Predictors of academic performance of nursing and paramedic students in first year bioscience

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SUMMARY

The expanding scope of practice of paramedics and nurses demands they possess a sophisticated knowledge of bioscience to enable them to think critically and make rational clinical decisions. It is well documented that nursing students struggle with bioscience but there are no studies examining the performance of paramedic students in this crucial subject. In this study, we compared the academic performance of first year nursing, paramedic and nursing/paramedic double degree students in a bioscience subject. Regression analyses were used to identify predictors of academic success. Data revealed a low success rate in bioscience for all three degree programs (63.2, 58.8, and 67.6% respectively) and a strong correlation between academic success in bioscience and non-bioscience subjects ($r^2 = 0.49$). The best predictors of overall academic success were the University Admission Index score and mature entry into the course. Previous study of biology was associated with an increased bioscience and overall GPA but not with non-bioscience grades. Discriminant analysis was used to develop a model that could predict overall academic success with an accuracy of 78.5%. These criteria may be useful during the admission process and for the early identification of students at risk of failure.

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Introduction

Bioscience comprises a fundamental part of tertiary nursing and paramedic degree programs, providing the scientific basis from which clinical practice is derived. A solid grounding in the basic sciences is a pivotal step in the development of proficient practitioners with the necessary knowledge, level of clinical competency and complex decision making skills required in today's highly technical and rapidly evolving health care environment. As the scope of practice of nurses and paramedics in Australia expands from a traditional role to one of an independent allied health care practitioner so too will the required level of understanding of basic science and the disease process. An increased knowledge of the biosciences is crucial in order to produce a practitioner with the critical thinking skills necessary to make independent, rational clinical decisions (Council of Ambulance Authorities, 2008, Driscoll et al., 2005).

Nursing students have a well documented love–hate relationship with bioscience. A survey of students completing a tertiary nursing course in New Zealand revealed a positive attitude towards the role of bioscience in nursing education and practice (Friedel and Treagust,

2005). Similar findings were reported in studies from the United Kingdom (Davis, 2010) and Sweden (Andersson and Edberg, 2010), highlighting the global importance of bioscience to the nursing profession; not only in terms of improving clinical practice but also through the development of more general skills that facilitate access and evaluation of new knowledge and the vocabulary necessary to understand it. However, in spite of its importance in the curriculum, bioscience represents a significant hurdle for many nursing students (Friedel and Treagust, 2005, Jordan et al., 1999, McKee, 2002). Bioscience remains a source of anxiety in nursing students, with the majority reporting that they found the language and terminology difficult to comprehend and that the study required for the subject was time consuming (Friedel and Treagust, 2005, Jordan et al., 1999). It is, therefore, not surprising that academic performance in biosciences is related to a student's self-efficacy for science (Andrew, 1998) and can be a strong predictor of overall success in the nursing curriculum (Griffiths et al., 1995, Wong and Wong, 1999).

In contrast to the nursing literature, there is very little data on paramedic education and existing data tends to focus on clinical skills and competencies. This is largely due to the fact that paramedicine, as an academic discipline, is still in its infancy, with the first undergraduate course in Australia not offered until 1994 (Lord, 2003). Anecdotal evidence from our university suggests that paramedic students are similar to those enrolled in nursing in that they struggle with bioscience and have a large attrition rate. Therefore, the purpose of the current

study was threefold: first, to compare the academic performance of nursing, paramedic and nursing/paramedic double degree students in a first year bioscience subject; second, to identify potential predictors of academic performance in both bioscience and non-bioscience subjects and third, develop a model to predict the probability of student success in order to improve student selection processes and/or identify students who may be at risk of failing.

Methods

Study design

This cross sectional study examined the relationship between students' academic performance in a first year, first semester, undergraduate bioscience subject with a number of potential predictors of academic performance. The data set was obtained from official university records and de-identified to maintain students' anonymity by coding the raw data and removing names and university identification numbers. Approval for this study was granted by the university's Human Ethics Committee.

Sample

Data were obtained from the academic records of 543 students enrolled in the first year of an on-campus, undergraduate nursing, paramedic or nursing/paramedic double degree program at an Australian university during 2008 and 2009. Students included in the study were completing the bioscience subject for the first time during the first semester of their respective degree programs. Complete enrolment data were only available for 426 (78.5%) of these students and subsequent analyses were only performed on this subset of the student population. A complete description of the participants can be found in Table 1.

