

# Metadata of the article that will be visualized in OnlineFirst

ArticleTitle	Factors associated with the academic success of first year Health Science students	
Article Sub-Title		
Article CopyRight - Year	Springer Science+Business Media B.V. 2008 (This will be the copyright line in the final PDF)	
Journal Name	Advances in Health Sciences Education	
Corresponding Author	Family Name	<b>Mills</b>
	Particle	
	Given Name	<b>Christina</b>
	Suffix	
	Division	School of Population Health, M431
	Organization	The University of Western Australia
	Address	35 Stirling Highway, 6009, Crawley, WA, Australia
	Email	christina.mills@uwa.edu.au
Author	Family Name	<b>Heyworth</b>
	Particle	
	Given Name	<b>Jane</b>
	Suffix	
	Division	School of Population Health, M431
	Organization	The University of Western Australia
	Address	35 Stirling Highway, 6009, Crawley, WA, Australia
	Email	
Author	Family Name	<b>Rosenwax</b>
	Particle	
	Given Name	<b>Lorna</b>
	Suffix	
	Division	School of Occupational Therapy
	Organization	Curtin University of Technology
	Address	Perth, Australia
	Email	
Author	Family Name	<b>Carr</b>
	Particle	
	Given Name	<b>Sandra</b>
	Suffix	
	Division	Education Centre—Faculty of Medicine, Dentistry and Health Sciences
	Organization	The University of Western Australia
	Address	Crawley, Australia
	Email	
Author	Family Name	<b>Rosenberg</b>
	Particle	
	Given Name	<b>Michael</b>
	Suffix	
	Division	School of Population Health, M431

Organization The University of Western Australia  
Address 35 Stirling Highway, 6009, Crawley, WA, Australia  
Email

---

Schedule  
Received 9 July 2007  
Revised  
Accepted 6 February 2008

---

Abstract The academic success of students is a priority for all universities. This study identifies factors associated with first year academic success (performance and retention) that can be used to improve the quality of the student learning experience. A retrospective cohort study was conducted with a census of all 381 full time students enrolled in the Bachelor of Health Science at The University of Western Australia since the inception of the course in the year 2000. Factors found to be associated with successful academic performance were high matriculation score, female sex, non-Indigenous status, attendance at a government secondary school, upfront payment of university fees and completion of secondary school English Literature. The most influential factor on first year academic performance was a high matriculation score. Retention into second year was found to be influenced by participation in the university mentor scheme, non-Indigenous status and first year university marks. The factor of most influence on student retention was first year university marks. Valuable information about the performance and retention of first year Bachelor of Health Science students is provided in this study which is relevant to the operational priorities of any university.

---

Keywords (separated by '-') Academic success - First year students - Health science - Logistic regression - Linear regression - Performance - Retention

---

Footnote Information

---

Journal: AHSE  
Article: 10459-9103



Springer

the business of publishing

## Author Query Form

**Please ensure you fill out your response to the queries raised below  
and return this form along with your corrections**

Dear Author,

During the preparation of your manuscript for typesetting, some questions have arisen. These are listed below. Please check your typeset proof carefully and mark any corrections in the margin of the proof or compile them as a separate list. This form should then be returned with your marked proof/list of corrections to [spr\\_corrections1@sps.co.in](mailto:spr_corrections1@sps.co.in)

### Disk use

In some instances we may be unable to process the electronic file of your article and/or artwork. In that case we have, for efficiency reasons, proceeded by using the hard copy of your manuscript. If this is the case the reasons are indicated below:

- Disk damaged       Incompatible file format       LaTeX file for non-Latex journal  
 Virus infected       Discrepancies between electronic file and (peer-reviewed, therefore definitive) hard copy  
 Other: .....

We have proceeded as follows:

- Manuscript scanned     Manuscript keyed in       Artwork scanned  
 Files only partly used (parts processed differently: .....) )

### Bibliography

If discrepancies were noted between the literature list and the text references, the following may apply:

- The references listed below were noted in the text but appear to be missing from your literature list. Please complete the list or remove the references from the text.  
 *Uncited references*: This section comprises references that occur in the reference list but not in the body of the text. Please position each reference in the text or delete it. Any reference not dealt with will be retained in this section.

### Queries and/or remarks

Section/paragraph	Details required	Author's response
Front matter	Please check and approve affiliations.	

2 **Factors associated with the academic success of first year**  
3 **Health Science students**

4 Christina Mills · Jane Heyworth · Lorna Rosenwax · Sandra Carr ·  
5 Michael Rosenberg

6 Received: 9 July 2007 / Accepted: 6 February 2008  
7 © Springer Science+Business Media B.V. 2008

8 **Abstract** The academic success of students is a priority for all universities. This study  
9 identifies factors associated with first year academic success (performance and retention)  
10 that can be used to improve the quality of the student learning experience. A retrospective  
11 cohort study was conducted with a census of all 381 full time students enrolled in the  
12 Bachelor of Health Science at The University of Western Australia since the inception of  
13 the course in the year 2000. Factors found to be associated with successful academic  
14 performance were high matriculation score, female sex, non-Indigenous status, attendance  
15 at a government secondary school, upfront payment of university fees and completion of  
16 secondary school English Literature. The most influential factor on first year academic  
17 performance was a high matriculation score. Retention into second year was found to be  
18 influenced by participation in the university mentor scheme, non-Indigenous status and first  
19 year university marks. The factor of most influence on student retention was first year  
20 university marks. Valuable information about the performance and retention of first year  
21 Bachelor of Health Science students is provided in this study which is relevant to the  
22 operational priorities of any university.

