Short Online Test And Survey As An Indicator Of Student Risk In Bioscience At A Regional University.

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Abstract

Bioscience has long been reported as a source of difficulty and anxiety for nursing students. A number of factors have been identified as risk indicators for non-completion and failure in human bioscience classes. Much of this work however has been retrospective and has focused on urban cohorts. Relatively little information is available for rural/regional cohorts.
Aim: Determine indicators of risk, independent of university entry scores, for a regional/rural student body using an online demographic survey tool that includes a quick science test.
Method: Students voluntarily completed a short science test and demographic survey upon entry to Human bioscience 1. Individual results/responses were combined with the final summative scores for each student and a multivariate analysis undertaken.
Results: A total of 963 students participated in the study; 916 completed all assessments. Only 40.3% had university entry scores. Several risk factors surfaced, the most significant included if a student was the first in their family to attend university. Intended hours of work, study mode, nor socioeconomic status were statistically significant contributors to risk.
Conclusion and Implications: Further development of tools such as the one used for this study needs to be undertaken to enable early identification of 'at risk' students and implementation of strategies to assist these students appropriately.

Introduction/Literature Review

Student transition and retention has become an important focus of the Higher Education sector in recent years. Much of the research investigating student risk of failure and attrition in health-related programs has focused on undergraduate nursing student cohorts. This is perhaps not surprising in light of a recent study which indicated that for each subject a nursing student failed the likelihood of degree completion dropped by 36% (Abele, Penrase & Ternes, 2011).

Human bioscience courses are often attributed with being the most difficult for nursing students (van Rooyan, Dixon, Dixon & Wells, 2006) and performance in science courses has been directly linked to overall academic performance in the program (Uyehara, Magnussen, Itano & Zhang, 2007; van Rooyan et al., 2006). Consequently, in recent years an increasing number of studies have examined factors that may impact on nursing student success in bioscience courses. Some of the factors investigated include number of hours in paid work (Salamonson & Andrew, 2006; Salamonson, Everett, Koch, Andrew & Davidson, 2012;

Snelling, Lipscomb, Lockyer, Yates & Young, 2010), non-attendance at classes (McCarey, Barr & Rattray, 2006; Salamonson & Andrew, 2009), previous study of high school biology (Ofori 2000; Whyte, Madigan & Drinkwater, 2011), student age at entry (McCarey, Barr & Rattray, 2006; Salamonson & Andrew, 2006; Whyte, Madigan & Drinkwater, 2011) and science self-efficacy (Andrew, 1998).

The findings of this research have, however, been variable, with contradictory results evident for factors such as age. For example, mature age has been determined to be a positive predictor by several groups of researchers (McCarey, Barr & Rattray, 2006; Ofori, 2000; Salamonson & Andrew, 2006; Salamonson, Ramjan, Lombardo, Lanser, Fernandez & Griffiths, 2012; van Rooyan et al., 2006; Whyte, Madigan & Drinkwater, 2011). However, other studies have shown no impact (Ali & Naylor, 2009; Dante, Vallopi, Siani & Palese, 2010). Similarly, previous biology study was recognised as positively predictive by Griffiths and colleagues (Griffiths, Bevil, O'Connor & Wieland, 1995) and Whyte and colleagues (2011), whilst others cast doubt about specific science study being of benefit (Andrew, 1998; Dante et al., 2011; Thalluri, Penman & Petkov, 2005). Self-efficacy – a person's expectations of their ability to succeed in a task or behaviour, has been linked to academic achievement by nursing students (Andrew, 1998). Andrew (1998) developed a tool for determining student self-efficacy specifically in science that predicted between 19 and 24% of the variance in performance in first year science for nursing students. Certainly, nursing students have a long history of expressing concern with regard to their ability to successfully complete science studies in their degree (Wilson, 1975; Logan, 2012; Craft, Hudson, Plenderleith, Wirihana, & Gordon, 2012) and perceptions of difficulty have been linked to poor exam performance (Caon & Treagust, 1993).

