

Selection and Participation in Higher Education

University selection in support of student
success and diversity of participation

March 2011

Prepared for the Group of Eight



Nigel Palmer, Emmaline Bexley and Richard James
Centre for the Study of Higher Education
University of Melbourne

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Foreword

This report was commissioned by the Group of Eight, with funding support from the Department of Education, Employment and Workplace Relations, to inform discussion on university selection strategies. The report builds on the 2009 report *Improving Selection for Tertiary Education Places in Victoria*, prepared by the Centre for the Study of Higher Education for the State Government of Victoria. Development of this paper has been informed by the Group of Eight Equity Framework and Equity Strategy, with invaluable input from the Group of Eight Equity Directors network.

This paper reviews criteria and strategies in student selection and the implications of their use for equity of participation in higher education and the prospects for student success. The paper offers an analysis of the strengths and weaknesses of criteria for prior academic achievement, tests of aptitude and preparedness and broader criteria used in university selection. The aim of this paper is to support informed discussion regarding the development and improvement of university selection criteria and practices, recognising the common challenges universities face in fostering diversity of participation and student success in an expanding tertiary education environment.

Executive summary

A range of imperatives underpin university selection practices. These include demonstrating merit based on prior academic achievement and supporting successful graduate outcomes in the professions and in broader fields of endeavour. They also include improving diversity of participation and equality of educational opportunity. Selection for admission therefore involves selecting for student characteristics associated with success at university and also for those associated with the desired mix of students. Finally, fair and transparent selection practices are of particular importance in the context of expanded enrolments and also for courses where the number of applications exceeds the number of places available. While a move toward a “demand driven” funding model for undergraduate enrolments in Australia might imply a shift in emphasis from selection to recruitment in university admissions, selection to courses for which there is high demand will remain necessary and the need for measures to help ensure equity of participation will remain.

Student selection therefore involves three primary challenges:

- ensuring fairness and transparency in student selection;
- identifying the potential for student success in higher education; and
- improving equity of participation and equality of educational opportunity.

Clearly no single criterion for selection will be able to address all of these challenges. Institutions will require selection criteria and selection information according to their missions and contexts and in relation to the curricula and outcomes to which they aspire.

Criteria in Student Selection

The main findings of this report regarding the utility of criteria in student selection, and their implications for equity of participation, are summarised below.

I. Prior academic achievement

Tertiary entrance rank derived from final year secondary school assessment (as in the Australian Tertiary Admissions Rank or ATAR) remains the most prominent criterion for undergraduate admission in Australian universities. Strong performance in the final year of secondary schooling (particularly that found in the top ATAR quintile) is a good predictor of success at university, as reflected in first year grade averages, degree program grade average and degree completion rates and times. However, middle band results are a less reliable predictor of university success, as many students with average or comparatively low senior secondary results also do well once at university. When equity and increased participation are goals, it is important to identify the capacity for success at university among students who do not appear in the upper ranges of ranked final year secondary school results.

Year 12 completion, eligibility for a tertiary entrance rank and secondary school performance as reflected in tertiary entrance rank are all correlated with socio-economic status. Given this relationship, selection strategies based solely or predominantly on rank derived from secondary school achievement will work against efforts to promote diversity of participation over time, unless additional steps are taken. While high SES students are more likely to attain high ATARs, when ATAR is held constant, some SES effects disappear: High and low SES students at the same ATAR band are equally likely to attend university and in broad terms are equally as likely to perform well.

Employing criteria supplementary to entrance rank is one means of overcoming some of the limitations of its use without compromising its strengths. These criteria include tests of aptitude and preparedness and other measures of motivation and achievement.

2. Tests of aptitude and preparedness for university study

Tests of aptitude and preparedness are commonly held to be an objective predictor for success at university and a means of identifying student potential. However, evidence from extensive use of aptitude testing for university admissions in the United States shows that the most commonly used tests have only moderate predictive power for university success and show a correlation with socio-economic status comparable to that found in the use of ATAR in Australia.

However, it is clear that in some contexts, some tests can add validity as a predictor of success at university. Further research is needed to determine which tests offer the best predictive validity, in what capacity and in what context. There is scope for the increased use of tests of aptitude and preparedness in Australia supplementary to other criteria, including in potentially identifying the likelihood of university success among “middle band” ATAR.

3. Broader student attributes associated with success at university

Personal and dispositional characteristics, such as achievement motivation, conscientiousness, academic discipline and commitment to study have to varying degrees been associated with success at university. While these characteristics may be reflected in psychometric assessment, they are more commonly assessed in university selection by means of interviews, portfolios, application essays, referee reports and evidence of extra-curricular activities.

Interviews, while offering a valuable opportunity to meet with students as part of the selection process, appear to be a poor predictor of student success (particularly in the case of relatively un-structured, one-off interviews), may be costly in terms of staff time and are not guaranteed to improve the diversity of participation. Similarly, admissions essays, personal statements, recommendations and referees each offer prospective students opportunities to demonstrate their aptitude, motivation and level of preparedness for university study, but also bring with them a range of shortcomings, including a lack of reliability in predicting success and questionable capacity for improving diversity of participation. By contrast, there is evidence that portfolio applications can be an effective means of identifying student potential as well as being a means of improving diversity of participation.

There is scope for the increased use of portfolios in university admissions, where appropriate to the discipline and intended course of study. This is particularly the case in assessing non-school leaver and postgraduate applications, for non-traditional entry pathways and in identifying potential from among under-represented groups.

The assessment of broader student attributes is of particular importance in admission for postgraduate students. While senior secondary school results have less relevance for postgraduates and other non-school leaving age students, other evidence of prior academic achievement remains an important predictor for success in both research and coursework higher degrees. More broadly, further research is needed in support of a better understanding of the kind of qualifications and experience indicative of the potential for success in postgraduate study, and the implications of the use of criteria in selection for postgraduate study on patterns of participation over time.

4. Student equity characteristics

Special entry programs are one means of directly supporting diversity of participation in higher education. Often such programs employ eligibility criteria based on demographic characteristics. Students admitted through special entry programs have rates of retention and success that are broadly comparable to those of other students. There is scope to diversify and expand special entry programs, providing also that patterns of academic achievement are monitored and appropriate support measures are in place to ensure students are able to make the most of the educational opportunities available to them.

5. School rank strategies

Many special entry programs employ school-based criteria, such as university-school partnerships, or ‘bonus point’ schemes for schools identified as having low university progression rates. A variation on initiatives like this is the so-called “Texas model” or “class rank” admissions strategy. Perhaps more appropriately defined as a “school rank” criterion, with this model consideration is given in university admissions to the performance of students relative to that of their peers from the same school, rather than their rank relative to the broader secondary school graduating cohort for that year (as is the case with the ATAR).

School rank programs provide a means for evaluating and comparing student characteristics in student cohorts within schools and may go some way to mitigating uneven university progression rates between schools. When used in conjunction with other measures of academic achievement, the use of this approach in the United States has proven to be an effective means of both improving diversity of participation and selecting students on the basis of their potential to succeed.

There is also evidence to suggest that such an approach would be effective in the Australian context in ameliorating “school” effects, for individual student performance is partly determined by the context of the school. In this sense a school rank strategy would perform a function comparable to that of existing bonus point schemes, with the added benefit of providing an additional measure of prior academic achievement. There is scope for exploring the possibilities for using “school rank” as one approach to the selection of school-leavers in Australia.

I University selection in Australia

While university selection criteria and practices in Australia have in broad terms remained relatively stable for some time, they have nevertheless long been the subject of analysis and debate. In 2009 the State Government of Victoria's Joint Policy Unit on Youth Transitions commissioned the Centre for the Study of Higher Education at the University of Melbourne (CSHE) to review Victoria's tertiary selection processes. That report examined the role and influence of the Australian Tertiary Admissions Rank (ATAR), and its suitability as the principal selection criterion for tertiary study, as well as exploring the possible benefits and implications of alternative approaches to selection (James et al., 2009). Limitations of an over-reliance in university selection on ranked final year secondary school results were also noted in the 2008 'Bradley' Review of Australian Higher Education. The final report from that review observed that there was scope to reconsider their use, and encouraged the development of a broader range of selection criteria (Bradley et al., 2008, p.38). The last major review of the use of university selection criteria in Australia was commissioned by the National Board of Employment, Education and Training (NBEET) in 1997, which concluded there were opportunities for improving university selection practices in Australia through moving away from the prevailing reliance on ranked final year secondary school results, and in drawing on successful international examples of student selection (Andrich & Mercer, 1997; Pascoe et al., 1997).

Each of the reports noted above concluded that while there were significant strengths to prevailing approaches to university selection in Australia, there was also increasing recognition of the shortcomings of a continuing reliance on rank derived from overall final year secondary school results in university selection. Each also found that while there were opportunities to draw on international examples of the use of a broader range of selection criteria, each bring with them their own strengths and their own shortcomings, particularly in the case of the use of tests of aptitude and achievement.

There are two senses of eligibility when it comes to university admissions; meeting the basic criteria to apply for admission to university, and relative performance on selection criteria once an application has been accepted for consideration. The former has implications for overall patterns of participation, entails many more hurdles, and speaks to a greater divide in the opportunities available to prospective students. The latter sense has greater implications for patterns of participation in particular disciplines and courses, especially professional qualifications for which there is high demand.

Managing university selection and promoting equity of participation are challenges that all institutions face. These challenges are particularly acute however in the case of courses where the number of applications significantly exceeds the number of places available. Distinctions between selective and recruiting courses and institutions become blurred in expanding tertiary systems, where selection decisions are also informed by equity priorities. Not only are all institutions in a sense recruiting for student attributes reflecting good prospects for success, they are also recruiting for students who will improve the diversity of their student population. Institutions need to employ criteria which provide a means for the evaluation and comparison of student attributes consistent with these aims, and which combine to support transparent and justifiable selection decisions. These are in practical terms the principal contemporary dilemmas of university selection.