23 **Keywords** Academic success · First year students · Health science · Logistic  
24 regression · Linear regression · Performance · Retention

25

---

A1 C. Mills (✉) · J. Heyworth · M. Rosenberg  
A2 School of Population Health, M431, The University of Western Australia, 35 Stirling Highway,  
A3 Crawley, WA 6009, Australia  
A4 e-mail: christina.mills@uwa.edu.au

A5 L. Rosenwax  
A6 School of Occupational Therapy, Curtin University of Technology, Perth, Australia

A7 S. Carr  
A8 Education Centre—Faculty of Medicine, Dentistry and Health Sciences,  
A9 The University of Western Australia, Crawley, Australia

## 26 Introduction

27 In the current competitive environment surrounding higher education, academic success of  
28 students is a growing priority for all universities. The experiences gained by first year  
29 university students are vital to establishing baseline knowledge, positive attitudes, self-  
30 confidence and commitment to study (Kuh 2001; Pargetter et al. 1998). For some students,  
31 commencing a degree is not easy and this can have a negative impact on academic success.  
32 Furthermore, poor academic success can lower self-confidence and self-esteem (McInnis  
33 et al. 2000). From an institutional perspective, poor academic outcomes can influence the  
34 reputation of a university as academic success is associated with institution quality (Price  
35 et al. 1991; Vivekananda et al. 2003).

36 For the purposes of this study, first year academic success was considered in terms of a  
37 student's academic performance and retention. Numerous models and conceptual frame-  
38 works have been developed to explain academic success (Bean 1980, 1982; Bean and  
39 Metzner 1985; Evans 2000; Tinto 1975). Overall, academic success can be described as  
40 a complex process that involves the interplay of factors relating to the institution  
41 (e.g. support programs, type of degree) and factors relating to the individual student  
42 (e.g. demographic factors).

## 43 Academic performance

44 Academic performance is influenced by a student's intake of knowledge and their ability to  
45 demonstrate and apply learned information. In the United States grade point averages  
46 (GPAs) are often used to measure performance, whereas in Australia weighted average  
47 marks (WAMs), percentage pass marks and GPAs are calculated (Dalziel and Peat 1998;  
48 Evans 2000; Everett and Robins 1991; Murray-Harvey 1993; Win and Miller 2004).

49 Student support programs, such as orientation programs and mentor schemes can yield  
50 substantial benefits to the first year experience of students and hence their academic  
51 performance (Vivekananda et al. 2003). These programs positively influence 'student fit'  
52 with the institution by teaching students about the campus, increasing the possibility of  
53 student involvement in campus activities, providing assistance to at-risk students and  
54 helping students cultivate behaviours necessary to succeed both academically and socially  
55 (Cabrera 2001; Gardner 2005; Higbee et al. 2002; Higgins 2004; Kuh 2001; McInnis et al.  
56 2000; Murtaugh et al. 1999).

57 Degree preference is also an important factor to consider when looking at academic  
58 performance. McInnis (2002) noted that the number of combined degrees offered by  
59 Australian institutions has increased over time, although specific information about these  
60 degrees, in terms of their influence on academic success, is lacking. In Western Australia,  
61 university applicants nominate four preferences of the tertiary institution and degree into  
62 which they would like to be admitted. If a student is granted entry into a degree that is not  
63 his/her first preference, it is conceivable that the student's interest in that degree may not be  
64 as high as a student who has received a first preference.

65 The relationship between matriculation scores and academic performance at university  
66 is well established (Abbott-Chapman et al. 1992; Dalziel and Peat 1998; DeBerard et al.  
67 2004; Downes 1976; Everett and Robins 1991; Murphy et al. 2001; Pike and Saupe 2002).  
68 In Western Australia, Tertiary Entrance Rank (TER) is the matriculation score used by  
69 universities to measure a student's academic ability. TERs range from zero to 99.95 and  
70 relate to how well a student has performed in his/her Tertiary Entrance Examination (TEE)

71 relative to all other applicants that year. Once at university, it has been found that students  
72 with high TERs out perform students with low TERs (Everett and Robins 1991). The type  
73 of secondary school attended by a student has also been researched in relation to academic  
74 performance at university. Once at university, students from government secondary  
75 schools have been found to out perform students from non-government/private schools  
76 (Abbott-Chapman et al. 1992; Evans and Farley 1998; West 1985; Win and Miller 2004).  
77 West (1985) suggests that these differences may be due to disparities in the school system  
78 that require government school students to be more self-directed and responsible for their  
79 own learning as compared with non-government school students who are more likely to  
80 receive extra tutoring and coaching.

81 The influence of age and sex on academic performance is varied with some studies finding  
82 these variables to be important (Dalziel and Peat 1998; Graunke and Woosley 2005;  
83 McClelland and Kruger 1993; Murray-Harvey 1993; Ofori and Charlton 2002; Tay 1994; Win  
84 and Miller 2004) and others finding no significant associations (De Clercq et al. 2001;  
85 Hoschl and Kozeny 1997; Stacey and Whittaker 2005; Tutton and Wigg 1990; Walmsley  
86 1990). Student characteristics such as socio-economic status, language spoken in the home  
87 and ethnicity have also been used to predict academic performance (Graunke and Woosley  
88 2005; McClelland and Kruger 1993; Tay 1994). In Australia it has been found that Indige-  
89 nous students are often less successful than other students in a tertiary setting, despite being  
90 highly focused on developing their talents and finding lectures more intellectually stimu-  
91 lating than other students (Hillman 2005; Krause et al. 2005; McClelland and Kruger 1993).