Much of this work, however, has been undertaken with urban student cohorts. Non-metropolitan students in general have lower incomes and high school completions (Haberkorn, 2004) leading to a higher numbers of applications to university based on non-traditional pathways. A relatively small number of studies have investigated risk factors specifically in a rural/regional context. Madigan (2006) examined risk factors for cohorts of Australian pre-hospital care (paramedic) students undertaking bioscience subjects similar to those undertaken by nursing students. It was found that a University Admissions Index (UAI) above 50 (max score was 100) was positively predictive of success for these students, and that urban students outperformed their rural peers. In a later study with a combined nursing and paramedic student cohort at the same institution, Whyte and colleagues (2011) confirmed this result determining that the UAI was the most important predictor for successful completion of first session subjects. Tertiary entrance scores such as the UAI or the Australian Tertiary Admissions Rank (ATAR) that superseded it are, however, becoming less useful as predictors of student success as the number of pathways into higher education increases. For example, Dobson and Skuja (2005) demonstrated that university entrance scores were poor predictors of successful program completions for health or education students, and Jacob et al. (2011) confirmed this in their study of nursing students (Jacob, Chapman, Birks & Al-Motlaq, 2011).

Being the 'first in family to attend university' can also play a significant role in the transition to higher education. It may take longer for a first in family student to adapt to university expectations compared to those whose parents or siblings can share university experiences. Scutter et al. (2011) surveyed over 3,000 students at three South Australian universities and found that less than a third of first year students had entered with a realistic understanding of the amount of time necessary for university study (Scutter, Palmer, Luzeckyj, Burke, da Silva

& Brinkworth, 2011). Students who were the first in their family to attend university relied on school counsellors and teachers or university counsellors and websites much more for advice than those not first in family who accessed family members. First in family students were less likely to be enrolled in those areas requiring high university entry scores such as law and medicine (Luzeckyj, King, Scutter & Brinkworth, 2011). They were also more likely to be female, come from a rural area, and have invested time in paid work. This is an important finding in the context of undergraduate nursing student cohorts, given the disproportionately high representation of females. However, the impact of being 'first in family' on student success specifically in first human bioscience subjects has not been addressed.

Given the influential nature of science courses to nursing student progression and retention and the increasing number of university entry pathways, it is important for regional institutions to understand the impact of entry characteristics (including being 'first in family') and educational background on student performance in the rural/regional context and be able to identify 'at risk' students as early as possible. The study presented here reviews data collected over four sessions to enable risk factors to be determined for non-completion or failure of the first year undergraduate subject Human Bioscience 1 at a regional university. (N.B. This university has used the term 'sessions' instead of 'semesters' since moving from a two semester model to a three session model for the academic year.)

Method

Students enrolled in Human Bioscience 1 in 2011 and 2012 were invited in the early weeks of each session to participate in a two-part survey which included a demographic section (see Table 1) followed by an eight question science test. The self-selected sample was drawn from four successive cohorts of students; a total of 1,328. Those who undertook the survey and test numbered 963, an overall response rate of 71.5%, however not all these students completed and had final summative scores and grades. The survey results and demographic data were matched to enrolment information for socioeconomic background and whether the student was the first in their family to study at university. The demographic questions are provided in Table 1. Socioeconomic status (SES) was categorised as either 'low' or 'not low' and derived from geographic postcode data and 'First in family to attend university' status was categorised as either 'yes' or 'no'. Final summative assessment scores were then added to participants survey and test results. The resulting spreadsheet was then de-identified.

The science test questions used were derived from New South Wales (NSW) School Certificate Board of Studies Science examinations (a statewide school assessment that becomes obsolete in 2013) that was undertaken by all school students aged approximately 15 years (Year 10 of High School). In NSW students commence school at age 5 years. Previous years examination papers are freely available to students on the Board of Studies website (http://www.boardofstudies.nsw.edu.au/schoolcertificate/). The test was deliberately kept short, consisting of eight multiple choice questions: three introductory chemistry questions, three basic physiology questions, one decimal place question and one question requiring interpretation of numeric data.

Demographic descriptors were extracted for each cohort of participants. A multiple regression analysis using R statistical software (R-Development Core Team, 2010) was applied to the data to determine factors that relate to a final summative score of less than 50% (the usual boundary for awarding of a fail grade). All analysis took place after the students'

grades had been finalized for the session and the researchers were not involved in teaching or assessing these specific student cohorts.

The Charles Sturt University Human Minimal Risk Ethics Committee for the School of Biomedical Science approved the project.

