Hosseini, M.R., Shaw, L., Tivendale, L. and Mills, A. 2016, Tertiary architecture and construction management students' academic performance: role of demographic variables*, in AUBEA 2016 : Proceedings of the 40th Australasian Universities Building Education Association Annual Conference*, Central Queensland University, Rockhampton, Qld., pp. 361-270.

TERTIARY ARCHITECTURE AND CONSTRUCTION MANAGEMENT STUDENTS' ACADEMIC PERFORMANCE: ROLE OF DEMOGRAPHIC VARIABLES

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ABSTRACT

This study presents an account of how different demographic variables affect students' academic performance. The studied sample comprises a cohort of 133 Architecture and Construction Management (ACM) students in a third-year unit allocated to construction methodology and structural knowledge required for high-rise construction. Data is collected for these students studying at the School of Architecture and Built Environment at Deakin University (A+B). Outcomes of group and individual task (exam) are analysed deploying statistical methods. The findings show no significant difference between students coming to university from Year-12-to-and those that come from the vocational education sector. Furthermore, the findings indicate significant discrepancy in terms of performance amongst the students enrolled in construction management course with double-degree and architecture students. Additionally, the study reveals that female students outperform male students in individual tasks. The findings could be applicable to redesigning assessments as well as planning of prerequisite units in the studied curricula.

Keywords: Academic performance, demographic variables, students, architecture and construction management, Deakin University

INTRODUCTION

Evidence shows that demographic variables could act as significant predictors of university academic performance for students. These variables include gender (Smith & Naylor, 2001) and impacts of transferring from one tertiary institution to another (Tickell & Smyrnios, 2005). This is particularly important within the Australian higher education system in which students can transfer from Technical and Further Education (TAFE) to a university (Tickell &

Smyrnios, 2005). Performance in particular subjects could also be manipulated by established priorities and the curriculum of different university courses from which students commence their studies (Becerik-Gerber, Gerber, & Ku, 2011; Tickell & Smyrnios, 2005). Yet, despite the salience of the matter, findings of studies on impacts of demographic variables on tertiary-level students' academic performance have remained inconclusive and inconsistent (Tickell & Smyrnios, 2005). Moreover, any knowledge associated with students' academic performance should be situated in the context of local experiences based on expectations and conditions of particular academic subjects (Bloxham & Boyd, 2007). Against this background, a review of literature reveals a paucity of research into the influence of demographic variables of academic performance for Architecture and Construction Management (ACM) students. In view of this, the primary objective of this paper is to identify whether factors known as demographic variables affect the academic performance of students in a particular unit SRT351–construction and Structures 3. SRT351 is the third in a series of 3 core units allocated to construction methodology and structural knowledge for Architecture and Construction Management (ACM) curricula at A+B. The reason for focusing on this unit comes from the fact that units allocated to structural concepts are unique in view of their challenging nature for ACM students (Nawari, 2015). Besides, due to the high rate of failure of students, SRT351 is regarded as the unit with the highest failure rate amongst the units of the abovementioned curricula. Where the outcome of an assessment is not acceptable for stakeholders, reviewing the potential factors leading to such outcome becomes necessary (Baartman, Prins, Kirschner, & van der Vleuten, 2007; Banta & Palomba, 2015). This has been the raison d'être for conducting the present study.

BACKGROUND

Studying structural analysis concepts is necessary for ACM students. That is because architects and construction managers have to exhibit an understanding of how engineering considerations affect design and management of construction projects (Dabby & Bedi, 2012). Teaching structural engineering concepts needs students to think in ways that are not common to their discipline. Thus, units allocated to structural engineering concepts stand out as the most challenging and are delineated from other units in ACM curricula (Nawari, 2015). By the same token, SRT351 has been always a challenging unit for students at A+B in terms of high rate of fails and discontent with results of the assessments.

According to Sadler (2005) assessment represents the process of forming a judgment of the level of students' academic performance.

The main aim of assessments is to evaluate the ability of students to perform professional tasks and assessing their theoretical knowledge. This is to safeguarded students' professional and generic competencies (Gulikers, Baartman, & Biemans, 2010). Such judgment occurs on account of grading the task(s) completed by a student. This entails classification of the quality of a student's performance for a single piece of work, which a student submits in response to a specific task. A wide range of tasks could be utilised as elements of assessment including various combinations of assignments and examinations (Sadler, 2005). The grade received by students for these tasks could be regarded as indicators of students' performance, which is an acceptable approach in the literature (Tickell & Smyrnios, 2005). However, regardless of the nature of the assessment tasks, previous studies have warned against the impacts of demographic variables on the way students perform in assessments.