1.1 University admissions in Australia

Australian universities are supported in their selection of students by centralised admissions agencies across Australian States and Territories. Common tertiary admissions centres were established in Australian states and territories during the 1970s (Pascoe et al., 1997). Australian tertiary admissions agencies predominantly administer domestic applications and offers for the majority of undergraduate courses, and many coursework postgraduate degrees.¹ For undergraduate admissions, all Australian states and territories except Queensland have adopted a common ranking system and nomenclature for admissions as of 2009-2010 known as the Australian Tertiary Admissions Rank, or ATAR. The ATAR is derived from student performance in the senior secondary school curriculum, and is intended to support the reliable evaluation and comparison of student achievement. Prospective students applying for university directly from secondary school are assigned an ATAR, while non-school leaving applicants are assigned an equivalent rank.

ATAR (and their equivalents) are currently derived in the following way:

- In New South Wales and the Australian Capital Territory the ATAR is calculated by the Universities Admissions Centre (UAC) from students' Higher School Certificate marks (HSC);
- In Victoria the ATAR is derived by the Victorian Tertiary Admissions Centre (VTAC) from students' Victorian Certificate of Education (VCE) subject scores;
- The South Australian Tertiary Admissions Centre (SATAC) calculates an ATAR from the South Australian Certificate of Education (SACE) and the Northern Territory Certificate of Education (NTCE);
- The University of Tasmania calculates ATAR for that state from the Tasmanian Certificate of Education (TCE);
- In Western Australia the ATAR is derived by the Tertiary Institutions Service Centre (TISC) from students' Tertiary Entrance Aggregate, TEA (replacing the Tertiary Entrance Score (TES) in 2008); and
- Queensland differs from the other States and Territories in that it does not use a TER. Instead, the Queensland Tertiary Admissions Centre (QTAC) calculates students' Overall Position (OP) rank, based on student's secondary school Subject Achievement Indicators (SAIs), on a scale of one to twenty-five (with the twenty-fifth position the lowest).

Transparency, uniformity and a streamlined application process across institutions are among the benefits of centralised management of university applications and offers. Centrally coordinated application processes in Australia also preserve institutional autonomy in selection decisions, as each university is able to maintain its own admissions policies supported by the services provided by these agencies. Further benefits of this approach include improved reliability and availability of applications and admissions information and simplified application procedures and cost benefits to both institutions and students.

Centralised management of applications and of large-scale quantitative selection measures remain among the strengths of selection frameworks in Australia. A move away from this approach toward institution-based procedures, such as institution-specific admission testing, may have unintended consequences including increasing the costs, labour and complexity associated with the application process (costs that would largely be borne by students).

¹ Applications for coursework postgraduate programs not handled by tertiary admissions centres are managed directly by individual providers, along with admissions for all research higher degrees and the majority of international enrolments. It should also be noted that DEEWR estimate roughly 20% of domestic undergraduate applications are also handled outside of the main admissions process managed by tertiary admissions centres (Department of Education Employment and Workplace Relations (DEEWR), 2008a, p.3).

1.2 University selection and equity of participation in higher education

The challenge of improving equity of participation in higher education is directly linked with the process of selecting for admission, and with efforts to improve prospects for student success. Selecting for student characteristics associated with success at university is important; in part due to the need to ensure that educational opportunities and resources are deployed to best effect, and in part to help ensure that commencing students have reasonable prospects for completing their degree, and do not bear an undue risk of attrition or failure. Planning for university selection also requires consideration of the patterns of participation that any given mix of selection measures will yield. In other words, planning for university selection, engagement and recruitment practices (and even student support services) should be informed not only by the predictive validity of selection criteria for student success at university, but also by the long-term implications of their use for access to and equity of participation in higher education over time.

1.2.1 Selection and student success

Prior academic achievement consistently features among the most reliable predictors in Australian and international studies of success at university.² Indicators of student success typically include first year grade averages, degree program grade average and degree completion rates and times (Birch & Miller, 2005a). Other selection tools, such as tests of aptitude and preparedness, have to varying degrees been found to offer incremental validity as predictors of student success.³ Broader characteristics that have been associated with student success include school type, age, motivational factors, employment patterns, study habits, parents' level of education, eligibility for student income support and the costs of attending university (McKenzie et al., 2004; Birch & Miller, 2005a; Robbins et al., 2006; James et al., 2007). Overall, however, prior academic achievement is consistently identified as the best predictor for future academic success.

An important consideration in selecting for prospects for student success is that selection measures do not serve to perpetuate social disadvantage. Where universities select for only those characteristics which are also correlated with relative social advantage (which is arguably the case when relying largely or solely on rankings derived from senior secondary school grades), they are in effect selecting for students that are already doing well, rather than those that are likely to do well. The difference may appear subtle, but has profound social implications over time. Among the challenges in this area, therefore, is the need to identify selection criteria and practices that are good predictors of student success, without inadvertently selecting also for relative social advantage.

Finally, university selection practices both in Australia and internationally tend to select for a reasonably narrow set of abilities. It is clear however that there are broader student characteristics associated with success in particular disciplines and subject areas. Student selection for medical studies offers a good example.⁴ Students able to cultivate a narrow academic focus at an early age are very likely to feature among the top ranked students in final year secondary school results, however it is not the case that these are by themselves the kind of characteristics indicative of a well-rounded (or even highly specialised) medical practitioner (Pilotto et al., 2007, pp.36-37). In light of this, admissions for medical studies in Australia and

² A summary of Australian studies of the predictive validity of senior secondary school results for university success from Birch and Miller (2005a, p.48) is included here as Appendix III.

³ Incremental validity for the purposes of this report is understood as the capacity for any criterion to predict outcomes over and above the predictive capacity offered by other criteria.

⁴ Significant attention has been given in the health sciences literature to the use and effectiveness of criteria in student selection, particularly in the case of medical studies, from which a number of examples in this paper have been drawn.

internationally have increasingly come to feature the use of a range of selection criteria, with the aim of identifying student characteristics associated with successful professional practice as well as success at university.

1.2.2 Expanding participation and improving equity

Efforts to expand participation in higher education in Australia have been informed by the aim of ensuring that equity of participation features as part of this growth. Equity plans became a feature of the move toward a unified national system during the 1980s (Pascoe, 1999, p.18), and specific aims toward improving equity in higher education were outlined in the 1990s through the *A Fair chance for All* initiative (Dept. of Employment Education and Training & National Board of Employment Education and Training, 1990). While improvements since that time may be mixed (Higher Education Council, 1996; Bradley et al., 2008), imperatives for both expansion of participation and promoting equity in higher education have been given a significant boost in Australia more recently as a result of recommendations of the Review of Australian Higher Education.

Recommendation 2 of the Bradley Review was to set a national target of at least 40 per cent of 25 to 34 year-olds attaining a qualification at bachelor level or above (Bradley et al., 2008, p.21). The Australian Federal Government subsequently adopted this recommendation, to be achieved through a range of measures including a move toward a “demand driven” system for managing Government supported undergraduate places. Under the new arrangements institutions will no longer be allocated a negotiated number of Commonwealth Supported Places, but will instead be funded for as many undergraduate students as they wish to enrol. These and related measures are hoped to result in 217,000 additional graduates with a bachelor degree by 2025 (Australian Government, 2009, p.12).

Recommendation 4 of the Bradley Review was that a national target be set for 20 per cent of higher education enrolments at undergraduate level to be comprised of people from low socio-economic backgrounds by 2020 (Bradley et al., 2008, p.45). This proposal was also adopted by the Australian Federal Government, with the recommended target to be supported through funding for partnership activities and an increased enrolment loading for low SES students (Australian Government, 2009, pp.13-14). Efforts in Australia mirror international trends toward expansion, and policies to improve equity of participation in higher education. However, it is also clear that *diversification* of participation in higher education does not automatically follow from an expansion in the participation base (James, 2007, p.10). Additional measures are required if improvements are to be made in addressing the diversity among students participating in higher education.

1.3 Applications, enrolments and socio-economic status in Australia

Overall there were 249,743 applicants for undergraduate study in 2008-2009. Seventy six percent of these of those (191,068) received an offer of a university place, of which 84% (161,206) were accepted by the student (Department of Education Employment and Workplace Relations (DEEWR), 2009). Overall, 44.3% of offers for undergraduate admission were made on the basis of secondary school results (as illustrated in Table I below).⁵

Table I Undergraduate offers by basis of admission for university type

	Secondary Education	Higher Education Course	Other Basis	TAFE Award Course ⁶	Mature Age Special Entry	Professional Qualification	Not Stated	Total
Group of Eight Member Universities	53.8%	11.1%	4.9%	1.4%	1.4%	0.1%	27.3%	100%
Universities of Technology (ATN plus Swinburne)	48.4%	12.4%	3.5%	5.0%	3.0%	1.1%	26.5%	100%
Innovative Research Member Universities	46.4%	12.6%	8.1%	7.4%	5.5%	0.9%	19.1%	100%
Non Affiliated Metro Universities	36.9%	14.4%	5.1%	6.3%	6.2%	0.1%	31.2%	100%
Former New Generation Member Universities (Metro)	33.8%	9.3%	11.8%	11.3%	8.1%	0.4%	25.1%	100%
Former New Generation Member Universities (Regional)	31.2%	18.8%	9.3%	9.5%	10.6%	3.5%	17.1%	100%
Non Affiliated Regional Universities	25.9%	14.2%	24.3%	9.0%	21.5%	0.4%	4.6%	100%
Overall:	44.3%	12.2%	7.2%	5.9%	5.2%	0.7%	24.5%	100%

From *Undergraduate Applications, Offers and Acceptances, 2009*. Department of Education, Employment and Workplace Relations (DEEWR) 2009 (universities grouped by the Department as per Appendix I).