Table 1: Demographic Survey questions

Question	Answer Choices
Gender	Male/female
Age Group	18-24 years; 25-38 years; over 39-45 years, over 45 years
Mode of Study	Distance education or on campus
Course	Paramedic; Nursing; Double Degree (Nursing/Paramedic); Oral Health, Complimentary Medicine, Other
Previous education level	Technical College; School Certificate Year 10; Higher School Certificate or equivalent Year 12; other
Subjects studied at school	Biology; chemistry; physics; maths
Hours of intended work during teaching session	none; < than 8 hours; 8-16 hours; more than 16 hours
Previous experience as a health care worker	Yes/No
Previously known a health care worker	Yes/No

Results

Not all students completed both the survey and science test, a few only finishing the demographic section (results shown in Table 2). Of the four cohorts, on average, only 40.3% had completed high school to Year 12 and undertaken their Higher School Certificate (HSC). This national exam enables the calculation of a university entry score to facilitate entry to particular undergraduate degree programs. The students enrolled in Human Bioscience 1 had, in the majority, obtained entry to university through other pathways such as technical college studies or school principal recommendations. Nursing students comprised 65% to 78% of participants depending on the session. Pre-hospital Care (paramedic) students were enrolled in session 1 as internal on campus students in most cases.

For each intake 'first in family' students formed between 50% and 67% of the cohort. Women, by proportion, comprised the larger component of those who were the first in their family to study at university. Those entering university from low socioeconomic areas (as determined by geographical postcode) made up approximately a quarter of each cohort. Again, the majority of these students were female. Table 2 also shows that the more mature students were to be found more often in the distance education only sessions. This reflects the enrolment of students undertaking the conversion program from enrolled to registered nurse that schedules Human Bioscience 1 to occur in their second semester of university study.

Lastly, it was apparent that those intending to undertake more than 16 hours per week in paid work were mostly enrolled in the session for distance education students. A Chi-squared test of independence showed that the number of hours worked by students was dependant on the mode of study (p-value <0.001).

Table 2: Demographics for survey respondents by cohort for 2011 through to 2012. Cohorts identified by Year (session).

Human Bioscience 1 student cohort n= no. of survey responders	**2011 (1) Mixture of education modes** n = 460 (males - 18.5%, n = 85)	**2012 (1) Mixture of education modes** N = 331 (males - 19.6%, n = 65)	**2011 (2) Distance education only** N = 114 (males - 8.8%, n = 10)	**2012 (2) Distance education only** N = 58 (males - 15.5%, n = 9)
HSC completed	50%	39%	22%	10%
Nursing degree	65%	70%	69%	78%
Pre-Hospital care (Paramedic) degree	20%	23%	<10 students	<10 students
Other degree	5%	8%	9%	19%
First in family to attend university	64%	61%	64%	67%
Living in low socioeconomic areas	25% (87% were female)	27% (70% were female)	22% (96% were female)	28% (100% were female)
Intended to work more than 16 hours per week	29%	22.4%	58.5%	84.5%
Age 18-24 years	68%	68%	34%	17%
Age 25-31 years	15%	14%	16.7%	17%
Age 32-38 years	7%	10%	<10 students	24%
Age 39-44 years	6%	5%	13%	22%
Age >45 years	5%	3%	13%	19%

Each cohort, to varying extents, included students who were repeating the subject after failing during session 1. Table 3 provides the pass rates for each session giving an indication of the numbers of repeating students to be found in the following session. For those who undertook the science test, Table 4 reveals that of the 103 participants in 2011 session 2, only 48 were new students to Human Bioscience 1.

Table 3: Students with grades of Pass or better per cohort. The combined pass rate for the participants was 68.8%.

Cohort Year (session)	**Number of participants who completed all assessment tasks**	**Number participants with pass grades or better**	**Pass rate** Percentage %
2011 (1)	460	287	62
2011 (2)	114	88	77
2012 (1)	309	242	78
2012 (2)	58	30	50

Table 4: Comparing correct responses by cohort to short science test questions. Note:– not all students who undertook the survey undertook the science test and of those who did both not all remained enrolled beyond the date at which the commonwealth government levies fees for enrolment or completed the final exam.