As asserted by Bloxham and Boyd (2007, p. 49) "Students' perception of what assessment task require can vary significantly and are influenced by their prior experience and preferences.". Students in Construction Management, Architecture and those seeking a double-degree have to pass the studied unit. Discrepancies in terms of background knowledge of these three groups on structural analyses concepts have yet to be investigated. Nevertheless, Becerik-Gerber et al. (2011) established that priorities and the contents of each of these courses are glaringly different.

At A+B, the majority of offers are made through VTAC (Victorian Tertiary Admissions Centre). This applies for Year 12 entrants as well as mature age applicants such as those who are articulating from TAFE. For the latter, there are a number of criteria for acceptance, one of which is the successful completion of a Diploma or Advanced Diploma in a cognate field. Nearly every applicant to the Bachelor of Construction Management (Honours) has completed the Diploma of Building and Construction with those applying for the Bachelor of Design (Architecture) having completed the Advanced Diploma of Building Design (Architecture). The Advanced Diploma is also the usual qualification for those seeking entry to the combined Bachelor of Design (Architecture) / Bachelor of Construction Management (Honours). There is agreed Credit for Prior Learning in place for students who have completed these qualifications at a TAFE. There is disagreement amongst Australian-based researchers with regard to performance of students coming through the TAFE and those admitted through the Year-12-to-university pathway. Where Bowden, Abhayawansa, and Bahtsevanoglou (2015) believes that there is significant discrepancy between the performance of the

former and latter cohorts, the findings by Tickell and Smyrnios (2005) show no difference by final years of university study.

The impact of gender on performance of students is also still a matter of controversy. In this regard, Smith and Naylor (2001) showed that performance of students shows different results based on the course under question where female students are worse in architecture. On the contrary McNabb, Pal, and Sloane (2002) asserted that female students perform generally better regardless of the type of subject. Furthermore, observations amongst ACM students by Fonseca, Martí, Redondo, Navarro, and Sánchez (2014) manifested no discrepancy among female and male students. As a result, the impact of gender on ACM students' performance has remained to be studied (Maghiar, Sturges, Maurer, & Jackson, 2015).

RESEARCH METHODS

Assessments should be treated as highly context-specific phenomena (Bloxham & Boyd, 2007; Gulikers et al., 2010). As a result, the "case study" approach was deemed most appropriate in being capable of providing the best correlation with the natural context and the highest level of detail (Flyvbjerg, 2006). Conforming to the definition proposed by Flyvbjerg (2006) the essence of the case study in this paper encompassed exploring an entity (assessment results for a unit) for a certain period of time. This was to illuminate what the results of interactions of a number of factors would be.

Data for this study was sourced from unidentifiable academic student results in in 2015. This included results of students in group tasks (50%) and an examination (50%) as the individual parts of the assessment for the studied unit. Further, students were separated based on their mode of entry (Education), enrolled course (Course) and their gender (Gender).

These three variables were conceptualised as independent variables potentially affecting students' performance in assessment of the studied unit. Data analyses entailed use of parametric data analyses tests in view of the nature of variables in the data. That was because, marks (numbers) were regarded as dependent variables, which manifest performance. Hence, parametric methods were used due to their higher analytical power (Cronk, 2014).

FINDINGS OF THE STUDY

Sample diversity

As illustrated in Figure 1, the studied unit was dominated by male students with above 75% of students enrolled in the unit were male (see Figure 1). Likewise, around 65% of students enrolled in the unit were coming from TAFE where only 35% of students were accepted as Year 12 students. Students were enrolled in four different courses with Architecture students in majority, comprising above 44% of all students in the unit. Construction management and double-degree students accounted accordingly for around 26% and 25% of students in the sample while architecture technology students represented only 4.5% of the sample.

