Patterns of Achievement in a Tertiary Setting

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Background to Study

During the latter half of this century, demand for university places throughout the world has increased dramatically. As a result of this excess demand for tertiary enrolment combined with an economic imperative to minimise drop-out rates and ensure quality, universities have been compelled to develop the means to determine which students are most likely to succeed in their courses. The United States uses standardised testing—the Scholastic Aptitude Test—for general admission to university with some specialised courses imposing additional testing. In Australia, all states rank students according to their performance in Year 12 known as the Higher School Certificate (HSC), with the major portion gained from externally-assessed examinations on a range of subjects. In New South Wales, the most heavily populated state in Australia, students are awarded a tertiary entrance rank (TER) based on their results on these examinations. This TER score is then used to determine an individual's suitability for university entrance. The minimum TER score for enrolment varies among courses and universities, depending on the student demand for the course. The underlying assumption is that the TER will accurately predict a student's chances of successfully completing a particular program at the tertiary level.

Unlike the United States, nearly all universities in Australia are government funded with levels of finance depending on student quotas. For a number of reasons, universities in New South Wales in the last year or so have been faced with a reduction in student demand which has resulted in lower TER scores being set for several courses. Many academics have questioned whether this decline will lead to lowered standards at the tertiary level—again, the assumption is that TER scores accurately predict a student's performance at university. If, however, the TER is not universally highly correlated with university performance, then the fears of declining standards at universities may be unfounded. We hypothesised that the TER may be more important for some courses than others and, therefore, some university faculties may find it preferable to develop alternative means for student selection. In order to initially explore the patterns of university performance, an extensive study was conducted at the University of Wollongong in New South Wales, the preliminary findings of which are reported in this paper.

Previous Research Studies

Several studies exploring the question of prediction of university performance, have been conducted in Australia since the 1960s. Despite the range of methods employed, these studies consistently demonstrated a strong relationship between HSC results and university performance in science and engineering courses but a weaker relationship for arts and humanities courses. An early study of 400 Queensland students conducted by Schonell, Meddleton and Roe (1962) indicated a strong correlation between the HSC score and university performance in chemistry, physics and mathematics but not for English, French, Latin and history. Dunn (1984) and West (1985) compared HSC performance to grade-point average (GPA) received in the first year of university. Dunn's study found higher correlations for Science than Arts results; West reported strong correlations for Engineering, Science and Medicine, moderate correlations in Arts and Economics, and a low correlation in Law. A comprehensive study of South Australian students, conducted by Power, Robertson and Baker (1987), demonstrated higher correlations for Engineering and Sciences compared to Arts, Teaching, Nursing and Business. Similarly, Everett and Robins (1991) found a stronger relationship for Medicine, Agriculture, Economics and Engineering than those of Arts and Architecture. It is clear from these studies that the HSC is a more accurate predictor of university performance in science, engineering and medicine than it is for arts, humanities and law.

In 1994, a comprehensive study of university performance was conducted by Lewis at the University of Wollongong. This study sought to determine the performance of different equity groups and students who had been admitted through alternative modes of entry. Lewis concluded that the TER was "an important but imperfect predictor of performance at university" (1994, p. x). He also reported that women out-perform men across all faculties, a difference in performance that becomes more marked after the first year of study.

Method

The purpose of this study, then, was to examine whether the patterns of university achievement that had been noted by previous studies pertained at the University of Wollongong. In particular, we wished to examine the correlations between TER at entry to university and level of performance upon graduation. Five cohorts of students, who first enrolled at the University of Wollongong in the years 1989 to 1993 inclusive, were selected for the purposes of this study; the total sample size exceeded 15,000.

TER scores are percentiles, in that a TER of 100 means the student was in the top 1% of students who sat for the examinations, and a TER of 50 means that the student outscored 50% of students. Universities set the minimum TER scores based on their need to balance student numbers and

student quality, and select more than half of their students in this way. Student entry to university is also possible through other methods, particularly for mature-aged students and for socially disadvantaged students, and large numbers of students enter through these avenues. The TER scores for the student data used in this investigation are shown in table 1. This table also indicates the percentage of students admitted to the faculty who had TER scores of less than 50.

Table 1: TER scores, by Faculty, 1989-1993

	Mean	Range	%TER < 50
Arts	66.8	4 - 100	13.0
Commerce	72.5	1 - 100	13.6
Creative Arts	64.6	4 - 99	21.7
Education	64.0	2 - 99	18.4
Engineering	73.0	4 - 99	8.2
Health & Behav. Sciences	61.7	4 - 100	25.9
Informatics	72.2	10 - 100	8.4
Law	72.7	4 - 98	14.7
Science	70.3	10 - 100	4.9

The TER scores in table 1 indicate the mean scores are above 70 for half of the faculties, with the lowest still more than 60. The range of these scores, together with the percentage of students admitted to the university with TERs less than 50, reflect the policy of admission

through alternative modes of entry to some extent. The higher TER scores in Engineering, Informatics and Science, for example, may reflect the direct movement from high school to university whereas the lower TER scores in Health and Education reflect the high level of students who enter through alternative means where a low TER score achieved some years previously has been set aside in preference to other selection criteria.

The student administration section of the university provided us with data concerning students' TER scores, the weighted average marks (WAM) and the grade point average (GPA) of every student enrolling in the university over the period 1989 to 1993. Calculations of these WAM and GPA scores were available for each year in which students were enrolled. The WAM is calculated in the following manner:

$$\frac{\sum cm}{\sum m}$$

where

m is the actual mark obtained in each attempt at each subject; and

c is the credit point value of the subject.