Question N = no. survey response of entire cohort of 1,328 students	**Chose correct answer 201130 Mixed cohort N=483 of 529**	**Chose correct answer 201230 Internal only N=265 of 516**	**Chose correct answer 201160 DE only N=103 (n=48 new**) of 187**	**Chose correct answer 201260 DE only n=54 (n=53 new**) of 96.**
Decimal place conversion*	46%	42%	38%	39%
Breakfast cereal nutritional data	90%	91%	95%	94%
Windspeed and chill factor table	90%	93%	92%	89%
Carbon dioxide chemical formula	91%	96%	94%	92%
Smallest unit of an element	65%	64%	61%	64%
Cellular division for reproduction	75%	74%	68%	67%
Cellular division for replacement of cells	89%	86%	93%	87%
Salts absorption and excretion in GIT*	52%	53%	51%	46%

*Salts absorption and excretion in GIT question and the decimal place question were the two that appeared to cause the most consternation with one distracter option scoring 32% in each case. All others gave a clear demarcation for the correct answer. **'New' indicates 'new' students to the subject only with repeating students from session 1 data removed.

An earlier multiple regression analysis of just the 2011 session 1 cohort (n = 460) had shown that the Science test score was a significant indicator of risk. 'First in family' and 'socioeconomic status' had both been contributors to the model of risk for this particular cohort. Consequently the science test was closely examined to see if particular questions were more indicative of risk than others (Table 4). The decimal place conversion question and the question that asked students to indicate where salts were absorbed and excreted by the gastrointestinal tract proved the most challenging. These two questions showed that one distracter option in the multiple choice question was chosen as correct by 32% of the participants in each case while approximately 53% or less of the participants chose the correct option (see * in Table 4). The results of the science test score were plotted against final summative scores (TotalMark) for each cohort. These are presented in Figure 1. The plot for the entire participant group for all four sessions is given in Figure 2. The plots indicate a potential relationship between science test score and final score once incomplete scores were recognized as invalid results – for example the scores of zero and one for the science test score in 2012 session 2 were discovered to be two students neither of whom had completed the science test. The reasons for non-completion are unknown. In total 15 students with scores of zero or one exist in the dataset. Nine of these only completed the demographic survey and not the science test, the remainder began the test but did not complete it.