Variables

Students' academic performance in the bioscience subject (bioGPA) was graded using a five point scale; 0–4. Grades were assigned based on the students' overall percentage score in the subject: 0 = fail (0–49.9%), 1 = pass (50.0–64.9%), 2 = credit (65.0–74.9%), 3 = distinction (75.0–84.9%) and 4 = high distinction (85.0–100%). Successful completion of the bioscience subject was defined as achievement of a score ≥ 1. An overall grade point average (GPA) was calculated by averaging the grades each student obtained in all of their first semester subjects. A clinical GPA (clinGPA) was also calculated by averaging the grades obtained by each student in non-bioscience subjects.

Approximately half of the students (50.7%, Table 1) had a gap of at least a year between the completion of high school education and the start of study in their respective course. As a consequence, entry into the courses was divided into two categories; traditional and mature. Traditional entry was defined as students who began the course in the year immediately following graduation from high school. Mature entry students were those who had at least one year between the completion of high school and enrolment in their course.

During the study period, universities in New South Wales and the Australian Capital Territory used the University Admission Index (UAI) to rank prospective students from 0 (lowest) to 100 (highest) based on their academic performance at high school. However, not all the students admitted to the university had a UAI score. Lack of a UAI score could occur for a number of reasons, such as leaving high school before year 12, not taking sufficient subjects at a year 12 level, attending high school prior to the introduction of the UAI system or completing high school outside of New South Wales and the Australian Capital Territory. As a result, we included other potential predictors of academic success. Prior tertiary education experience, either at a university or Technical and Further Education Institute (TAFE), was included as a variable. No distinction was made between the type of institution, courses taken, GPA or whether or not the course was completed successfully. Similarly, previous work experience in a health-related field (e.g., enrolled nurse, voluntary paramedic) was also considered. The majority (85.9%) of those with prior health-related work experience had been, or were still working as either a nursing assistant or an enrolled nurse. We also examined whether previous study of biology at the year 12 level had any impact on success in the bioscience subject.

Students were further classified according to the socio-economic status and remoteness of the permanent address provided in their application. The collective socio-economic status of each postcode was determined using the Index of Relative Socio-Economic Advantage and Disadvantage from the Australian Bureau of Statistics, Socio-Economic Indexes for Areas (SEIFA) (Australian Bureau of Statistics, 2008). The SEIFA index divides postcodes into deciles with the most advantaged areas receiving a score of 1 and the most disadvantaged areas a score of 10 (Australian Bureau of Statistics, 2008).

Rather than arbitrarily defining students as 'rural' or 'urban', postcodes were also used to determine the remoteness of the location using the Accessibility/Remoteness Index of Australia (ARIA) (Commonwealth Department of Health and Aged Care, 2001). The ARIA calculates a postcode's geographic remoteness on a scale of 1–5, where 1 = highly accessible and 5 = very remote. A postcode's remoteness is determined by its road distance from service centres, as defined by the Australian Bureau of Statistics (Commonwealth Department of Health and Aged Care, Care, 2001).

Table 1
Summary of participants.

	Nursing n = 250 (58.7%)	Paramedic n = 102 (23.9%)	Double degree n = 74 (17.4%)	Total n = 426 (100%)
Male (%)	23 (9.2)	55 (53.9)	15 (20.3)	93 (21.8)
Female (%)	227 (90.8)	47 (46.1)	59 (79.7)	333 (78.2)
Age in years (average ± SD)	24.1 ± 8.45	21.0 ± 4.37**	20.2 ± 3.66**	22.6 ± 7.18
Traditional entry[a] (%)	110 (44.0)	49 (48.0)	51 (68.9)†**	210 (49.3)
Mature entry[b] (%)	140 (56.0)	53 (52.0)	23 (31.1)†**	216 (50.7)
Awarded UAI (%)	198 (79.2)	88 (86.3)	68 (91.9)*	354 (83.1)
UAI (average ± SD)	56.5 ± 18.02	61.9 ± 16.68**	62.7 ± 18.16**	59.0 ± 17.95
Health related experience (%)	58 (23.2)	9 (8.8)**	9 (12.2)*	76 (17.8)
Previous tertiary experience (%)	121 (48.4)	35 (34.3)**	20 (27.0)**	176 (41.3)
High school biology (%)	123 (49.2)	54 (52.9)	49 (66.2)**	226 (53.1)
Successful completion of bioscience (%)	158 (63.2)	60 (58.8)	50 (67.6)	268 (62.9)

*Significantly different from nursing students, p<0.05; **p<0.01, †significantly different from paramedic students, p<0.01.
  [a] Enrolled in the course in the year immediately following completion of high school.
  [b] Enrolled in the course at least one year after the completion of high school.