in the context of science is an area of urgent attention (Belward et al., 2011b). The Australian Learning and Teaching Council (ALTC, 2010) provides clear statements on suggested learning outcomes for Australian science graduates. These statements outline threshold learning outcomes that all recent graduates of science are expected to demonstrate regarding the use of quantitative skills. Furthermore, there is international acknowledgment that articulates the need for science students to be competent quantitative thinkers (AAAS, 2009; Tariq, 2008).

An inability to demonstrate fundamental quantitative skills at the undergraduate level stymies deep learning, contributes to student attrition, and may have dire implications for clinical professions (Thomson et al., 2010). A common method for addressing low mathematical competency among undergraduates is to impose course requirements on identified low capability students to complete a foundational mathematical elective early within the undergraduate degree. However, these units often focus on abstract mathematical processes and students are at risk of not transferring these skills to the applications specific to the degree requirements (McNaught & Hoyne, 2011).

Scholars have identified that secondary school academic performance is highly predictive of university performance (Harackiewicz et al., 2002; McKenzie & Schweitzer, 2001; Nicholas et al., 2015). More specifically, there is evidence to suggest that success in university mathematics courses (Poladian & Nicholas, 2013; Rylands & Coady, 2009) and university science courses (Nicholas et al., 2015; Sadler & Tai, 2007) depends on the level of mathematics studied in secondary school. However, studies in New Zealand (Comer, Brogt, & Sampson, 2011) and Australia (Green, Brown, & Ward, 2009) examining the transition of secondary school students into university have revealed that predicting first-year student academic success can be a challenging task, with unexpected results (Comer, Brogt, & Sampson, 2011).

Aims

There were three aims for this research project. The first aim was to investigate whether grade point average (GPA) was associated with the level of mathematics completed at secondary school, for students undertaking a Health Sciences degree directly from secondary school. The second aim was to determine if a between-group difference was observed for gender for the first aim. Third, the researchers wished to discern whether any relationships were observed between GPA, tertiary entrance ranking (TER), and result of the level of mathematics completed at secondary school.

Context

The School of Health Sciences at The University of Notre Dame Australia (UNDA) (Fremantle campus) offers undergraduate degrees in biomedical science, exercise and sports science, health and physical education, outdoor recreation, and preventive health. While the majority of students enter into university study after the completion of secondary education and obtaining a requisite Australian TER score, several alternative university entrance pathways are available for mature age students. The addition of those entering via previous tertiary study, foundation year or TAFE preliminary qualifications creates a heterogeneous pool of students with concomitant disparities of prior knowledge, learning pace, and digital literacy. In this study, the 2014 first year cohort of health science students was examined in order to determine if the level of mathematics completed at secondary school is associated with academic performance (GPA). Successfully identifying such factors will allow for the formulation of student-specific approaches in view of academic support and student retention.

Methodology

Methods

Fifty seven (n = 57) 2014 school leavers were grouped according to gender (24 male, 33 female) and level of mathematics completed at secondary school (8 male, 10 female for 2C2D; 12 male, 16 female for 3A3B; 4 male, 7 female for 3C3D). To see if ability of mathematics at a secondary school level transferred directly to university, this study only used secondary school students who enrolled in university directly from secondary school. Before commencement of first year university study, each student's TER and the result of the level of mathematics completed at secondary school was obtained by through the Student Admissions Office database at UNDA (Human Research and Ethics Committee approval: 015005F). Upon completion of their first year studying a health sciences degree within the School of Health Sciences at UNDA, GPA was obtained through the academic transcripts of each student, and graded on a four point scale (0-4).

Statistical Analysis

Statistics software IBM SPSS Statistics for Windows V.22 (Armonk, NY) was used to perform a two-way between-groups ANOVA with post-hoc analyses, with the two independent variables being gender (male and female), and the groups' level of mathematics completed at secondary school (2C2DMAT, 3A3BMAT, 3C3DMAT). The Tukey post-hoc analyses were conducted to observe any differences within level of mathematics completed at secondary school. GPA was used as the dependent variable. One-way ANOVAs were used to observe simple effects for each gender, and finally, independent t-tests were conducted to observe differences between-gender for; TER, result of level of mathematics completed at secondary school and GPA.