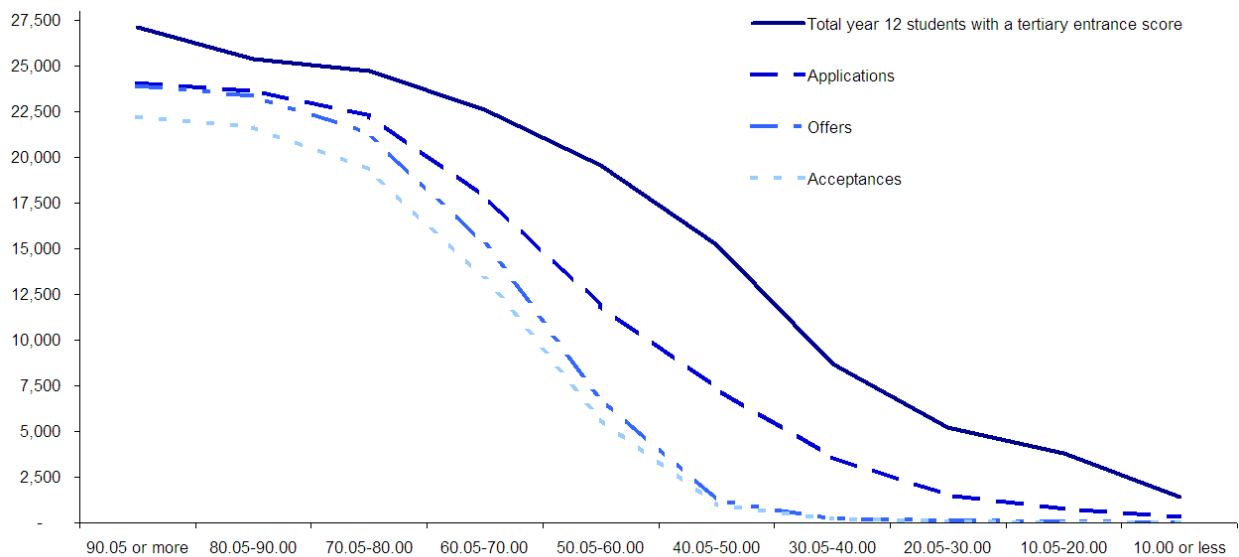
Of year 12 students, 114,296 (or 61%) of 187,489 students under the age of 20 applied for undergraduate admission to a tertiary institution in their own state in 2008-2009.⁷ Propensity to apply for university admission varied by tertiary entrance rank, with application rates dropping off sharply for the middle deciles, as illustrated in Figure I below (Department of Education Employment and Workplace Relations (DEEWR), 2009, pp.58-59).

⁵ In reviewing the 2009 DEEWR applications, offers and admissions data it is important to note limitations including a significant proportion of unavailable or “non-stated” information, and categories which may only be a general reflection of practices or trends in each case. “Non-stated” data for 2008-2009 do not include students applying directly to institutions.

⁶ While 5.9% of 2008-2009 undergraduate offers were made on the basis of TAFE/VTE award courses, 14.5% of applicants reported undertaking prior TAFE /VTE study (see section 2.1.2, p.14).

⁷ Eighty four percent of school students in Australia progress from year 11 to year 12, and close to 70% progress from years 8 to 12 (Australian Bureau of Statistics, 2010, p.31). As of the census date the total number of full time year 12 students enrolled in 2008 was 202,453 (Australian Bureau of Statistics, 2009, p.14).

Figure 1 Undergraduate applications, offers and acceptances for year 12 students under the age of 20 applying in their home state by entrance rank decile (2009)



From *Undergraduate Applications, Offers and Acceptances*, Department of Education Employment and Workplace Relations (DEEWR) (2009).

The undergraduate application rate for medium SES students (defined as the middle 50% of SES bands by postcode) was close to the representative population share in 2008-2009 at 48.7% (as reflected in Table 2 below). Low SES applicants (the lowest 25% SES bands) were under-represented at 18%, and high SES applicants (top 25%) were over-represented relative to their population share at 31.6% (Department of Education Employment and Workplace Relations (DEEWR), 2009).⁸

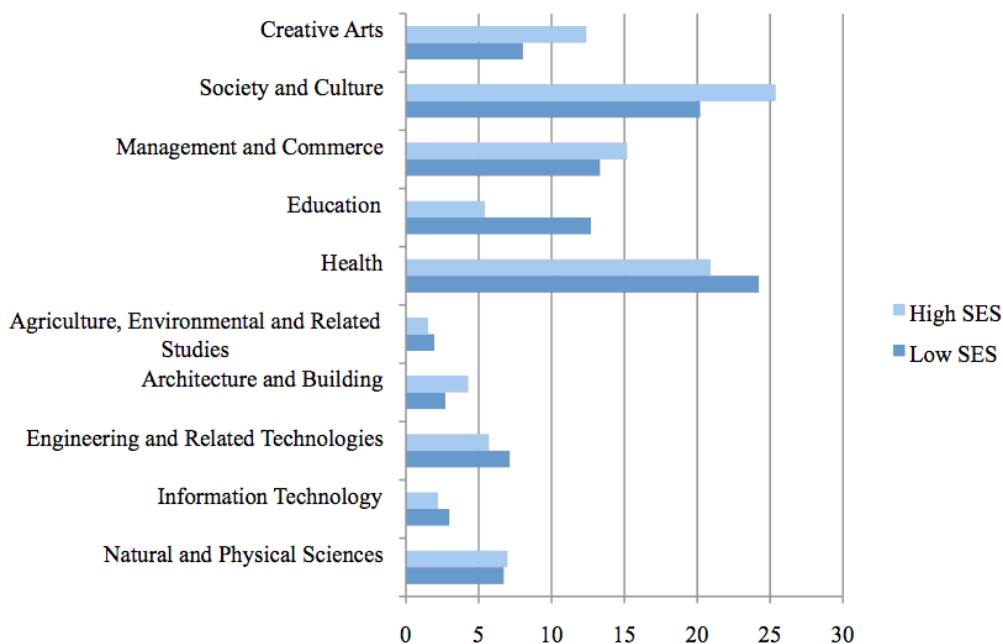
Table 2 Applicants, offers and acceptances by socio-economic status (2009)

	Low SES	Medium SES	High SES
Number of applications	45,028	121,490	78,697
Share of total applications	18.0%	48.7%	31.6%
Number receiving an offer	33,803	92,707	61,684
Offer rate	75.1%	76.3%	78.4%
Number accepting offer	29,030	79,032	51,366
Acceptance rate	85.9%	85.2%	83.3%

From *Undergraduate Applications, Offers and Acceptances*, Department of Education Employment and Workplace Relations (DEEWR) (2009).

⁸ Assuming a quartile-based socio-economic status population share with middle SES defined as the two middle quartiles (50%) and low and high SES defined as the bottom and top quartiles of 25% each. Socio-economic status for 2008-2009 was derived using postcode data (Department of Education Employment and Workplace Relations (DEEWR), 2009, p.52).

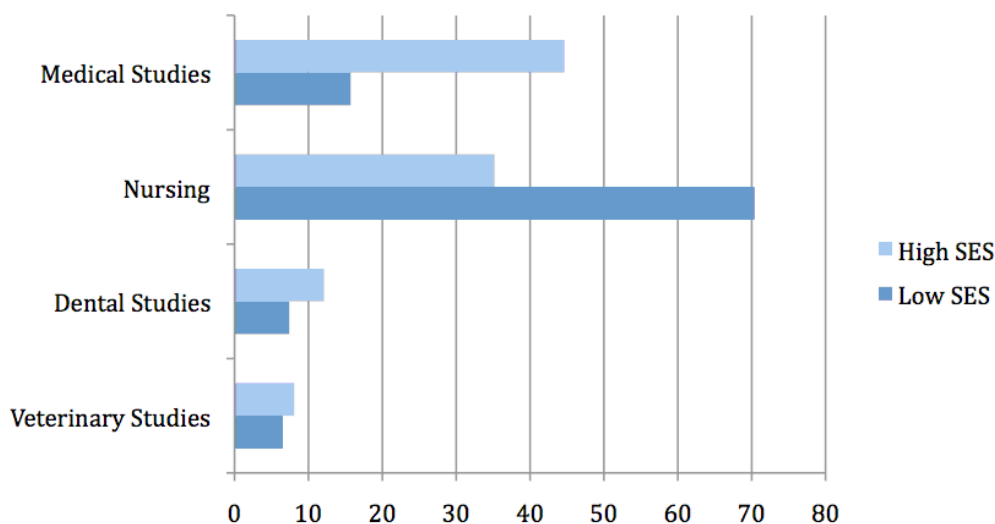
Figure 2 Proportion of low and high SES applicants by selected broad field of education



From *Undergraduate Applications, Offers and Acceptances, 2009*. Department of Education, Employment and Workplace Relations (DEEWR) 2009.

There was some variation in application rates for socio-economic status by discipline, with stronger low-SES application rates in education and health, and a greater proportion of high-SES students applying for creative arts, society and culture, architecture and building, and management and commerce (as illustrated in Figure 2 above). Closer examination of applications for health disciplines by narrow field of education shows a greater proportion of low SES students applying for nursing, and a greater proportion of high SES students applying for medicine (as illustrated in Figure 3 below).

Figure 3 Proportion of high and low SES applications for health disciplines by selected narrow field of education



From *Undergraduate Applications, Offers and Acceptances, 2009*. Department of Education, Employment and Workplace Relations (DEEWR) 2009.

Offer rates for undergraduate admission in 2008-2009 were relatively comparable for high, medium and low socio-economic status applicants, at 78.4%, 76.3% and 75.1% respectively. Acceptance rates by SES were also comparable, at 83.3%, 85.2% and 85.9% (Department of

Education Employment and Workplace Relations (DEEWR), 2009). There was some variation in offer rates for socio-economic status by discipline, with high SES students receiving higher offer rates for information technology, engineering and architecture than low SES students, and the reverse being the case in health (as illustrated in Table 3 below).