## 92 Retention

93 Retention can be defined in terms of the number of students who continue to be enrolled in  
94 a degree after a certain time period (e.g. one year). In Australia, the annual national higher  
95 education retention rates are generally between 70 and 80 per cent, with some variations by  
96 institution and faculty (Abbott-Chapman et al. 1992; Department of Education Science and  
97 Training (DEST) 2004).

98 According to Tinto (1975), academic performance while at university is the single most  
99 important factor in predicting student retention. Numerous studies have found a positive  
100 relationship between first year university academic performance and retention (Bean 1982;  
101 Huon and Sankey 2000; Krause et al. 2005; Murtaugh et al. 1999; Potts et al. 2003).  
102 A positive relationship between matriculation scores and student retention at university has  
103 also been reported (Abbott-Chapman et al. 1992; Arulampalam et al. 2004; Bean and  
104 Metzner 1985; Johnes and McNabb 2004; Murphy et al. 2001; Murtaugh et al. 1999; Potts  
105 et al. 2003).

106 As with academic performance, student support programs can positively influence the  
107 retention of first year students through the provision of knowledge, skills and socialisation  
108 opportunities (Zepke and Leach 2005). In addition, students who participate in mentor or  
109 orientation programs are more likely to be retained in their degree than non-participants  
110 (Campbell and Campbell 1997; Murtaugh et al. 1999).

111 The relationship between retention, sex and age is inconclusive. Some studies have  
112 found no relationship (Kirby and Sharpe 2001), while others have found females more  
113 likely to be retained (Arulampalam et al. 2004; Bradsen and Farrington 1986; Johnes and  
114 McNabb 2004), females more likely to discontinue (Abbott-Chapman et al. 1992), older  
115 students more likely to discontinue (Murtaugh et al. 1999; Scott 2004) and older students  
116 more likely to be retained (Johnes and McNabb 2004).

117 In the United States, the link between retention and ethnicity has been widely research-  
118 ched, with no clear pattern emerging (Bean and Metzner 1985; Gardner 2005; Murtaugh  
119 et al. 1999). Possible reasons for this include differences accounted for by socio-economic  
120 status, past academic achievement or institutional variations (Bean and Metzner 1985). In  
121 Australia and in New Zealand, Indigenous students have been found to be more likely to  
122 discontinue their degree than other students in first year (Hillman 2005; Scott 2004).  
123 According to both Tinto (1975) and Bean and Metzner (1985), students who come from  
124 families that are more educated, more affluent and more able to pay for their university  
125 education, are more likely to persist with their degree.

126 The Bachelor of Health Science degree (BHS) at The University of Western Australia  
127 (UWA) commenced in 2000. This course can be completed either as a single degree (four  
128 years full time) or as a combined degree with a Bachelor's degree in Commerce, Economics,  
129 Law or Music (up to six and a half years full time). The BHS is a generic degree that  
130 incorporates both a public health and science major with business units. The degree is  
131 structured to prepare graduates for a health related career. As the academic success of  
132 students is a priority for all universities, the aim of this study was to investigate the first year  
133 academic performance and retention of BHS students at The University of Western Australia  
134 using the 2000 to 2005 cohort. The first year of university was specifically chosen as this  
135 is the time when the highest amount of academic failure and discontinuation occurs  
136 (Hillman 2005; McInnis et al. 2000).

## 137 Methods

### 138 Participants

139 The study consisted of 381 students and was a census of all full-time students who  
140 commenced the BHS between 2000 and 2005. Part time students were excluded from the  
141 study as it was acknowledged that factors influencing their performance and retention  
142 differ from full time students (Bean and Metzner 1985; Hillman 2005; Krause et al. 2005).

### 143 Design and procedure

144 This retrospective cohort study considered two outcomes, academic performance and  
145 retention. Academic performance was defined in terms of a student's first year weighted  
146 average mark (WAM). A WAM is an indicator of overall academic performance and ranges  
147 from 0 to 100. Student retention was defined as the proportion of first year students that were  
148 still enrolled in the BHS the following year. If a student discontinued their course, trans-  
149 ferred to a non-BHS degree or took a leave of absence, they were classified as 'not retained'.

150 The factors considered for inclusion in the models of first year academic performance  
151 and retention are shown in Table 1. The independent variables included in the analysis  
152 were those for which data were available either from a university department or the student  
153 records system. As student psychological data are not collected by the University, the  
154 relationship between psychological variables, academic performance and retention was not  
155 considered in this study.