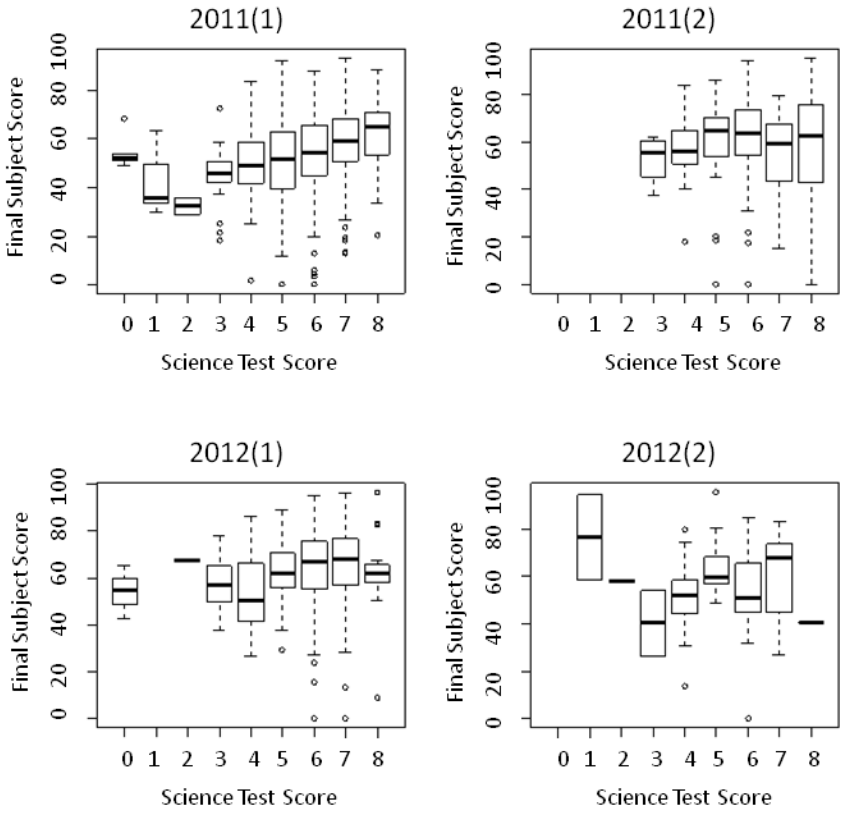

Figure 1: Science test score plotted against final subject score (summative assessment score) for each cohort. Standard box-plots are presented where the dark horizontal line is the median, the enclosed box represents 50% of the data and the whiskers extend to the maximum and minimum values for that Science test score. Extreme outliers are represented as points. Of the cohort 2011(1) cohort, all those with a zero score completed the demographic survey only; all those with a zero score in 2012 (1) completed the demographic survey only. One student has a score of two in 2012 (1) – this student only attempted the last two questions in the science test. Two students had a score of one in 2012 (2); neither student completed the test.

When reviewing the plots of science test scores against total summative mark ('TotalMark') for the entire cohort (Figure 2) it can be seen that the additional three sessions of data have caused a flattening of the potential relationship that was revealed in the earlier single cohort data. The multivariate analysis using data from all cohorts did not ultimately indicate that the science test was significant to the risk model for 'TotalMark'. However, the previous model for the 2011 session 1 data also indicated that non-traditional entry to the university was a risk factor whereas previous biology, physics or chemistry study was not. The additional data has shown that study of these subjects does impact on the model of risk significantly and some interaction is evident between these variables (see Table 5.).

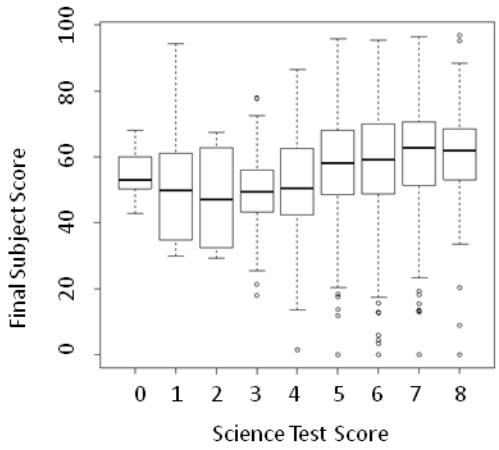

Figure 2: Science Test Score plotted against final subject score for all 916 participants. Note – all those with a score of zero did not attempt the science test but contributed their demographic information to the survey.

Being a first generation student was a significant risk factor for success in Human Bioscience 1 (see Table 5). The demographics for each session cohort (Table 2) indicated that between 61 and 67% of the students were the first in their family to attend university. Women made up the larger proportion of this group (males - 56%; females - 66.5%). However, gender did not surface as a significant risk factor. It is probable that gender is compensated for within the model by the other significant factors. Demographic variables that were shown not to be of significance to the model were: socioeconomic status, hours of intended work, mode of study, and previous education level. However, mode combined with previous health care experience was shown to be significant. Factors identified as significant are provided in Table 5.

Table 5: Factors of risk identified through multiple regression analysis (n=916).

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	Significance
Course	3	10574	3524.8	12.1	8.516e-08	***
First Generation	2	9201	4600.4	15.8	1.717e-07	***
Age Group	2	3104	1552.2	5.3	0.005	**
Health Care Experience	1	1423	1422.5	4.9	0.027	*
Physics	1	824	824.4	2.8	0.092	.
Chemistry	1	3261	3260.9	11.2	0.001	***
Biology	1	3416	3415.9	11.8	0.001	***
Course & Physics	3	2646	881.9	3.0	0.028	*
Mode & Health Care Experience	1	1976	1975.8	6.8	0.009	**
Chemistry & Biology	1	1917	1917.0	6.6	0.010	*
Significance codes – p< than 0.001 '***' p < 0.001 '**' p < 0.01 '*' p < 0.05 '.'						