Table 3: Undergraduate offer rates for low, medium and high SES applicants by discipline

	Low SES	Medium SES	High SES
Medical Studies	22.6	22.5	21.6
Veterinary Studies	26.4	28.1	33
Dental Studies	28.1	32.5	29.9
Architecture and Building	58.6	63.2	70.5
Law	60.9	62.5	67.3
Health	65.3	64.9	57.5
Creative Arts	66.2	66	67.4
Education	73.0	73.9	74.4
Nursing	73.2	75.2	76.8
Teacher Education	73.5	74.4	75.1
Information Technology	76.2	78.4	87
Management and Commerce	78.2	79.8	82.5
Engineering and Related Technologies	79.8	82.3	88.3
Society and Culture	80.2	82.5	87.6
Agriculture, Environmental and Related	92.9	91.6	101
Natural and Physical Sciences	99.2	103	110.2
Overall	75.1%	76.3%	78.4%

From *Undergraduate Applications, Offers and Acceptances, 2009*. Department of Education, Employment and Workplace Relations (DEEWR) 2009.

Finally, offer rates for SES bands also varied by institution type (as outlined in Table 4 below).⁹

Table 4 Undergraduate offer rates for low, medium and high SES applicants by institution type¹⁰

	Low SES	Medium SES	High SES
Group of Eight Member Universities	63.2	66.3	71.8
Universities of Technology (ATN plus Swinburne)	65.9	68.1	70.4
Non Affiliated Metropolitan Universities	75.8	73.8	79.0
Innovative Research Member Universities	80.0	83.5	92.2
Former New Generation Member Universities - Metropolitan	85.7	90.4	112.2
Former New Generation Member Universities - Regional	86.8	88.5	93.7
Non Affiliated Regional Universities	93.3	91.6	103.2
Overall	75.1%	76.3%	78.4%

From *Undergraduate Applications, Offers and Acceptances, 2009*. Department of Education, Employment and Workplace Relations (DEEWR) 2009.

⁹ In some instances offer rates exceed 100% where the number of offers made exceeds the number of first preference applications for a particular discipline or institution.

¹⁰ Grouping of institutions by type by the Department of Education, Employment and Workplace Relations (DEEWR) is outlined in detail in Appendix I.

Applications for university study begin to decline around the middle deciles of tertiary entrance rank where offer rates are still relatively high, which implies that there are some year 12 students with a tertiary entrance rank that would be very likely to gain admission if they were to apply (particularly in the 60-70 ATAR range), but choose not to do so. Both application and offer rates decline sharply from the 50-60 ATAR range. Taken together, these trends suggest that admitting more students from the middle tertiary entrance rank deciles would require attention to both student selection and student recruitment efforts.

While offer rates and acceptance rates are comparable across socio-economic groups, high SES applicants were over-represented relative to their overall population share, and low SES applicants were under-represented. Targeted strategies will be required for recruiting and selecting low socio-economic status students who have the potential to benefit from and succeed in university if participation targets are to be met. This will require attention to engagement strategies in support of low SES participation, support services to help ensure low SES students have the best chance of success, and selection strategies that assist in identifying ability, preparedness and potential to succeed from among low SES applicants. It also requires ensuring that prevailing practices in university selection do not work against the aims of improving the participation of students from low SES backgrounds.

2 Selection criteria and their use

Both students and educational systems benefit where there is a reasonable degree of alignment between student interests, attributes and the kind of characteristics associated with reasonable prospects for student success. Dimensions of student attributes that feature in student selection include academic preparation, aptitude for university study and broader characteristics associated with success at university. Where equity of participation is also a priority in university selection, students' educational opportunities also feature among the attributes included for consideration.

Academic preparation is a desirable attribute in prospective students for any discipline. Perhaps the most straightforward reflection of academic preparedness is the successful completion of relevant prior academic work. Academic preparation in secondary school is the most obvious example here, but this may also include additional studies, post-secondary, technical and vocational education and university study already completed.

While academic aptitude can be clearly demonstrated through previous academic work, it may also be evaluated by means of admissions tests. The assessment of aptitude for university study has been a central feature of university selection in the United States. Taken by some as a measure of students' innate ability, the assessment of academic aptitude by means of admissions tests has evolved to also reflect aspects of academic preparedness, even if only at the level of the generic academic skills. Standardised subject-based assessment is also becoming increasingly popular in the United States. In the absence of common curricula, subject-based assessment can in many respects reflect aspects of final-year secondary school examinations, and in some cases can more closely resemble tests of preparedness than of aptitude.

There are also broader attributes associated with success at university. These have variously been described in terms of the level of student engagement in study, motivation or an innovative disposition reflected in study, recreation or work. While such characteristics may be reflected in psychometric assessment, they are more commonly assessed in university selection by means of interviews, portfolios, application essays, referee reports and evidence of extra-curricular activities or prior professional experience.

The following sections offer an overview of criteria used in university selection, grouped by the general student characteristics they are employed to assess.

2.1 Assessment of prior academic achievement

Academic preparation is a desirable attribute in prospective students. Perhaps the most straightforward reflection of academic preparedness is the successful completion of prior academic work. Academic preparation in secondary school is the most obvious example here, but this may also include post-secondary, technical and vocational education and university study already completed.

2.1.1 Selection criteria based on secondary school results

University admissions in Australia have largely evolved around matriculation in the final year of secondary school. Historically, secondary school matriculation has been the principal prerequisite for entry into tertiary education, and it is fair to say that for some time performance in senior secondary school has been the best available means of selecting for university. University selection practices, based largely on secondary school performance, changed little from the 1850s through to the 1960s (Cooney, 2001). This means of selection had decreasing utility however where matriculation rates increased relative to the number of university places available. Between the mid-1970s and mid-90s the proportion of final year secondary school students progressing to university rose from roughly 12 to 35 per cent, and in 2008-2009 that figure was close to 40% (Pascoe et al., 1997, p.3; Department of Education Employment and Workplace Relations (DEEWR), 2009).

By far the most widespread selection criterion employed by Australian institutions in selecting school leavers (who comprise the majority of domestic undergraduate applicants) is student performance in senior secondary school subjects relative to others in their cohort. Individual universities decide how secondary school performance factors into selection decisions, and how that fits with their use of other criteria in the general course of admissions and in the case of selecting for particular courses. Merits of the use of metrics based on final year secondary school results include efficiency, transparency, and cost effectiveness. They also have the positive effect of bringing a focus to the academic importance of the senior secondary school years.

Secondary school results as a predictor of university success

Studies of the relationship between rank derived from year 12 results and success at university consistently show a correlation between performance at school and success at university. In this respect, secondary school performance is a good predictor of success at university. Birch and Miller offer an excellent overview of studies from 1975 to 2001, providing an estimated coefficient for the predictive validity of metrics based on final year secondary school results for various measures of success at university.¹¹ Noting variation by subject and discipline, they estimate an overall increase in the range of 0.5 to 1.0 percentage point in first year university grades for each percentage increase in tertiary entrance rank (Birch & Miller, 2006, p.2). As Birch and Miller suggest, the strong predictive power of prior high academic achievement seemingly vindicates the use of secondary school results in university selection (Birch & Miller, 2006, p.3).

A number of studies suggest however that tertiary entrance rank may not be a good predictor across the board. While high entrance rank correlates well with various measures of university success, middle and low entrance rank does not appear to have the same predictive power (Murphy et al., 2001; Dobson & Skuja, 2005, p.55; Birch & Miller, 2006, p.3). Murphy et al (2001) found that while entrance rank over 80 (on a scale of 0 to 99.5) was a good predictor of success at university, and rank below 80 was not. They concluded that “a lower [secondary school] entrance ranking than is sometimes considered appropriate for university is not a

¹¹ A summary of which is included here as Appendix III.

barrier to success” and that “an over-reliance on secondary school performance for selection purposes will exclude many potentially successful applicants” (Murphy et al., 2001, p.14).

In their 2005 study, Birch and Miller found that while tertiary entrance rank was correlated with first year grades, there was also a positive effect for students *below* the entrance rank cut-off threshold (Birch & Miller, 2005a, p.60). They concluded this supports the case for broadening admissions criteria beyond reliance on tertiary entrance rank alone (Birch & Miller, 2005a, p.74). This conclusion was echoed in Birch and Miller’s 2006 study, where they concluded that since lower tertiary entrance ranks are a poor predictor of university success, a composite selection index might be a more effective selection strategy than one based largely or solely on tertiary entrance rank (Birch & Miller, 2006, p.3).

A further consideration in the use of tertiary entrance rank is that while highly ranked secondary school graduates tend to do well at university, secondary school results appear to be a poor predictor for those who do *very well* at university. In Birch and Miller’s 2006 study tertiary entrance rank was poorly correlated with the top fifteen percentiles of first year grades. In other words, on this evidence there appears to be an asymmetric relationship between school and university success: those who do very well at school tend to do well at university, but not all those who do very well at university were among top ranked high school graduates. This led Birch and Miller to observe that while a high tertiary entrance rank may be a good overall predictor of university success (and thus still worthy of inclusion as a means of selection), that tertiary entrance rank by itself may not be the most appropriate means of identifying students who are likely to be the very best academically in the first year of study (as in selection for undergraduate scholarship schemes for example) (Birch & Miller, 2006, p.15).

Finally, the predictive capacity of tertiary entrance rank for success at university diminishes rapidly as students progress through tertiary study. Murphy et al. (2001) found secondary school performance to be a relatively poor predictor of academic performance overall subsequent to the first year of university study. McKenzie et al. also found the strength of the correlation between entrance rank and university grade average drops from 0.42 to 0.23 as early as the second semester of studies (with first semester grades having the closest correlation at .052; McKenzie et al., 2004, p.105). Similar effects have been found in the Kay-Lambkin et al. study of first year medical students (Kay-Lambkin et al., 2002, p.158), and in subsequent years of medical training (Siu & Reiter, 2009, p.769). Murphy et al. offered similar findings, with tertiary entrance rank being poorly correlated with academic improvements in the later years of study, and with prior university performance again being the strongest predictor of success (Murphy et al., 2001, p.13).