156 The analysis strategy comprised an initial descriptive investigation of the data. To  
157 increase the efficiency of the starting multiple regression model, single associations between  
158 each independent variable (Table 1) and outcome variable (performance or retention) were

**Table 1** Independent variables—name and description

Independent variable	Description
<i>Factors relating to the institution</i>	
Participation in the UWA mentor scheme	UWA program designed to orientate first year students to the campus and help them meet other students and staff
Degree type	Whether the student was completing a single degree (one degree) or a combined degree (two degrees)
<i>Factors relating to the student</i>	
Sex	Male, female
Age group	Student age when he/she commenced the first year of the BHS
Language spoken at home	Language spoken at home by the student
Indigenous status	Whether or not a student identified themselves as being of Aboriginal and/or Torres Strait Islander (ATSI) descent
Secondary school type	Type of secondary school or high school attended by the student
Australian Socio-Economic Status (ASES)	Higher education equity indicator of socio-economic status
Payment of university fees	Method used by a student to pay for his/her university education (i.e upfront payment or student loan). This measure relates to a students ability to finance his/her education and is a measure of socio-economic status
Matriculation score	The University of Western Australia (UWA) classification of Tertiary Entrance Rank (TER) as high, medium or low
Secondary school mathematics course	The type of secondary school mathematics course completed by the student prior to commencement of the BHS. Applicable Mathematics/Calculus as compared to Discrete Mathematics is designed for more mathematically able students (Curriculum Council of Western Australia 2005)
Secondary school English course	The type of secondary school English course completed by the student prior to commencement of the BHS. The English Literature course is aimed at a higher level than the English course. English as a Second Language (ESL) addresses the needs of students for whom English is not their first language (Curriculum Council of Western Australia 2005)
BHS selected as first preference	Whether or not the BHS at UWA was the student's first preference
First year WAM group	UWA classification of first year marks. This variable was only used in the analysis of retention

159 calculated. Single association variables with a conservative  $p$ -value of 0.20 were included in  
 160 the starting regression model. A parsimonious final model was identified using a backward  
 161 elimination strategy. Interaction terms considered plausible were investigated as part of the  
 162 model. Finally, the model was assessed for multicollinearity. As academic performance is a  
 163 continuous outcome variable a multiple linear regression analysis was used. For the analysis  
 164 of retention, a logistic regression analysis was conducted as the outcome was dichotomous.  
 165 All data were analysed using SAS for Windows (Version 9.1). Permission to undertake this  
 166 study was granted by the UWA Human Research Ethics Committee.

## 167 Results

168 Table 2 describes the variables of interest for all 381 subjects. Overall, most students were  
 169 enrolled in a single degree (61%), were female (73%) and were 18 years or less (68%).



**Table 2** Description of study participants—First year, Full time, Bachelor of Health Science Students (2000–2005)

Independent variable		n	%
Degree type	Single degree	234	61.4
	Combined degree	147	38.6
Course commencement year	2000	37	9.7
	2001	71	18.6
	2002	51	13.4
	2003	59	15.5
	2004	77	20.2
	2005	86	22.6
Sex	Female	279	73.2
	Male	102	26.8
Age group	18 years or less	260	68.2
	19–21 years	109	28.6
	22 years or more	12	3.2
Language spoken at home	English	331	86.9
	Other	50	13.1
Indigenous status	Non-ATSI <sup>a</sup>	368	96.6
	ATSI <sup>a</sup>	13	3.4
Secondary school type	Independent non-catholic (private)	133	34.9
	Government	129	33.9
	Independent catholic (private)	90	23.6
	Overseas/other	29	7.6
Australian socio-economic status (ASES)	High	201	52.8
	Medium	112	29.4
	Low	52	13.6
	Overseas <sup>b</sup>	16	4.2
Payment of university fees	Deferred (student loan)	232	60.9
	Paid upfront	149	39.1
Matriculation score	High (TER > 96)	52	13.7
	Medium (88–96)	204	53.5
	Low (TER < 88)	103	27.0
	Non TER	22	5.8
Secondary school mathematics course	TEE Applicable Mathematics/Calculus	224	58.8
	TEE Discrete Mathematics	157	41.2
Secondary school English course	TEE English	219	57.5
	TEE English Literature	155	40.7
	ESL	7	1.8
BHS selected as first preference	No	190	49.9
	Yes	111	29.1
	Non standard entry	80	21.0
Participation in the UWA mentor scheme	No	253	66.4
	Yes	128	33.6

Table 2 continued

Independent variable		n	%
First year WAM group	0–49.9	33	8.7
	50–69.9	263	69.0
	70–100	85	22.3

<sup>a</sup> ATSI = Aboriginal &/or Torres Strait Islander

<sup>b</sup> ASES not available for international students

170 One half of all students did not select BHS as their first preference and most did not  
171 participate in the UWA mentor scheme (66%).

## 172 Academic performance

173 Single associations between academic performance and each independent variable were  
174 assessed for inclusion in the starting multiple linear regression model. Single association  
175 variables that attained a conservative significance level of  $p \leq 0.20$  were sex, language  
176 spoken at home, Indigenous status, type of secondary school, payment of university fees,  
177 matriculation score, type of secondary school mathematics course, type of secondary  
178 school English course, degree type and participation in the UWA mentor scheme.

179 When modelled together, matriculation score, Indigenous status, secondary school type,  
180 sex, payment of university fees, and secondary school English course were found to be  
181 significantly associated with first year academic performance. The final, parsimonious  
182 model is shown below in Table 3. A moderate amount of the variance (32%) in student  
183 marks could be explained by this model.

184 Overall, three interactions were considered plausible in terms of their possible modi-  
185 fying effect. These interactions were (1) sex and matriculation score, (2) sex and secondary  
186 school English course, and (3) degree type and matriculation score. None of the assessed  
187 interaction terms was statistically significant and therefore these terms were not considered  
188 further. Multicollinearity was also assessed and not found to be statistically significant.

189 According to the final model, a non-Indigenous female student, who attended a  
190 government secondary school, who previously completed secondary school English  
191 Literature, attained a high matriculation score and paid their university fees upfront could be  
192 predicted to gain a higher first year mark in the BHS at UWA than other types of students.