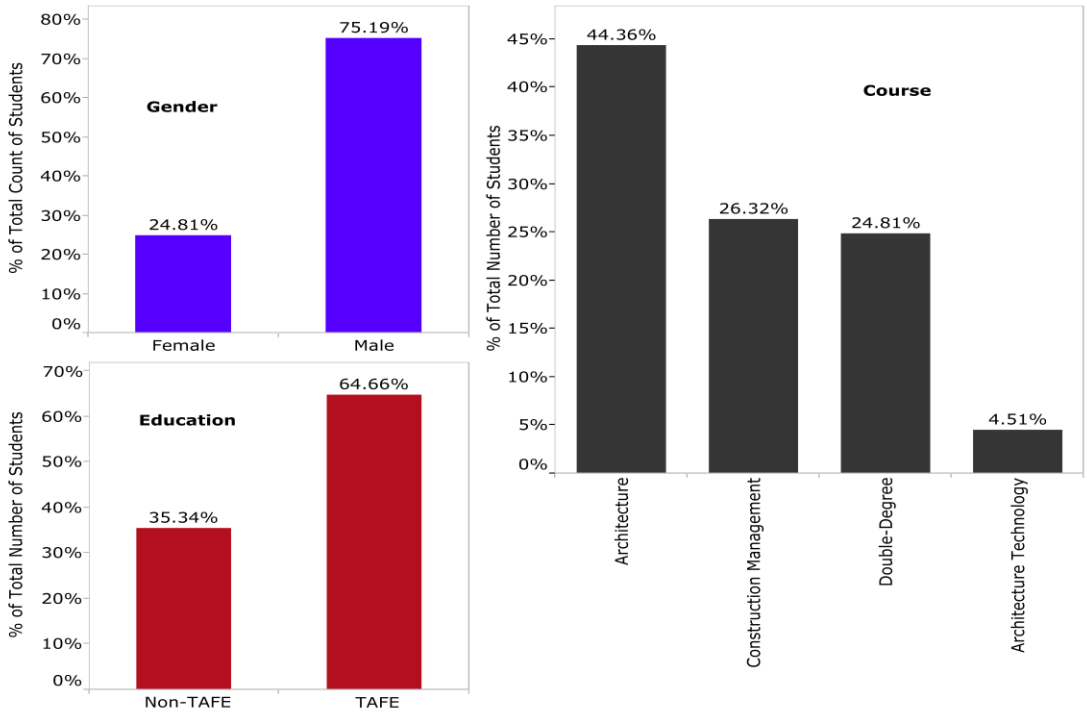

Figure 1 Diversity of students in the sample

Impact of Students' Backgrounds

Gender

Table 1 illustrated the mean scores of students' results for group and individual tasks for each value of Gender as the independent variable. As inferred from Table 1, female students outperformed male students in individual assessment tasks as well as group tasks. To investigate whether the observed discrepancy is statistically significant, an *independent-sample t test* comparing the mean scores of male and female students in both types of tasks was performed. The test found a significant difference between the mean to two groups for the individual task ($t(131) = -2.474, p < .05$).

Table 1 Performance of male and female students in the studied unit

Assessment	Gender	N	Mean (*M*)	Std. Deviation (*sd*)
Individual	Male	100	29.57	6.68
	Female	33	33.04	7.80
Group	Male	100	36.92	5.05
	Female	33	37.93	4.04

Hence, the mean score of results for female students ($M = 33.04, sd = 7.80$) was significantly higher than the same scores for male students ($M = 29.57, sd = 6.68$). Interestingly, the group task scores did not show any meaningful discrepancy in terms of gender. That is, no significant difference was found ($t(131) = -1.042, p > .05$). Thus, the mean score of group tasks for female students $(M = 37.93, sd = 4.04)$ was not significantly different from that of male students $(M = 36.92, sd = 5.05)$.

Education

Considering the educational background as the independent variable, mean scores of students' results are illustrated in Table 2. As inferred from Table 2, Non-TAFE students had a higher performance based on the higher scores received in individual task as well as the group task of the studied unit. Nevertheless, none of the tasks scores showed any meaningful discrepancy in terms of educational background of students. That is, no significant difference was found for individual tasks ($t(131) = -1.769,\ p > .05$) as well as group task ($t(131) = .561,\ p > .05$). Thus, the mean score of group tasks for students coming from TAFE was not significantly different from that of students accepted as Year 12 students (see Table 2).

Table 2 Performance of students based on their educational background

Assessment	Gender	N	Mean (*M*)	Std. Deviation (*sd*)
Individual	TAFE	86	29.65	6.49
	Non-TAFE	47	31.90	7.98
Group	TAFE	86	37.34	4.62
	Non-TAFE	47	36.85	5.21

Course

As shown in Figure 1, students in the sample were enrolled in four different courses. To investigate if the results are significantly different across these four groups, a one-way ANOVA test was conducted. Use of one-way ANOVA was considered as using

independent-sample t pair-wise comparison of two groups ends up in an inflated Type I error and increases the risk of drawing incorrect conclusions (Cronk, 2014). Post-hoc test are necessary where one-way ANOVA is utilised to predict the event of a significant ANOVA. That is because. Where results show a significant ANOVA, post-hoc tests enable researchers to identify which groups are different from which other groups. A wide range of post-hoc tests is available for one-way ANOVA. The mostly used one is Tukey's HSD as the method deployed in the present study in line with the recommendations put forward by Cronk (2014). Descriptive statistics for the four groups in the sample are illustrated in Table 3.