Tertiary entrance rank and socio-economic status

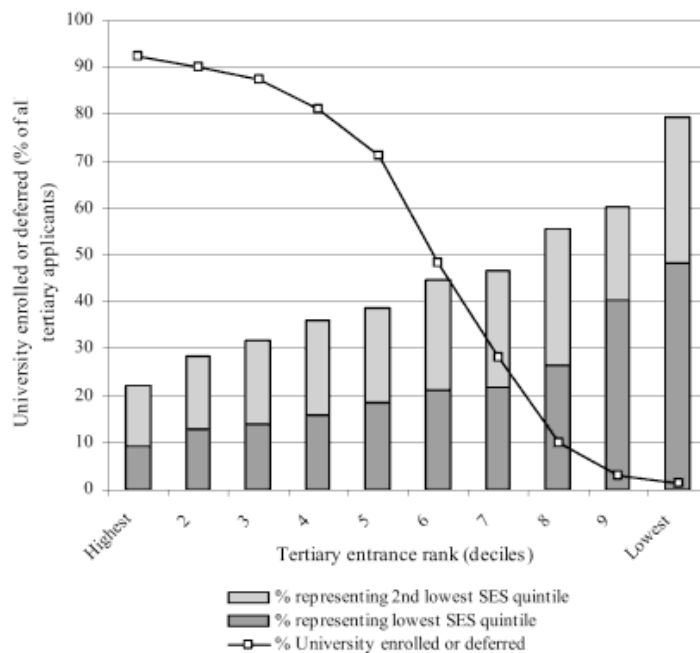
Socio-economic status features among the student characteristics correlated with tertiary entrance rank, as highlighted in Figure 4 below. Rates of year 12 completion, eligibility for a tertiary entrance rank and secondary school performance as reflected in tertiary entrance rank are all positively correlated with socio-economic status (Cardak & Ryan, 2009, p.438). Given this correlation, selection criteria based solely or predominantly on ranked indicators of school achievement will work against efforts to promote diversity of participation over time. They also bring other shortcomings, including their inability to assist in identifying broader attributes such as motivation for study, or aptitude for particular fields (James et al., 2009).

Teese (2007) reported a range of inequalities in school achievement outcomes for students from different social backgrounds and school types. Teese argues that inequalities in higher education participation are inevitable as long as selection procedures are based predominantly on rankings derived from secondary school results. Teese argues that “institutional reliance on score enables a direct communication of social influence. In other words, simply by relying on

an academic measure of student rank, universities filter their intakes along social lines. The more academically selective the university... the more severe the degree of social filtration” (Teese et al., 2007, p.52).

The figure below, drawn from Teese’s 2007 study, shows the proportion of students at each tertiary entrance rank decile drawn from the lowest two SES quintiles. At the highest entrance rank band, less than ten per cent of students come from the poorest families, while such students comprise nearly half of those in the lowest entrance rank band. As expected in a competitive system, university places (depicted here as a line) are heavily skewed towards the upper ENTER bands.

Figure 4 Enrolling in university by general achievement band and social profile of each achievement band (Teese et al., 2007).



While high SES students are more likely to attain high ATARs, when ATAR is held constant, the effect of SES disappears. High and low SES students at the same ATAR band are equally likely to attend university, as illustrated in Figure 5 below (Cardak & Ryan, 2009, p.438).

Figure 5 Socio-economic status and the probability of university participation

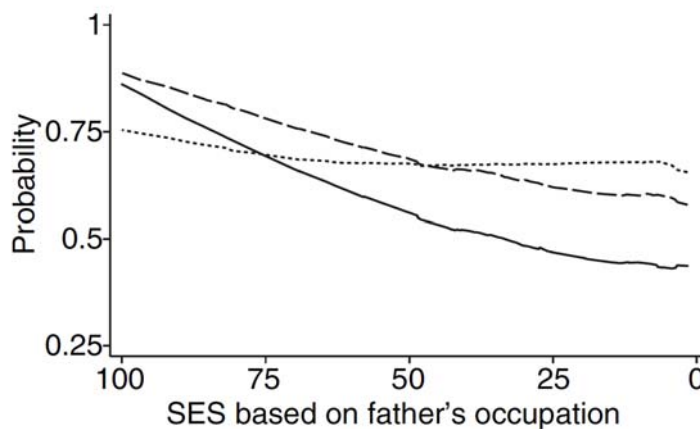


Figure 5 above illustrates the relationship between socio-economic status and university participation. The solid line reflects secondary school graduates’ probability of attending university by socio-economic status; the dashed line shows the same but only for secondary school graduates with a valid entrance rank; the dotted line indicates secondary school graduates’ probability of attending university controlling for secondary school completion and entrance rank (from Cardak & Ryan, 2009, p.437).

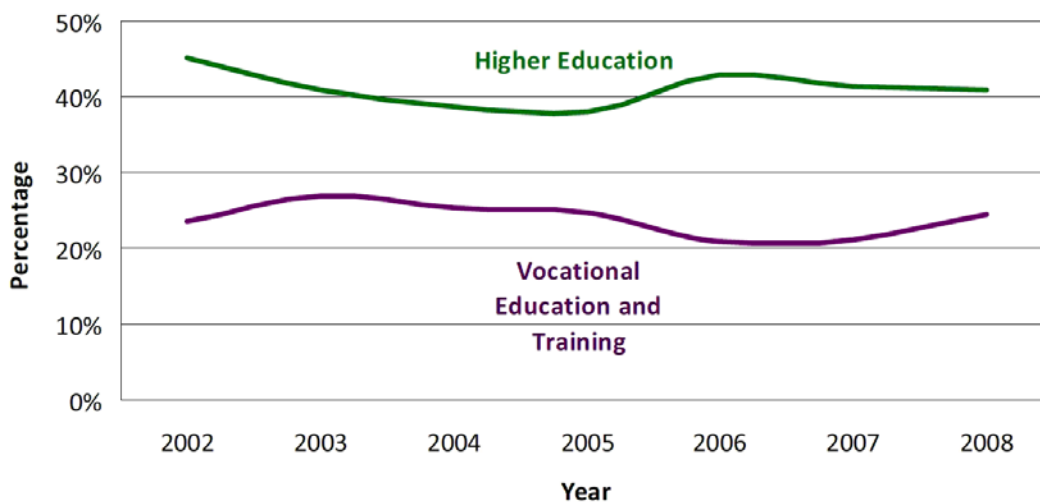
Cardak and Ryan conclude that greater attention to improving early educational outcomes through primary and early secondary school (up to and including year 9) would be among the most effective means of improving eligibility rates among low SES students, which would subsequently be reflected in improved university participation rates (Cardak & Ryan, 2009, p.444).

Strong prior academic achievement remains a good predictor for future academic success, and rank derived from final year secondary school results (as in the case of the Australian Tertiary Admission Rank or ATAR) remain in many respects a good metric for the evaluation and comparison of secondary school academic achievement. The predictive capacity of tertiary entrance rank for success at university is however, uneven. Tertiary entrance rank therefore has variable utility as a selection criterion for university admission where the aim is to select for prospects for student success, and this is particularly the case for students ranked in the low and middle ranges. Tertiary entrance rank also shows a correlation with socio-economic status. This means that reliance on tertiary entrance rank as a criterion for university selection will work against efforts to improve diversity of participation over time, unless additional steps are taken. It is also the case that for the same entrance rank low socio-economic status students perform as well or better at university than their high-socio-economic status peers. There is therefore student potential in the middle and lower bands of tertiary entrance rank that may not otherwise be identified.

The use of criteria supplementary to entrance rank based on final year secondary school results may assist in identifying student potential that might otherwise be missed, and may also yield some improvement in selecting students with good prospects for success from a broader range of backgrounds. An overview of some of these is outlined below.

2.1.2 Prior achievement in technical or vocational education

Figure 6 Proportion of Year 12 completing cohort participating in higher education or VET the following year (2002 - 2008)



Source: ABS Survey of Education and Work (Cat. No. 6227.0), in Department of Education Employment and Workplace Relations (DEEWR) (2009).

While much of the attention around academic achievement centres around the final year of secondary school, prior academic achievement may also be demonstrated through previous technical or vocational education. While participation data for completing year 12 students in Australia suggest an inverse relationship between participation in higher education and vocational education and training (as illustrated in Figure 6 above), TAFE or VET qualifications often form the basis for university admission, and articulation and credit transfer arrangements

may facilitate admission to university degree programs either during or following completion of a VET award. In 2009 14.5% of applicants for undergraduate degree programs had undertaken at least some prior VET study, with 5.9% of offers for admission made on the basis of a completed VET award (DEEWR, 2009).¹²

Some universities' pathway strategies include setting aside places for entrants from TAFE and VET. Effective pathways can also be achieved through recognising qualifications of Certificate 3 or higher as an entry qualification, or through offering course credit for TAFE or VET awards of Certificate 4 and above, where relevant to a given course of study. Course credit is also sometimes available for students applying for university admission who have completed all or part of a technical or vocational qualification (PhillipsKPA, 2006; James et al., 2008, p.65). The development of pathway models linking TAFE and VET with higher education is also the subject of ongoing development (PhillipsKPA, 2010).

Preliminary research suggests that students admitted on the basis of TAFE results perform academically on a par with other members of their cohort, particularly where measures are in place to support the transition to university study during the first year (Wheelahan, 2005; Abbott-Chapman, 2006).

2.1.3 Foundation programs and prior university study

Academic preparedness for university study can also be demonstrated through completion of university foundation, pathway or bridging programs. Most university foundation programs aim to provide a supportive environment where students have the opportunity to develop their academic confidence and the broad-based skills to assist their progress in university study. These can include (Levy & Murray, 2005, p.130):

- critical thinking, problem-solving and effective communication in an academic context;
- effective use of lectures and tutorials;
- effective preparation for examination;
- developing research strategies and essay writing skills;
- understanding academic integrity and referencing; and
- effective engagement with the university library, academic support services and online student resources.