## 193 Retention

194 Variables that met the single association criteria ( $p \leq 0.20$ ) for inclusion in the starting  
195 multiple logistic regression model were sex, Indigenous status, degree preference,  
196 participation in the UWA mentor scheme and first year WAM group. Participation in the  
197 UWA mentor scheme and first year WAM group were found to be significantly related to  
198 retention in the first year of the BHS. As Indigenous status was so close to significance  
199 ( $p = 0.07$ ) and due to the size of the odds ratio, this variable was included in the final  
200 model. The final, parsimonious model is shown below in Table 4.

201 Overall, four interactions were considered plausible in terms of their possible modifying  
202 effect. These interactions were (1) sex and participation in the UWA mentor scheme,

**Table 3** Multiple linear regression model—Predictors of academic performance (WAMs) in First year, Full time, Bachelor of Health Science Students (2000–2005)

Independent variable <sup>a</sup>		n	Estimate (B)	SE	p-value
Matriculation score	Non TER	22	-15.4	3.4	<0.01
	Low (TER < 88)	103	-13.7	1.6	<0.01
	Medium (88–96)	204	-9.9	1.4	<0.01
	High (TER > 96) <sup>b</sup>	52	0.0		
Indigenous status	ATSI	13	-12.1	3.0	<0.01
	Non ATSI <sup>b</sup>	368	0.0		
Secondary school type	Independent catholic (private)	90	-4.0	1.3	<0.01
	Independent non-catholic (private)	133	-5.4	1.2	<0.01
	Overseas/Other	29	2.7	2.7	0.32
	Government <sup>b</sup>	129	0.0		
Sex	Male	102	-3.2	1.1	<0.01
	Female <sup>b</sup>	279	0.0		
Payment of university fees	Paid upfront	149	2.6	1.0	<0.01
	Deferred (student loan) <sup>b</sup>	232	0.0		
Secondary school English course	TEE English	219	-2.7	1.0	<0.01
	ESL	7	5.1	3.6	0.16
	TEE English Literature <sup>b</sup>	155	0.0		

<sup>a</sup> Model F-Value=15.6, df (11,369),  $p < 0.01$ ,  $R^2=0.32$

<sup>b</sup> Reference group

**Table 4** Multiple Logistic Regression Model – Predictors of Retention in First Year, Full Time, Bachelor of Health Science Students (2000 to 2005)

Independent variable <sup>a</sup>		n	Odds ratio	(95% CI)	p-value
Participated in the UWA mentor scheme	No	253	0.50	(0.25-0.96)	0.04
	Yes <sup>b</sup>	128	1.00		
First year WAM group <sup>c</sup>	0–49.9	33	0.28	(0.12-0.67)	<0.01
	70–100	85	0.37	(0.20-0.69)	<0.01
	50–69.9 <sup>b</sup>	263	1.00		
Indigenous status	ATSI	13	0.31	(0.09-1.10)	0.07
	Non-ATSI <sup>b</sup>	368	1.00		

<sup>a</sup> Model Chi-square = 25.0,  $p < 0.01$ , df = 4

<sup>b</sup> Reference group

<sup>c</sup> First year WAM group—0 to 49.9 = fail, 50–69.9 = pass or credit, 70–100 = distinction or high distinction

203 (2) sex and first year WAMs, (3) degree type and participation in the UWA mentor scheme,  
 204 and (4) degree type and first year WAMs. None of the assessed interaction terms was found  
 205 to be significant and therefore these terms were not considered further. Multicollinearity  
 206 was also assessed and not found to influence the analysis.

207 According to this model, a non-Indigenous student who participated in the university  
208 mentor scheme and who scored a first year WAM in the pass/credit range (i.e. 50–69.9)  
209 was more likely to be retained the following year in the BHS at UWA than other types of  
210 students.

## 211 Discussion and conclusions

212 Consistent with the literature, the factor of most influence on the academic performance of  
213 first year students was matriculation score and the factor of most influence on retention was  
214 first year marks.

215 Matriculation scores were found to be the strongest predictor of academic performance  
216 in first year students. This is an important finding as it highlights the importance of  
217 previous academic success. For those university staff in charge of student entry and quotas  
218 this finding is noteworthy as it highlights the importance of minimum entry requirement for  
219 a course. That is, if entry requirements are set too low, the institution may be setting  
220 students up for poor performance in first year. High matriculation scores and academic  
221 performance may also be a sign of maturity or organisation therefore more research is  
222 needed to better understand this factor.

223 Academic performance in the first year of university was found to be the strongest  
224 predictor of first year retention. The literature suggests that students with high academic  
225 performance are more likely to be retained at university than students with low academic  
226 performance (Bean 1982; Huon and Sankey 2000; Krause et al. 2005; Murtaugh et al.  
227 1999; Potts et al. 2003). In this study, students with failing first year grades were more  
228 likely to discontinue than students with pass/credit grades, the most common reason for  
229 discontinuing being unsatisfactory academic performance. However, students with  
230 distinction/high distinction grades were found to be less likely to be retained in the BHS  
231 than students with pass/credit grades, the most common reason for withdrawal being to  
232 transfer to another degree. It is interesting that 25% of distinction/high distinction students  
233 left the BHS in their first year. This finding warrants further investigation to understand the  
234 reasons behind this decision, in particular the relationship between degree preference and  
235 the degrees into which the students transferred.