Findings and Discussion

Results

Results from the two-way between-groups ANOVA revealed that level of mathematics completed at secondary school was a significant ($p = .00$) main effect, and influenced GPA. Gender was not shown as a significant ($p > 0.05$) main effect, and therefore did not influence GPA. Tukey post-hoc analyses of level of mathematics completed at secondary school revealed a significant ($p = .00$) difference between 2C2D and 3C3D groups (Table 1). Both ANOVAs (one for male, one for female) used to analyse within-group effects of level of mathematics completed at secondary school for GPA reported significant main effects. Tukey post-hoc analyses for both ANOVAs revealed a significant ($p = .00$) difference between 2C2D and 3C3D groups. Independent t-tests reported no significant differences between-gender for GPA, TER, or result of level of mathematics completed at secondary school.

Table 1. Descriptive statistics of level of mathematics completed at secondary school, result, TER and GPA. Mean (SD).

Level of mathematics completed at secondary school	Result	TER	GPA
2C2D			
8 Male	53.1 (5.0)	73 (7.6)	1.63 (0.5)
10 Female	55.1 (6.9)	71 (5.3)	1.50 (0.4)
3A3B			
12 Male	60.3 (5.1)	78 (4.8)	1.56 (0.5)
16 Female	56.1 (5.4)	77 (6.2)	1.89 (0.7)
3C3D			
4 Male	68.1 (1.3)	87 (7.5)	2.91 (0.4)
7 Female	72.0 (7.8)	93 (5.1)	3.09 (0.7)

TER – tertiary entrance ranking, GPA – grade point average

Discussion

This research project reported that first year students studying a Health Sciences degree at UNDA achieved a higher GPA if they had completed a higher level of mathematics at secondary school. As a main effect, there was a significant ($p = .00$) difference between the 2C2D and the 3C3D groups. Similar results were report by Nicholas et al. (2015), who compared overall university mathematics performance to the level of mathematics they entered university with. Nicholas et al. (2015) also reported that 71 % of students who had completed a higher level of mathematics passed their enrolled course. Although this research project only reported GPA for the first year (of a three year degree), the reported difference in GPA between the 2C2D and 3C3D groups may foresee the likelihood of overall (three year) success. Importantly, anecdotal evidence within the School of Health Sciences at UNDA reports that the majority of students with GPAs greater than 2.5 continue to perform academically well throughout their degree, with GPA also correlating with lower course attrition.

Limitations

There were limitations associated with this pilot research project. Firstly, this research project only reports the findings relating to first year students enrolled in a Health Sciences degree at one tertiary institution. Results may differ between degrees within the same school, or across cohorts of students sampled from other schools at the university. Secondly, a relatively small sample size (n=57) was used. However, this research project only reported results for secondary school leavers, with other students enrolled in the same degree being of mature age (or other entry methods) not included. Thirdly, specific fields of mathematics were not identified. Finally, results do not reflect the performance across other commencement years (i.e. 2013) for the same course.

Conclusion

The overarching aim of this research project was to see if the level of mathematics a student completed at secondary school was related to their GPA average, upon completion of their first year studying a degree in the School of Health Sciences at UNDA. Results showed that irrespective of gender, students who completed level 3C3D mathematics at secondary school had a significantly ($p = .00$) higher GPA,

than those students who had studied level 2C2D mathematics. Based on the 2014 results, it can be said that school leavers who completed a higher level of mathematics were able to achieve higher first year GPAs than those secondary school leavers who completed a lower level of mathematics. Future research should investigate other years of commencement within the same degree, or across other schools within UNDA's Fremantle campus to see if similar results can be seen. It would also be interesting to investigate which specific fields of mathematics are transferable to specific units within the Health Sciences degree at UNDA.

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