Many of the universities surveyed for the 2008 *Participation and Equity* report provide bridging studies to prepare students for university. Commonly, participants in foundation or bridging programs are able to apply for admission to degree courses on the basis of academic potential demonstrated through such programs (James et al., 2008). Levy and Murray describe the effectiveness of foundation programs in a 2000-2003 study, where 87% of students were offered a university place on completion of such programs. With an aggregate retention rate of 86%, 73% of the students who *commenced* the program ultimately received an offer of a university place (Levy & Murray, 2005, p.133). Outcomes of such programs clearly suggest there are large numbers of students with low entrance rank who are capable of success in tertiary study with the appropriate preparation and support. As Levy and Murray conclude, there appears to be a large and untapped market of such students (Levy & Murray, 2005, p.139).

Foundation, pathway and bridging programs have also proven to be an effective means of recruiting and supporting equity-group students in preparing for university study. Ramsay's 2004 evaluation of a pathway program for adult learners found a high representation of

¹² This figure excludes secondary education courses completed at a TAFE or VET institution.

students reflecting equity-group characteristics, most notably low SES students and students reporting a disability (2004).

The benefits of foundation programs might also be made available to first year undergraduate students, possibly in the form of semester-long topics covering generic competencies associated with university study. These might also incorporate discipline-specific competencies to allow students to test their aptitude for various fields of study, while also providing academic departments an additional means of selecting for talented students subsequent to their commencing university studies. Such options might also form a compulsory component of conditional admissions to university where candidates rank in the lower bands of admissions criteria.

Prior university study has proven to be among the best predictors of success for future study. In 2008-2009 12.2% of offers for undergraduate admission were made on the basis of prior university study (DEEWR, 2009). In a longitudinal study of academic performance at university, Birch and Miller found prior university performance to be a good predictor of continued success (Birch & Miller, 2007b, pp.17-19). This effect is observed in first year success as a predictor of success in later years of study, and even in performance in a single semester as a predictor of success for subsequent semesters (McKenzie et al., 2004). Prior university study can be a particularly useful criterion for admission to courses and disciplines for which there is high demand. While not directly addressing barriers to university entry, employing prior university study as a criterion can support diversity of participation through offering additional pathways to high demand courses. Its capacity as a very good predictor of student success should also be of interest for high demand courses for which there is also a high cost per place.

2.2 Assessment of aptitude and preparedness

While academic aptitude can be demonstrated through strong performance in previous academic work, it may also be evaluated by means of formal assessment. The assessment of aptitude for university study has been a central feature of university selection in the United States. Taken by some as a measure of students' innate ability, the assessment of academic aptitude by means of tests has evolved to also reflect aspects of academic preparedness, even if only at the level of the generic academic skills. Standardised subject-based assessment is also becoming increasingly popular in the United States. In the absence of common curricula, subject-based assessment can in many respects reflect aspects of final-year secondary school examinations, and in some cases can more closely resemble tests of preparedness than of aptitude. A range of tests of aptitude and achievement are in use in Australia and internationally; a brief outline of some of the more prominent examples is included below.

Tests of aptitude and achievement in the United States

The distinction between assessment of aptitude and of achievement is not a straightforward one. Tests of aptitude are perhaps best characterised as an attempt to gauge students' general analytic ability, as opposed to their mastery or level of preparedness on specific subject matter (Atkinson & Geiser, 2009, p.666). Measures like the Scholastic Achievement Test (SAT) entail multiple-choice examinations with the aim of assessing both knowledge and reasoning. The SAT Reasoning Test is designed to derive a measure of students' critical thinking ability, and is the most widely used admissions test in the US. Testing for *achievement* (as opposed to *aptitude*) came to prominence in the US in 1959 with the introduction of the American College Testing Program (ACT) test. Achievement tests like the ACT are designed to assess students' preparedness for higher education, testing the level of skills in English, mathematics and science. The rationale behind achievement tests is clearly informed by the aim of assessing the *preparedness* of prospective students based on the kinds of knowledge and activities they will be expected to continue to develop at university (Baron & Norman, 1992, p.1054).

Perhaps in response to increasing recognition of the merits of achievement tests like the ACT, aptitude tests (most notably the SAT) have evolved to include subject-based components (in the form of SAT Subject tests). These, used in conjunction with information such as secondary school grades and broader criteria, are used by many US universities for admissions and for the purposes of subject selection. The curricular focus of subject tests is reflected in the advice of popular test-preparatory services in the US, who advise that the most effective way to prepare for such exams is through coursework relevant to the discipline and subject area (Atkinson & Geiser, 2009, p.669). Services marketed to support students to perform well on subject tests more closely resemble subject-based tutoring than the kind of test-and-repeat coaching typical of "prep" services like Kaplan and Princeton Review in the US, whose main business is coaching students to perform well on generic tests, often with questionable academic benefit, and at considerable expense to students.

The Special Tertiary Admissions Test (STAT)

The Special Tertiary Admissions Test (STAT) is increasingly used as part of the suite of selection measures employed in Australia and internationally. The STAT and comparable tests are in use in a range of countries including Canada, Ireland, Portugal, the Netherlands and Australia (Coates & Friedman, 2010). The STAT, first introduced in Australia 1992, comprises multiple choice and written components, and is a common tool for facilitating mature-age student entry pathways (i.e. for applicants who do not apply directly from secondary school). Since 1996 the STAT has been widely administered in Australia as a selection tool by Australian tertiary admission centres in cases where applicants are defined as mature age (usually over 21 years). The STAT is also increasingly being used as an assessment tool

supplementary to final year secondary school results for school-leaving age applicants. Of approximately 13,000 candidates who took STAT in 2006–07 more than half were aged under 25 years (Coates & Friedman, 2010). While aspects of the STAT resemble aptitude assessment, the test is closer in nature to those increasingly being employed in the US and elsewhere that measure both aptitude and preparedness.

The General Achievement Test (GAT)

The General Achievement Test (GAT), conducted by the Victorian Curriculum and Assessment Authority (VCAA), is taken by all VCE and IB students. The GAT assesses skills in written communication; mathematics, science and technology; and humanities, the arts and social sciences. The test is not included as part of overall VCE assessment, but is used in statistical moderation for school-based assessment, checking examination marking, and to generate Derived Examination Scores in cases where students report illness or are otherwise demonstrably disadvantaged in VCE examinations.

uniTEST

uniTEST, developed by ACER together with Cambridge Assessment, has been designed to aid universities in selection by assessing discipline-specific skills in mathematics and sciences, and in the humanities and social sciences. uniTEST is promoted as a tool for improving equity by minimising the effects of unequal school outcomes (ACER and Cambridge Assessment, 2006).

Entrance examinations

Entrance examinations are one means of evaluating preparedness (and to a lesser extent aptitude) for university study, and are a feature of some higher education systems internationally. Entrance exams may be employed as the sole means of selection for university admission, or may be given weighted consideration along side other criteria such as secondary school grade point average (as is the case of university admissions in Spain for example) (Helms, 2008). Typically, entrance examinations are centrally administered by admissions agencies (as is the case in China, Iran, Spain and Turkey). Admissions examinations arguably have the greatest utility where high school participation rates are low or uneven, or in nations where university admissions are particularly prone to corruption.

Entrance examinations do however create strong incentives for ‘niche’ preparation and narrowly targeted coaching focussed on specific test requirements, especially where there is a poor fit between senior secondary school curricula and the particular demands of entrance examinations (as demonstrated in particular in Japan, Brazil, Iran and India (Helms, 2008, p.26)). Many nations are now moving away from entrance exams in favour of “leaving exams” held in the final year of secondary school (Helms, 2008, p.33).

2.2.1 Equity and validity in admissions testing

Geiser (2009) argues that while the widespread use of the SAT in the United States has to a large extent been buoyed by meritocratic assumptions, SAT results themselves have proven a relatively poor predictor of student performance at university, and have done more to detract from than contribute to diversity of participation. Geiser and Santelices found the SAT compared poorly as a predictor of success relative to other measures such as the SATII subject tests and secondary school grades (Geiser & Santelices, 2007). They concluded that the SAT reasoning test was “consistently inferior” to the SATII subject tests as an indicator of performance (Atkinson & Geiser, 2009, p.667). They observed that school grades in the US are mistakenly assumed by many to be a less reliable indicator of academic potential than the SAT due to variation in school grading practices. However SAT scores are based on a single sitting of three to four hours, whereas high-school GPA is based on repeated sampling of

student performance over several years, consistent with the notion that prior performance in such activities would be indicative of later performance (Geiser, 2009).

The National Center for Fair & Open Testing in the United States (FairTest) has for some time raised concerns that the SAT by its nature has an exclusionary effect, in particular for minority and low-income groups (The National Center for Fair & Open Testing, 2007). FairTest is a non-profit organisation that has among its aims to advocate for assessment measures that are valid and fair, and “provide equal opportunity to measure what students know and can do, without bias against individuals on the bases of race, ethnicity, gender, income level, disability, or limited English proficiency status” (The National Center for Fair & Open Testing, 2010). Views of groups such as FairTest have been corroborated by research by Saul Geiser and others, challenging long-held beliefs about the SAT’s capacity to identify high-ability students from disadvantaged backgrounds, and to promote greater equity in college admissions in the United States. Geiser and Santelices (2007) found performance on the SAT to be more closely correlated with socio-economic status than other indicators. This means that selection with an emphasis on SAT performance would be matched by decreased diversity in the student population over time, in the absence of additional efforts effective in ameliorating that effect. For example, when applicants to the University of California system were rank-ordered by SAT scores, roughly half as many Latino, African-American, and American-Indian students appeared in the top third of the applicant pool than when the same students were ranked by high-school grades (Geiser, 2009).