R Statistical Software (R-Development Core Team, 2010) was used to perform a multiple regression analysis of the variables to reveal their relationship to an individual student's final summative score. The resultant regression equation can be written as:

Equation 1: *TotalMark = 49.28 – 4.20 x Course Nursing + 1.80 x Course other + 0.90 x Course Paramedic + 4.06 x Not First Generation – 7.28 x Unknown Generation + 6.74 x Mode Internal + 5.36 x Age Group 25 to 38 years + 5.65 x Age group over 38 years + 3.71 x Health Care Experience + 8.49 x Studied Chemistry + 8.15 x Studied Physics + 5.24 Studied Biology -3.88 x Course Nursing: Studied Physics – 29.32 x Course Other: Studied Physics - 4.23 x Course Paramedic: Studied Physics - 7.75 x Mode Internal: Health Care Experience – 8.46 x Studied Chemistry: Studied Biology*

The initial coefficient in the equation (49.28) is the average summative score for all students. It can been seen upon examining the various coefficients for the different variables that previous study in chemistry, physics or biology can have both negative and positive impact upon the average mark. This average mark is below the 50% boundary for a passing grade. To use the equation to predict a potential student's score, a zero is inserted for any variable that does not apply to a particular student and a one for any variable that describes the student. As an example - a 28 year old paramedic course internal student who is not first generation but has prior experience in health care work and has previously studied biology might be expected to obtain a TotalMark of 68 out of 100 (after rounding up the estimated value after calculation to prevent further incorporation of rounding errors). Such a score would indicate that this student was not likely to be at risk of failing Human bioscience 1.

TotalMark = 49.28 + 0.90 +4.06 +6.74 +5.36 +3.71 + 5.24 – 7.75 = 67.54

An actual student with these characteristics in fact scored a pass grade of 62.6%. Another example would be a first generation internal nursing student. In this case the formula reduces to:

Equation 2: *TotalMark = 51.82 + 5.36 x Age group 25 to 38 + 5.65 x Age Group over 38 years + 3.71 x Health Care Experience + 8.49 x Studied Chemistry + 8.15 x Studied Physics + 5.24 x Studied Biology – 3.88 x Course Nursing: Studied Physics – 7.75 x Mode Internal: Health Care Experience – 8.46 x Studied Chemistry: Studied Biology*

A review of the regression equation 1 provides insight into the previous health care experience variable. It indicates that health care experience of itself has a positive influence on 'TotalMark' (plus 3.7 +/- 2.7), however, when combined with being an internal mode student a negative influence occurs (negative 7.7 +/- 3.0). Internal students normally commence human bioscience 1 in their first session of study at university and complete a full time study load. Those working in the health care industry make up the bulk of the enrolled nurses who have completed technical college qualifications converting their qualifications to registered nurse. These students usually have several years of experience in the health care industry well over and above that of the internal students. They have also completed some anatomy and physiology studies and are universally mature aged entry students.

It is possible that it is the varied background at entry that has resulted in the multiple combinations of course and physics or biology or chemistry and the combined chemistry/biology influences upon the value of 'TotalMark'. The significance of these factors in the multiple regression analysis, either as individual factors or in combination, would compensate for the non-significant Science Test Score. Using equation 1 to indicate risk for an Enrolled Nurse entering the program as a first in family student whom is in the age group of 25 to 38 years without any other physics or chemistry study other than that included in

their technical college qualification the resultant 'TotalMark' becomes 59 out of 100. This would be deemed a Pass grade and provides an indication that previous study of biology, for this group of students, mediates the risk associated with first in family status (calculation using Equation 2 - see below). Of the actual 10 students in this grouping, seven passed while two withdrew.

TotalMark = 49.28 – 4.20 + 5.36 + 3.71 + 5.24 = 59.39

The course in which a student is enrolled may reflect the background of the student. With reference to Equation 1 it can been seen that enrollment in the nursing degree has a negative impact upon the value of 'TotalMark'. The paramedic course and enrollment in other courses both provided positive value coefficients. In the nursing cohort for 2011 and 2012 only 48% and 58% respectively of the participants in session 1 had completed school to obtain university entrance scores. This compares to 64% and 68% respectively for the paramedic students who completed the survey.

Discussion

A derived equation for assessing risk cannot account for all possible eventualities in a person's life nor might it be expected to have a precise level of accuracy. Personal misadventure or events in the lives of those students' dependants may impact on a student's capability to complete their studies. Our survey did not ask questions related to student family responsibilities although other authors have identified these responsibilities as impacting on student attrition (Dante et al., 2010). However, it is evident that being the first person in a family to undertake university studies does pose challenges to be overcome. The categorization as a first generation student may be incorporating a raft of other factors such as socioeconomic status and gender which have been identified by other researcher's studies as indicators for risk of attrition or fail grades.