Table 3 Performance of students based on their enrolled course

Assessment	Gender	N	Mean (*M*)	Std. Deviation (*sd*)
Individual	Architecture	59	30.54	6.88
	Architectural Technology	6	35.00	9.01
	Construction Management	35	27.33	6.22
	Double-Degree	33	32.70	6.99
Group	Architecture	59	37.75	4.09
	Architectural Technology	6	37.68	3.63
	Construction Management	35	34.32	5.90
	Double-Degree	33	39.07	3.65

Results of descriptive analysis of scores showed that construction management students were the group with the lowest scores both in the individual tasks (exam) and group task. Double-degree students received the highest scores in group tasks where Architecture-technology students received the highest scores in their individual task (exam).

Table 4 illustrates the results of one-way ANOVA test across these four groups. As inferred from Table 4, performance of students in individual task (exam) was different across the four courses ($F(3, 129) = 4.50, p < .05$). Likewise, performance in group task was found to be significantly different among students enrolled in the four courses ($F(3, 129) = 6.90, p < .05$) . The nature of spotted difference was revealed in view of the results provided by Tukey's HSD test. That is, the analysis showed that students enrolled in construction management performed at a significantly lower level in the individual task $(M = 27.33, sd = 6.22)$ compared to their peers enrolled as double-degree students $(M = 32.70, sd = 6.99)$. Students enrolled in other courses were not significantly different in terms of their performance in the individual task (exam).

Table 4 ANOVA results to test the significance of difference in performance across the four courses

Assessment		Sum of Squares	*df*	Mean Square	*F*	*Sig*.
Individual	Between Groups	633.32	3	211.11	4.50	.005
	Within Groups	6043.74	129	46.85		
Group	Between Groups	425.75	3	141.91	6.90	.000
	Within Groups	2652.54	129	20.56		

As for the group task, students enrolled in construction management received scores $(M = 34.32, sd = 5.90)$ significantly lower than the scores received by students in architecture $(M = 37.75, sd = 4.90)$ and double-degree students $(M = 39.07, sd = 3.65)$.

DISCUSSIONS

The findings of the study support the idea with regard to context-specific differences between male and female students. That was because, the findings show discrepancy between male and female students, which contradict the observations by Fonseca et al. (2014) who indicated that there is no meaningful difference between male and female students. Nevertheless, the findings resonate with the insight put forward by McNabb et al. (2002), who asserted that irrespective of subject, female students outperform male students. The findings also contradict the findings of the study by Bowden et al. (2015), who stated that students articulating from the TAFE sector underperformed academically compared to Non-TAFE students. That is, students from TAFE performed at the same level with other students. To explain this contradiction, Tickell and Smyrnios (2005) maintained that students from TAFE might perform at lower levels in early years of university study. However, by final years, TAFE students performed at the same level with the Year-12-to-univerity cohort. Yet, at A+B students from TAFE complete SRT351 as their first university study. Therefore, the findings establish that there is no discrepancy between TAFE and Non-TAFE students regardless of the year of university study. The findings of the study with regard to the impacts of enrolled course are in line with the observations by Tickell and Smyrnios (2005). According to Tickell and Smyrnios (2005), only demographic variables associated with the background discipline act as determinant of students' performance.

Nevertheless, the findings being evidence of underperformance of construction management students in comparison to architecture and doubled degree students should be treated as a source of concern. As well as revisiting the nature of the assessment tasks, the root causes of such underperformance should be thoroughly investigated and dealt with.

CONCLUSION

This is the first study in its kind, which focuses on investigating the impacts of demographic variables on performance of students within the ACM curricula. This is particularly important in view of the fact that the findings of the study put to test previous observations in other fields within the natural context of ACM curricula. The findings reveal a number of discrepancies among students enrolled in different courses within the curricula, which warrant further research to discover the root causes of such discrepancies. As another contribution, the present study provides a sample for similar units and a fertile ground for identify and discover the root causes of existing discrepancies. However, the findings of the study should be considered in light of a number of limitations. That is, the findings are based on considering the performance in one unit. Hence, the findings might be affected by the particular condition in assessment and teaching of the considered unit. Broader inquiries including a wider range of units might address this limitation as another potential area for further investigation.

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