There are concerns in the United States regarding the dominant role of admissions testing in university selection, and the range of adverse effects that it brings. Among these are concerns regarding test preparation activities, the educational merit surrounding the use of tests and increasing concerns around adverse equity implications associated with the widespread reliance on tests like the SAT in particular in university admissions, and their impact on the participation of minority and low income groups in higher education over time (Atkinson & Geiser, 2009). Students in the United States often regard SAT’s as arcane and unfair. They commonly reflect on the dissonance between SAT test outcomes and secondary school performance (typically reflected in cumulative grade point average), the unfair bias created by variations in students’ test taking skills, and the positive advantages gained by students who have the resources to undertake costly preparatory courses external to their secondary school curriculum.

In noting these concerns, it is also important not to dismiss the lessons learned as a result of developments in university selection in the United States, particularly in the last 20 years. In concluding their review of university admissions in the United States, Atkinson and Geiser outlined some of the features of selection frameworks they saw as desirable (Atkinson & Geiser, 2009, p.672) including that:

- Admissions tests should be criterion referenced rather than norm referenced (the primary consideration should not be how an applicant compares with others but whether he or she demonstrates sufficient preparedness to benefit from and succeed in university study);
- Admissions tests should have diagnostic utility: rather than a number or a percentile rank, tests should provide students with curriculum-related information about areas of strength and areas where they need to devote more study;
- Admissions tests should exhibit not only predictive validity but face validity: the relationship between the knowledge and skills being tested and those needed for university should be transparent;

- Admissions tests should be aligned with college preparatory coursework: assessments should be linked as closely as possible to materials that students encounter in the classroom and should reinforce teaching and learning of a rigorous academic curriculum in senior secondary school;
- Admissions tests should minimise the need for test preparation (and “test prep” services): admissions tests should be designed to reward mastery of curriculum content over simply assessing test-taking skills; and
- Admissions tests should signal to students that working hard and mastering academic subjects in high school is the most direct route to university.

Taken together, such concerns pose critical challenges regarding the role and efficacy of tests of aptitude and ability in university selection, while also identifying positive aspects of their use. In this and in other respects, the use of the SAT in the United States has become somewhat of a paradox. While informed by meritorious aims of identifying ability regardless of background, US studies suggest that the SAT adds incremental validity at best, but by itself appears to be a relatively poor predictor of performance. SAT results are also closely correlated with socio-economic status: its use seems to detract from the goal of promoting diversity of participation rather than supporting it. The use of tests in a sense can be seen to compensate for variability in schooling standards in the United States and the absence (in many cases) of common secondary school curricula. There is also a signalling effect in the use of selection measures, and this appears to be particularly the case in the use of admissions tests. Regardless of how “generic” the assessment of aptitude is, the incentives to prepare for, and in particular, “teach to the test” appear to be irresistible.

A recently published five-year pilot study of the use of the SAT in the UK also casts a shadow over its use. While the study found the SAT does have some predictive power in the absence of secondary school results, the study found that it does not offer any significant incremental validity over and above either the UK General Certificate of Secondary Education (GCSE) or GCSE A levels (Kirkup et al., 2010, p.49).

By contrast, there is evidence from the UK and Australia to suggest that other instruments, such as the STAT or uniTEST, may in fact offer students from under-represented groups opportunities for university entry they might otherwise be denied. Against a background of a reliance on rank derived from senior secondary school results, there does appear a *prima facie* argument for using such measures in support of promoting equity of participation, and for employing every available means for identifying prospects for student success. There is evidence to suggest that instruments like uniTEST and the STAT are able to reveal academic potential in candidates that have performed less well in their senior secondary results, and that these tests do add incremental predictive validity when used in conjunction with other measures (ACER and Cambridge Assessment, 2006, p.3; Coates & Friedman, 2010). Similar evidence of predictive validity has been found among discipline-specific tests such as the GAMSAT (Coates, 2008).

In the United States, concerns regarding the predominance of admissions tests, the impact of their use on equity of participation and aspects of their predictive validity has prompted greater attention to senior secondary school results as a criterion for university entry. Paradoxically, the reverse seems to be the case in countries like Australia, for precisely the same reasons. When it comes to the use of admissions tests, the experience in the United States is in some respects the opposite of that in Australia. Where Australian selection practices may suffer from an undue reliance on performance in the final year of secondary school, arguably the United States might envy the robust, efficient and transparent way in

which Australian tertiary admissions centres support a tertiary entrance rank supported by a common year 12 curriculum. Conversely, while some critics in the United States are increasingly questioning the dominance of admissions testing, there remains scope to broaden their use in Australia. An ironic aspect of the divergence of views on the relative merits of testing and school performance is that both are justified by the same concerns which are in fact central to the use of any criteria in university selection: the predictive validity of selection measures and their impact on the diversity of participation in higher education.

Care should be taken in drawing conclusions on the merits of admissions testing, as it may well be the case that the aims of doing so may be sound (and equitable), but that those aims may in fact be poorly served by the tests that have been used. Care should also be taken in drawing conclusions from the experience of selection in the United States more broadly. There are areas in which the US is looking to advance where Australia has already been proficient for some time, in particular in regard to a common senior secondary school curriculum. In this respect it is important to build on what has already been achieved in Australian education, and not forgo advantages already in place for the sake of simply emulating other systems. On the final analysis, the use of any criterion in selection needs to be justified on its own merits.

2.3 Assessing broader attributes associated with university success

While rank derived from final year secondary school results remains the most prominent criterion employed in university selection in Australia, broader means of selection have also been used for some time (Pascoe et al., 1997, p.5). This is also the case in the United States, where although admissions testing continues to play a dominant role, selection measures there are increasingly incorporating a broad suite of criteria (Andrich & Mercer, 1997; University of California, 2010b).¹³ In cases where the pool of qualified candidates who could benefit from and succeed in a particular program is larger than can be accommodated, Atkinson and Geiser note that a broader field of student characteristics is instrumental in being able to “craft a class” based on more than one kind of characteristic, ability or indicator (Atkinson & Geiser, 2009, pp.672-673). Assessing a broader range of attributes is also instrumental in identifying ability and potential to succeed that might otherwise be missed.

Broadening the scope of selection invites a broader view of indicators of potential for student success. Notable talents and skills, leadership and community service, social and cultural diversity not only feature among factors associated with success at university, they also feature among those associated with desirable characteristics for a student cohort. Personal characteristics are also associated with desirable graduate outcomes. Borrowing an example from medical studies, stress and dissatisfaction among graduate practitioners appears unrelated to either academic aptitude or achievement (McManus et al., 2003). While characteristics like propensity to choose rural practice on graduation may or may not be a predictor of success while at university, they are certainly an important factor in responding to contemporary demands faced by the medical profession (Department of Education Employment and Workplace Relations (DEEWR), 2008b, pp.53-54). Finally, assessing a broader range of student characteristics provides scope for evaluating and comparing applicants on their potential “fit” for particular courses of study.

2.3.1 Assessment of personal characteristics

Dispositional aspects have been held to play an important role in supporting success at university (McKenzie et al., 2004), and can include characteristics such as confidence in an academic setting, goal-directed strategic ability and appreciation of challenging tasks (Haigh et al., 2007). Academic self-efficacy and achievement motivation have also been found to play a significant role as predictors of success (Robbins et al., 2004). Preliminary studies suggest that motivational and academic-specific measures such as conscientiousness, academic discipline and commitment to study are the best predictors of this type, along with other measures of motivation, self-management, social engagement and study skills behaviours (McKenzie et al., 2004, p.108; Robbins et al., 2006, p.614).

While measures of conscientiousness in particular have been found to be related to academic performance (Ferguson et al., 2000, p.337; Ferguson et al., 2003, p.430; Poropat, 2009, p.330), the predictive validity of available measures of personal characteristics still compares poorly against prior academic achievement as a selection criterion (McManus et al., 2005; Thomas et al., 2007; Adebayo, 2008). Nevertheless, there is evidence that standardised assessment of academic discipline and motivational characteristics add incremental validity to academic achievement criteria in the same manner as tests of academic preparedness or aptitude (Robbins et al., 2006). Further research is needed to distinguish the incremental validity of the different forms of standardised assessment. Such research would seem justified given the need for reliable predictors of student success, particularly in selection among students without a reliable indicator of prior academic achievement (as in the case of non-school leaver applicants, for example).

¹³ An example of some of the criteria employed by the University of California is included here as Appendix II.

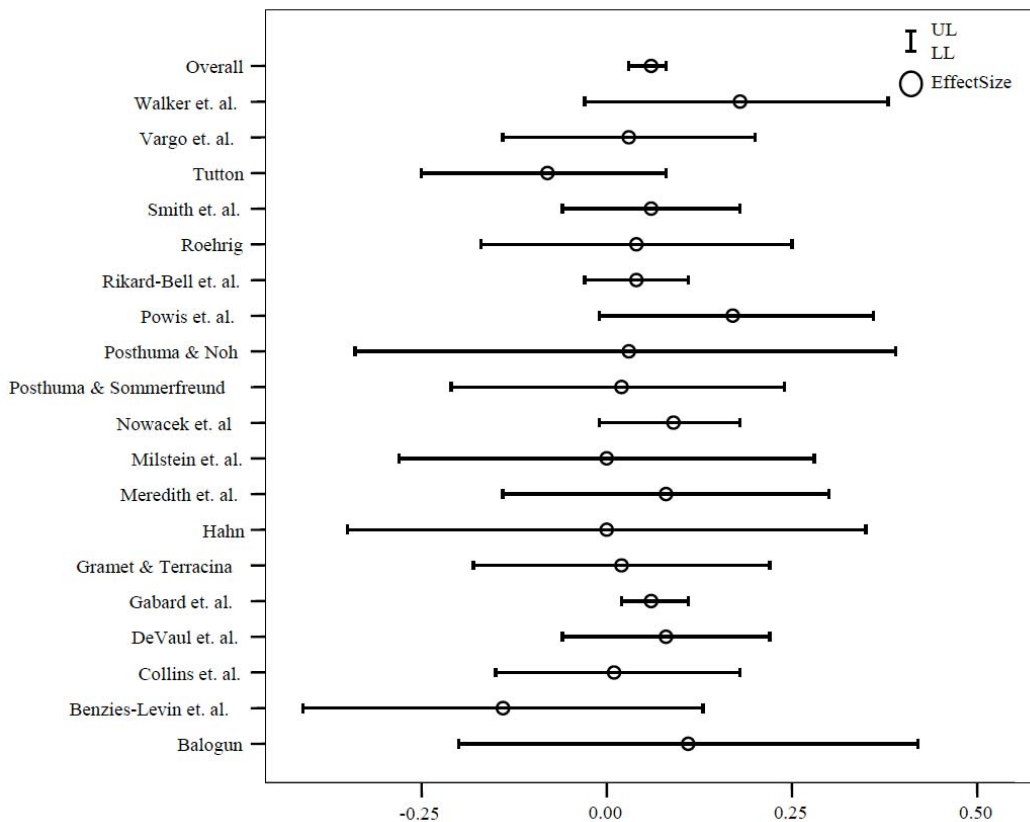
2.3.2 Interviews, portfolios and recommendation criteria

While personal characteristics may be reflected in psychometric assessment, they are more commonly assessed in university selection by means of interviews, portfolios, application essays, referee reports and evidence of extra-curricular activities. Selection practices for many courses include interviews, letters of recommendation, auditions and other evidence of aptitude, achievement or motivation demonstrated through various means, as appropriate to the discipline in each case.