236 The UWA mentor scheme integrates first year mentoring with orientation activities.  
237 Students who participated in this program were twice as likely to be retained as students  
238 who did not participate. This is an important finding as it highlights the importance of this  
239 program with regard to first year persistence. This may also imply that a university has a  
240 direct means by which the retention of students can be positively influenced. When all  
241 factors were considered, academic performance was not found to be associated with  
242 participation in the UWA mentor scheme. However, it should be noted that student  
243 retention rather than academic performance is the primary focus of this program. As the  
244 UWA mentor scheme is voluntary it is possible that successful students seek out and enrol  
245 in such programs and that this factor is actually a measure of social inclusion or extro-  
246 version rather than program success. As a result further exploration of this factor is  
247 recommended.

248 The type of secondary school attended by students was found to be associated with  
249 academic performance. When all other factors were taken into account, students who  
250 attended government secondary schools were found to have higher marks in first year than  
251 students who attended non-government/private secondary schools. This finding is consis-  
252 tent with the literature (Abbott-Chapman et al. 1992; Evans and Farley 1998; West 1985;

253 Win and Miller 2004). The type of English course completed by the student in secondary  
254 school was also found to be associated with academic performance. Most university  
255 courses require effective use of the English language in terms of literacy, understanding  
256 and communication (Jalili-Grenier and Chase 1997). Students who previously completed  
257 the secondary school English Literature course performed better than those who completed  
258 the secondary school English course. English as a Second Language (ESL) students were  
259 found to perform as well as English Literature students, however there were not enough  
260 ESL students in this study for results to be conclusive. The mathematics course previously  
261 completed by students was not found to be associated with academic performance. The  
262 type of mathematics and English course completed in secondary school was not found to  
263 be associated with retention. These findings will be of interest to people guiding students  
264 towards a career in health science as it demonstrates the benefit of certain secondary school  
265 courses. This finding also highlights a further avenue for research to assess which other  
266 secondary school courses are associated with success in this degree.

267 Few studies have measured the importance of degree preference or degree type on  
268 academic success. If a student is granted entry into a degree that is not his/her first  
269 preference, it is conceivable that his/her interest in that degree may not be as high as a  
270 student who has received a first preference. If a student is completing a combined degree  
271 and therefore a higher semester load than a single degree student they may not be able to  
272 commit as much time or effort to each unit. However, when all factors were taken into  
273 account, degree preference and degree type were not found to be associated with academic  
274 performance or retention.

275 In the literature, the relationship between academic success, sex and age was incon-  
276 clusive. In this study, first year academic performance was found to be associated with sex,  
277 as overall, female students had higher marks than male students. DeBerard et al. (2004)  
278 suggest two reasons for gender related differences in academic performance at university,  
279 these being degree structures that are more suited to a specific gender or course imbalances  
280 in which student populations are predominantly male or predominately female. The latter  
281 is an interesting proposition as the BHS at UWA is predominantly composed of female  
282 students. In this study, first year retention was not found to be associated with sex or age.

283 Indigenous status and language spoken at home were used as measures of cultural and  
284 linguistic background. Language spoken at home was not found to be associated with  
285 either retention or academic performance. In Australia, Indigenous students are often less  
286 successful than other students in a tertiary setting (Hillman 2005; Krause et al. 2005;  
287 McClelland and Kruger, 1993). In this study, academic performance was found to be  
288 associated with Indigenous status, in which the first year weighted average marks of  
289 Indigenous students, were found to be lower than non-Indigenous students. In Australia  
290 and in New Zealand, Indigenous students have also been found to be less likely to continue  
291 with their degree than other students (Hillman 2005; Scott 2004). This was also found in  
292 this study, as Indigenous students were three times more likely to discontinue their degree  
293 than non-Indigenous students. These findings are cause of concern however it should be  
294 kept in mind that there were only small numbers of Indigenous students in this study,  
295 therefore further research should be conducted. Finally, the method used by first year  
296 students to pay for their university fees was not found to be associated with retention but  
297 was found to be predictive of academic performance. Results showed that those who paid  
298 their fees up front performed better than those who deferred their fee payment.

299 From an Australian perspective, results from this study could be generalised to students  
300 completing similar degrees, providing the Australian university they are attending is  
301 similar to UWA in terms of institution size and student population. The ability to

302 generalise findings to overseas institutions is lower due to differences in admission policies  
 303 and the campus experience of students. For example, overseas institutions, particularly  
 304 American colleges, have open door admission policies compared with Australian admis-  
 305 sion policies which are mostly competitive and based on previous academic performance  
 306 (McInnis et al. 2000). Differences also occur in terms of the residential nature of some  
 307 overseas institutions in which a majority of students live on campus rather than commuting  
 308 from home to university each day, which is the method used by most full time Australian  
 309 students.

310 The strength of this study was that a census of all first year, full time, Bachelor of Health  
 311 Science students from 2000 to 2005 were included in the analysis. Therefore, most of the  
 312 usual sources of bias that occur in a cohort study (e.g. selection bias, loss to follow-up)  
 313 were not experienced. Bias in terms of misclassification, may have occurred, but its effects  
 314 are unlikely to be large. For example, non-differential misclassification may have occurred  
 315 in the form of random data entry mistakes when information is input into the student  
 316 records system. However, the possibility of this occurring was considered to be low, as  
 317 information (e.g. student marks) are checked before they are finalised. Finally, many  
 318 factors relating to the institution and to the individual student impact on academic success.  
 319 As existing university data were used in this study, a limitation was that only those  
 320 variables for which data were available were analysed. As a result, information about the  
 321 psychological characteristics of students or participation in student clubs was not available  
 322 and therefore not considered. Furthermore, no information relating to student's overall life  
 323 situation (i.e. work, living conditions, friends) were available for inclusion. Consequently,  
 324 the final models of first year retention and first year academic performance established in  
 325 this study may be incomplete. Further studies should therefore consider broadening the  
 326 information collected and perhaps consider using a prospective study design.