The GPA score is the mean of the awarded grades of all completed

subjects with the following weightings:
High Distinction4.0
Distinction3.0
Credit2.0
Pass1.0
Pass Conceded0.5
Fail0.0

Results
The TER, WAM and GPA data were analysed by calculating correlations between the TER score and the various WAM and GPA scores over the period in which students were enrolled in the university, on a faculty basis. These correlations are shown in table 2.

Table 2: Correlations between TER scores,
and WAM and GPA scores, faculty by faculty, 1989 - 1993.

WAMGPA WAMGPAn
100200300400100 200 300400
Arts.241.266.229 * .265.319.266 *.261.296860
Comm.349.210.176-.066.292.212.205-.072.343.3011424
Crea.231.196.319 * .336.313.398 *.256.122224
Educ.277.211.209.077.275.252.215.009.268.259545
Engi.528.488.472.432.551.531.500.473.507.544662
Heal.220.209.241 * .262.280.286 *.238.2971241
Info.439.352.299.279.459.415.338.276.430.454808
Law.267.477.410-.011.423.487.342.111.314.42464
Scie.440.369.323.079.490.409.373.158.420.228737
* n was too small for correlation calculation to be meaningful,
as most students leave after completing a three year degree.

In analysing the various correlations presented herein, there are two initial decisions to be made. Firstly, we must decide which of the WAM and GPA scores are the more important to focus upon. In deciding this, we need to re-consider what the function of the TER score is, that is, from a university perspective, if TER scores are a major selection criteria, one would hope that there was some relationship between them and student results in their first year of tertiary study. Therefore, we commence our analysis with the WAM100 and GPA100 correlations.

The second issue concerns the arbitrariness of determining the

practical importance given to interpretations of correlation values. In the data here, the correlations could be divided into those we consider to be high, where at least one of WAM100 or GPA100 are greater than .4, those that are of moderate size, more than .3 but less than .4, and those that we would consider to be low, where at least one of WMA100 or GPA100 is less than .3.

From Table 2, we see that there are three faculties where the initial correlations are greater than .4: engineering (WAM100 .528), informatics (WAM100 .439) and science (WAM100 .440). One explanation for this relationship is the possibility that these students studied relatively large amounts of mathematics and science during their last years at school, and that their subsequent university studies focus on mathematics and science. There seems to be not a surprising link between success in mathematics and science at school and success in these fields at university. The correlations in later WAM and GPA scores decrease in these faculties, and this is consistent with changes in the content of university courses as they move away from the kinds of mathematics and science studied at school, and especially into more specialised areas. The pattern, though, for engineering where the correlations fall much less than the faculties of science and informatics, again reflects the nature of the mathematics and science studied in these courses, and their relationship to high-school level mathematics and science.

By contrast, the faculties of arts, creative arts, education, and health and behavioural sciences allow students to study areas of knowledge that may have little to do with those fields studied for the higher school certificate. As a result, the low level of relationship between levels of success in these faculties and students' TER scores is not surprising. Generally, these low correlations are consistent across WAM and GPA scores throughout the programs of study. While there are exceptions, such as the correlation of .398 in creative arts GPA300 subjects, they may be thought of as aberrations from an otherwise consistent pattern.

Given the notion that as students progress through a degree, they will generally be studying material that is more complex and more specialised, one could argue that the final correlations between TER scores and the overall WAM or GPA scores are also important. In particular, if TER scores are used for student selection, then one would hope that they also relate to overall university success. The faculties of engineering, informatics and science again have overall WAM or GPA correlations greater than .4, with engineering having correlations of over .5. Commerce students have a modest level of correlation between TER and WAM/GPA scores, of a little over .3. The faculties of arts, creative arts, education and health and behavioural sciences, where there were low correlations in WAM100 or GPA100 subjects, continue to show low levels of correlation between TER scores and students' overall success at university.

The pattern of correlations cannot be aligned with the spread of TER scores because, as indicated in Table 1, all faculties have TERs ranging from very low to very high figures. There is, however, a pattern related to low TERs. The faculties of engineering, informatics and science which consistently gained high correlations are also those faculties which have the smallest percentage of students with TERs

below 50 (8.2, 8.4 and 4.9 respectively).

It is worthy of note that the faculty with the lowest correlations is creative arts. In this faculty, potential students must submit a portfolio and attend auditions before gaining acceptance into the

program. As students are not selected on the basis of TER alone, the relatively low correlations between TER and WAM/GPA scores is not surprising.

Another unusual pattern in the data is the relatively low WAM100 correlation of .267 in law, particularly when compared to the GPA100 correlation of .423. Given that law is a recent addition to the university's offerings and the correlations reflect one cohort of 64 students, this discrepancy may be an aberration.

Conclusions

This study confirms the findings of previous studies, indicating a strong relationship between TER and university performance in the fields of science, engineering and informatics. Smaller correlations were noted for the remaining faculties. On the basis of the correlational data presented above, then, it seems reasonable to continue to rely on TERs for student selection in engineering, informatics and science. The modest correlations pertaining in other faculties, however, suggest that these other faculties should consider alternative—or at least, supplementary—criteria for selection such as the faculty of creative arts has instituted.

Given the exploratory nature of the data reported herein, there is a need to examine the patterns more closely in future analyses. For example, it is possible to look more closely at the patterns of achievement for particular courses within faculties especially in those faculties where a diverse range of programs is available. It is also possible, and desirable, to look more closely at the performance of gender and equity groups across programs and faculties. Finally, we would like to examine the patterns pertaining to non-completions. All these analyses are within the scope of our current data. In order to extend our understandings of the reasons for differential patterns in student attrition and successful achievement, additional data collection methods will need to be employed. The long-term aim of such investigations would be to develop recommendations for university policy with respect to such areas as academic support for equity groups and alternative criteria for selection.

References

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