There have been a few studies that investigated student cultural capital (Scutter, Palmer, Luzeckyj, Burke, da Silva & Brinkworth, 2011) and self-efficacy (Zajacova, Lynch & Espenshade, 2005). It could be expected that students who are first in their family to attend university would arrive with very different attributes of cultural capital than those who come from families where university study is a normal expectation. There have also been a number of researchers who indicate that completion of high school studies might be more important to success than prior science study (Andrew, 1998; Thalluri, Penman & Petkov, 2005; Dante et al., 2011). It is proposed that these students are more self-efficacious having achieved a collection of generic skills including study skills that they then utilize at university. High school completions are higher in geographic areas of middle- to high-income families (Haberkorn, 2004). Regional and rural areas of NSW have, overall, lower levels of incomes and high school completions (Haberkorn, 2004). Certainly the demographic results presented in Table 2 reflect the lower high school completions of people in this university's community and geographic footprint. Our survey did not ask questions that might provide indicators of self-efficacy nor were questions related to determining student anxiety incorporated. We do know that many students we teach display high anxiety related to studying science.

Health care experience has been shown in this study to have a negative or positive impact on study results. Whyte and colleagues (2010) had indicated that previous health care experience was detrimental to regional cohort student success. The multiple regression analysis in the present study however indicates that previously working in health care is a positive factor

towards success in Human Bioscience 1 unless the student is studying on campus, internally. The majority of the on campus students are younger and entering the university having completed high school more recently than those studying by distance and off campus. These younger students when working in health related fields are unlikely to have been engaged in positions that required the more demanding responsibilities of those with higher technical college qualifications. Being in the older age groups was also positively predictive of successful grades. This result raises the question of whether the older students are more self-efficious or if, having more extensive and likely higher level qualifications in health care, they are better prepared. This would imply that lower level health care work may be the factor of difference.

Although prior study of areas of science was not shown to be significant for the 2011 (1) cohort, the eight question science test and the level of prior study completed did provide indicators of risk. The 2011 (1) cohort was comprised of younger aged students whereas the 2011 (2) and 2012 (2) cohorts tended to be older and had completed college training as Enrolled Nurses who were upgrading to Registered Nurses. Despite these second session cohorts being comprised of the greater number of first generation students they did not consistently have the lower pass rates (77% and 50% respectively). It is possible that the increased knowledge due to the biology studies incorporated in the college training combined with being more mature students may mediate the risk associated with being a first generation student. However, the lack of consistency indicates a need to further explore factors of risk for these distance cohorts. The multiple regression analysis showed that the mode of study was not a single indicator of risk. For our students, the program of study for distance students incorporates audio visual recorded lectures, live chat room or audio visual tutorials and residential schools where students come to campus to complete laboratory practicals and have face-to-face time with lecturers. In the current age of increased electronic student contact with lecturers it would appear that studying by distance is not a significant disadvantage.

Many of these factors have been identified before but not specifically in a regional/rural context for study of Human Bioscience 1. University entry scores have been shown to be significant for many student groups however our cohort have non-traditional entry pathways to university in the majority of cases. Despite a number of authors, for example Whyte, Madigan and Drinkwater, (2010) with nursing and paramedic students, having identified UAIs as the best predictors of success they were found to be unhelpful by Dobson and Skuja (2005) and Jacob and colleagues (2011) for nursing students. The conflicting results might be attributed to the comparatively lower numbers of nursing students entering university after acquiring university entry scores.

Conclusion

This is the first study to thoroughly explore the entry characteristics of regional/rural university students that impact on their success or failure when studying a first year science subject independent of university entry scores. The tool presented here provides a potential means to identify those students who may be at risk of marginal results or subject failure, however, the tool needs to be prospectively tested. It has shown that several mediating variables impact on the significance of being the first in family to undertake university studies. A student's age, previous study of science subjects and their experience as a health care worker at entry can be positive contributors to their success. Further studies to examine student anxiety, learning styles and self-efficacy at entry and the contribution of cultural

capital may enable a further refinement of our results and enable design and implementation of strategies to assist these students appropriately.

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