327 Valuable information about the academic success of students was provided in this study.  
 328 This information can be used to inform policy, for planning purposes and to assist in the  
 329 development or review of first year student support programs. To extend the findings of the  
 330 current study, further research could be conducted with other student cohorts such as  
 331 second or third year BHS students. Research about part time students would also be  
 332 informative. Finally, the information provided in this study is relevant to the operational  
 333 priorities of any university. Therefore, these findings should be considered and used to  
 334 improve academic outcomes such as performance and retention and therefore enhance the  
 335 quality of the student learning experience.

### 337 References

- 338 Abbott-Chapman, J., Hughes, P., & Wyld, C. (1992). *Monitoring student progress: A framework for*  
 339 *improving student performance and reducing attrition in higher education*. Hobart: Youth Education  
 340 Studies Centre, University of Tasmania.
- 341 Arulampalam, W., Naylor, R., & Smith, J. (2004). Factors Affecting the Probability of First year medical  
 342 students dropout in the UK: A logistic analysis for the intake cohorts of 1980–92. *Medical Education*,  
 343 38, 492–503.
- 344 Bean, J. (1980). Dropouts and turnover: The synthesis and test of a casual model of student attrition.  
 345 *Research in Higher Education*, 12, 155–187.
- 346 Bean, J. (1982). Student attrition, intentions and confidence: Interaction effects in a path model. *Research in*  
 347 *Higher Education*, 17, 291–319.
- 348 Bean, J., & Metzner, B. (1985). A conceptual model of non-traditional undergraduate student attrition.  
 349 *Review of Educational Research*, 55(4), 485–540.
- 350 Bradsen, J. R., & Farrington, J. A. (1986). Student selection and performance in the Faculty of Law the  
 351 University of Adelaide. *Australian Universities Review*, 29(1), 25–31.

352 Cabrera, R. (2001). Retention issues in legal education: The roles of undergraduate educators and of  
353 academic support in the Law School. *Journal of College Student Retention*, 3(2), 167–182.  
354 Campbell, T., & Campbell, D. (1997). Faculty/student mentor program: Effects on academic performance  
355 and retention. *Research in Higher Education*, 38(6), 727–742.  
356 Curriculum Council of Western Australia. (2005). *General information, assessment, grading and modera-*  
357 *tion*. Retrieved Feb 2006, 2006, from [www.curriculum.wa.edu.au/pages/syllabus\\_manuals/volumes/](http://www.curriculum.wa.edu.au/pages/syllabus_manuals/volumes/l_general/general.htm)  
358 [l\\_general/general.htm](http://www.curriculum.wa.edu.au/pages/syllabus_manuals/volumes/l_general/general.htm)  
359 Dalziel, J. R., & Peat, M. (1998). *Academic performance during student transition to university studies*.  
360 Retrieved July 2005, July 2005, from <http://science.uniserve.edu.au/workshop/fyc/mjpd.pdf>  
361 De Clereq, L., Pearson, S. A., & Rolfe, J. E. (2001). The relationship between previous tertiary education  
362 and course performance in First year medical students at Newcastle University, Australia. *Education*  
363 *for Health*, 14(3), 417–426.  
364 DeBerard, M., Spielman, G., & Julka, D. (2004). Predictors of academic achievement and retention among  
365 college freshmen: A longitudinal study. *College Student Journal*, 38(1), 66–80.  
366 Department of Education Science, Training (DEST). (2004). *Higher education attrition rates 1994–2002:*  
367 *A brief overview*. Canberra: DEST.  
368 Downes, B. (1976). A model for prediction of academic performance and selection of students of university  
369 entrance. *The Australian University*, 14(2), 202–212.  
370 Evans, M. (2000, 29 May 2003). *Planning for the transition to tertiary study: A literature review*. Retrieved  
371 23 Sept 2003, 23 Sept 2003, from <http://www.monash.edu.au/transition/research/evans.html>  
372 Evans, M. A., & Farley, A. (1998). Institutional characteristics and the relationship between students' first  
373 year university and final year secondary school academic performance. *Journal of Institutional*  
374 *Research in Australasia*, 7(2), 36–44.  
375 Everett, J., & Robins, J. (1991). Tertiary entrance predictors of first year university performance. *Australian*  
376 *Journal of Education*, 35(1), 24–40.  
377 Gardner, J. D. (2005). A successful minority retention project. *Journal of Nursing Education*, 44(12), 566–568.  
378 Graunke, S., & Woosley, S. (2005). An exploration of the factors that affect the academic success of college  
379 sophomores. *College Student Journal*, 39(2), 367–376.  
380 Higbee, J., Dwinell, P., & Thomas, P. (2002). Beyond University 101: Elective courses to enhance retention.  
381 *Journal of College Student Retention*, 3(4), 311–318.  
382 Higgins, B. (2004). Relationship between retention and peer tutoring for at risk students. *Journal of Nursing*  
383 *Education*, 43(7), 319–321.  
384 Hillman, K. (2005). *The first year experience: The transition from secondary school to University and TAFE*  
385 *in Australia*. Camberwell, Victoria: Australian Council for Educational Research.  
386 Hoschl, C., & Kozeny, J. (1997). Predicting academic performance of medical students: The first three  
387 years. *American Journal of Psychiatry*, 154(6 Suppl), 87–92.  
388 Huon, G., & Sankey, M. (2000). The transition to University: Understanding differences in success. *Paper*  
389 *presented at the 4th Pacific Rim first year in higher education conference*, Queensland, Australia.  
390 Jafili-Grenier, F., & Chase, M. (1997). Retention of nursing students with English as a second language.  
391 *Journal of Advanced Nursing*, 25, 199–203.  
392 Johns, G., & McNabb, R. (2004). Never give up on the good times: Student attrition in the UK. *Oxford*  
393 *Bulletin of Economics and Statistics*, 66(1), 23–47.  
394 Kirby, D., & Sharpe, D. (2001). Student attrition from Newfoundland and Labrador's public college. *Alberta*  
395 *Journal of Educational Research*, 47(4), 353.  
396 Krause, K., Hartley, R., James, R., & McInnis, C. (2005). *The first year experience in Australian Univer-*  
397 *sities: Findings from a decade of National studies*. Melbourne: Centre for the Study of Higher  
398 Education, University of Melbourne.  
399 Kuh, G. (2001). Organisational culture and student persistence: Prospects and puzzles. *Journal of College*  
400 *Student Retention*, 3(1), 23–39.  
401 McClelland, A. A., & Kruger, P. W. (1993). *An investigation of the subsequent performance in tertiary*  
402 *studies of students admitted through the Queensland tertiary admissions centre in 1989–90*. Canberra:  
403 Australian Government Publishing Service.  
404 McInnis, C. (2002). The place of foundational knowledge in the Australian undergraduate curriculum.  
405 *Higher Education Policy*, 15, 33–43.  
406 McInnis, C., Hartley, R., Polesel, J., & Teese, R. (2000). *Non-completion in vocational education and*  
407 *training and higher education*. Melbourne: Department of Education, Training and Youth Affairs.  
408 McInnis, C., James, R., & Hartley, R. (2000). *Trends in the first year experience—In Australian universities*.  
409 Melbourne: Department of Education, Training and Youth Affairs.  
410 Murphy, M., Papanicolaou, K., & McDowell, R. (2001). Entrance score and performance: A three year study  
411 of success. *Journal of Institutional Research*, 10(2), 32–49.

412 Murray-Harvey, R. (1993). Identifying characteristics of successful tertiary students using path analysis.  
413 *Australian Educational Researcher*, 20(3), 63–81.

414 Murtaugh, P. A., Nurns, I. D., & Schuster, J. (1999). Predicting the retention of university students. *Research*  
415 *in Higher Education*, 40(3), 355–371.

416 Ofori, R., & Charlton, J. P. (2002). A path model of factors influencing the academic performance of nursing  
417 students. *Journal of Advanced Nursing*, 38(5), 507–515.

418 Pargetter, R., McInnis, C., James, R., Evans, M., Peel, M., & Dobson, I. (1998). *Transition from secondary*  
419 *to tertiary: A performance study*. Canberra: Department of Education Training and Youth Affairs  
420 (DETYA). Higher Education Series, No. 36.

421 Pike, G., & Saupe, J. (2002). Does high school matter? An analysis of three methods of predicting first year  
422 grades. *Research in Higher Education*, 43(2), 187–207.

423 Potts, G., Schultz, B., & Foust, J. (2003). The effect of freshman cohort groups on academic performance  
424 and retention. *Journal of College Student Retention*, 5(4), 385–395.

425 Price, D., Harte, J., & Cole, M. (1991). *Student progression in higher education: A study of attrition at*  
426 *Northern Territory University*. Canberra: Australian Government Publishing Service.

427 Scott, D. (2004). *Retention, completion and progression in tertiary education 2003*. Auckland: Ministry of  
428 Education.

429 Stacey, D. G., & Whittaker, J. M. (2005). Predicting academic performance and clinical competency for  
430 international dental students: Seeking the most efficient and effective measures. *Journal of Dental*  
431 *Education*, 69(2), 270–280.

432 Tay, R. (1994). Students' performance in economics: Does the norm hold across cultural and institutional  
433 settings? *Journal of Economic Education*, 25(4), 291–301.

434 Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. *Review of*  
435 *Educational Research*, 45(1), 89–125.

436 Tutton, P., & Wigg, S. (1990). The influence of last secondary school attended, subjects taken in last year of  
437 secondary education and gender on pre clinical performance on medical students. *Australian Journal of*  
438 *Education*, 34(2), 168–173.

439 Vivekananda, K., Ramsay, S., Elphinstone, L., Peters, J., Lizzio, A., Tannoeh-Bland, J., et al. (2003).  
440 *Griffith University student retention project*. Gold Coast: Griffith University.

441 Walmsley, D. (1990). How well do HSC scaled aggregate scores predict university performance in geog-  
442 raphy. *Geography Bulletin*, 22(3), 241–245.

443 West, L. H. (1985). Differential prediction of first year University performance for students from different  
444 social backgrounds. *Australian Journal of Education*, 29(2), 175–187.

445 Win, R., & Miller, P. (2004). *The effects of individual and school factors on university students' academic*  
446 *performance*. Perth: The Centre for Labour Market Research, The University of Western Australia.

447 Zepke, N., & Leach, L. (2005). Integration and adaptation: Approaches to the student retention and  
448 achievement puzzle. *Active Learning in Higher Education*, 6(1), 46–59.

449