Interviews

Interviews are a common means of evaluating characteristics of prospective students that may not be reflected in other criteria. However, while a common feature of admissions for many courses, evidence as to the efficacy of interviews as a means of selection for admission appears to be mixed. For example, selection interviews have been found to have only negligible efficacy in predicting academic success in healthcare disciplines (as illustrated in Figure 7 below). Interviews often feature among selection criteria for medical studies, and certainly play a significant role in selection decisions for medical studies in the United States (Albanese et al., 2003, p.314). Overall however student interviews compare poorly with other criteria as a predictor of student success (Siu & Reiter, 2009, pp.762-763). While structured interviews and short-interview series do have better inter-rater reliability than unstructured interviews, they do not offer much improvement in predictive validity over un-structured interviews (Albanese et al., 2003, p.315; Goho & Blackman, 2006, p.335; Siu & Reiter, 2009, pp.761-762).

Figure 7 Effectiveness of interviews in predicting academic success in healthcare disciplines (Goho and Blackman, 2006).



Effect sizes for studies investigating the effectiveness of interviews in predicting academic success in healthcare disciplines (with 95% confidence intervals) (from Goho and Blackman, 2006).

Interviews are also among selection tools prone to corruption through coaching, and prone to bias in selection (Albanese et al., 2003, p.318). While interviews have been used as a means of identifying potential among under-represented students (James et al., 2009, p.12), there is also evidence to suggest that interview performance may itself be correlated with socio-economic status (Pascoe et al., 1997, p.30).

On the positive side, while selection interviews have been found to have only negligible efficacy in predicting academic success, they have been found to offer better predictive validity for subsequent graduate outcomes. Drawing evidence again from research in the health care disciplines, selection interviews do appear to have some capacity for predicting subsequent success in clinical practice (Goho & Blackman, 2006, p.335). Further research is needed to establish if this effect is also generalisable to other disciplines, but it does at least highlight that university selection is about more than just academic success; it also plays an important role in selecting for the kind of characteristics associated with desirable graduate outcomes.

Other positive features of the use of interviews in selection include that they can comprise a valuable part of admissions procedures in allowing students an opportunity to familiarise themselves with aspects of the environment and academic community they hope to join, in effect performing an adjunct induction and orientation role for students. Interviews may also be useful for institutions in allowing an opportunity for a qualitative, interpersonal evaluation of the students from which their commencing cohorts are drawn.

Admissions essays and personal statements

Admissions essays and personal statements are in many respects comparable to admissions interviews, in allowing prospective students an opportunity to demonstrate their motivation, highlight past achievements and offer a qualitative account of their potential “fit” for the course and institution of choice. Also much like interviews, personal statements are potentially useful in enabling the evaluation and comparison of personal characteristics which may not otherwise be apparent in other criteria. While sharing some of the strengths of interviews, admissions essays and personal statements also have particular limitations as criteria for university selection.

While the amount of information contained in personal statements appears to have some predictive validity (Ferguson et al., 2003, p.430), such a measure seems equally prone to students “padding” their statements with additional information regardless of veracity or relevance. Personal statements are also among those criteria that are coachable: performance on this measure can be improved with the support of professional coaching (Papadakis & Wofsy, 2010, p.128), therefore confounding its reliability as a means of evaluating and comparing student characteristics. Further, personal statements are prone to the inclusion of false or plagiarised information (Papadakis & Wofsy, 2010, pp.128-129). Finally, and perhaps most importantly, personal statements have been found in numerous studies to be a poor predictor of success at university (Ferguson et al., 2000; Ferguson et al., 2002; McManus et al., 2003; Siu & Reiter, 2009).

Admissions essays and personal statements do provide an opportunity for prospective students to demonstrate their motivation and suitability for their preferred course of study, and also allow institutions another qualitative means of evaluating and comparing student characteristics. Much of the merit in these criteria appears to lie in that they require clear and cogent written expression as part of the selection process. They may also perhaps confirm in the minds of applicants that writing tasks may indeed be a regular feature of their future studies. Further, where students approach these tasks in earnest, they can perform a valuable function in helping students conceptualise their prospective course of study in positive and constructive terms, while also allowing institutions a qualitative insight into the expectations and aspirations students associate with their programs.

Recommendations and referees

Referees and letters of recommendation have been employed as an alternative means of selection to aid in identifying potential among students from educationally disadvantaged backgrounds. They potentially support an additional means of evaluating and comparing student characteristics that might not be apparent in other criteria. While teacher recommendations in particular show some promise in highlighting student potential, the use of such criteria also brings with it a number of shortcomings.

There are numerous examples of the incorporation of teacher recommendations into selection processes internationally. In Australia, some universities have employed teacher recommendation programs in selecting students from secondary schools with low rates of participation in higher education (James et al., 2009). Outcomes from such programs can include assisting in improving the proportion of low socio-economic enrolments (James et al., 2008, p.63).

However, it may also be the case that propensity to secure convincing referee reports may itself be closely correlated with socio-economic status. High SES applicants are more likely able to secure convincing letters of recommendation through social networks than their low SES peers. Letters of recommendation are also prone to interference, and there is evidence to suggest that student involvement in the preparation of letters of support is widespread, particularly where included among selection criteria for competitive courses (Albanese et al., 2003, p.32). Finally, while they do offer students another opportunity to demonstrate potential to succeed, studies of the use of referees and recommendations as selection criteria show that they are a poor predictor of success at university (Ferguson et al., 2003, p.429; Siu & Reiter, 2009, p.763).

Portfolios and other evidence of prior achievement and experience

Portfolios have been employed as an assessment tool for some time, and are increasingly also featuring among criteria for university admission (Smith & Tillema, 2003). Portfolios allow students an opportunity to demonstrate aptitude and achievement through examples of prior academic and non-academic work. Portfolio entry is commonly employed in admissions for creative disciplines, journalism and where additional information may be compiled as evidence of aptitude and experience relevant to particular disciplines. Portfolio evidence has also been employed as a supplementary means of identifying potential among students from under-represented groups (George et al., 2005, p.142). While portfolios may include work completed as part of previous study, their principal benefit lies in supporting the evaluation of student characteristics demonstrated through prior achievement in addition to that reflected in formal assessment.

There is positive evidence of the predictive validity of portfolios in university admissions. O'Donoghue found portfolio score in admissions for art college was positively and significantly related to first year performance (2009, p.97). The four-year study found admission portfolios offered incremental validity to senior secondary results, accounting for 15.5% of variance in first year marks (O'Donoghue, 2009, pp.91-96). Dodge (2008) found a stronger effect in the use of portfolios for graduate admissions across a broad range of disciplines, where portfolio scores were in fact able to predict first year success equally as well as graduate admissions examination results and cumulative grade point average (Dodge, 2008).

George et al. identified a range of benefits in the use of portfolios in university selection (2005, p.146), including that they:

- Facilitate the evaluation and comparison of characteristics such as motivation, independence, time-management and enthusiasm for the program of study;
- Encourage students to consider career pathways available through the program of study;
- Allow students to demonstrate a wide range of prior achievement and learning experiences relevant to the program including through community-based and industry-related activities;
- Include for consideration any fully or partially completed prior study;
- Require no additional examination or assessment;
- Can be a particularly effective “safety net” for students without a senior secondary qualification;
- Can be employed as a supplement to senior secondary results; and
- Can be employed in selection in a rigorous, coherent and defensible manner, informed by the student characteristics and graduate outcomes specific to the particular course, context and institution.

Trials of the use of portfolios as part of special entry schemes for schools with low higher education participation rates have also shown positive outcomes. For example, George et al. found that while only twenty four percent of students registered for their trial completed portfolio applications, all of the completed applications were successful as the basis for university admission (64% on the strength of the portfolio application alone, and 36% as a supplement to senior secondary results) (George et al., 2005, p.147).

Portfolio admissions are a formalised means for applicants to demonstrate prior personal or professional experience relevant to their intended course of study, and in some respects may be considered an extension of professional qualifications as the basis for admission.¹⁴ In this respect they represent a form of admissions criterion that has been around for some time. The additional benefits they bring include allowing students to demonstrate aptitude, motivation and preparedness for study through drawing evidence from a broader range of endeavours, in a more structured manner. Portfolio applications also support students in demonstrating the relevance of their skills and experience for the requirements of their intended course of study.

¹⁴ Professional qualifications accounted for 0.7% of bases for admission among undergraduate offers in 2009 (Department of Education Employment and Workplace Relations (DEEWR), 2009).

2.4 Student equity in university selection

There are other student attributes that need to be taken into consideration in university selection, and these may be broadly understood as those reflecting prospective students' educational opportunities. University selection practices internationally often include for consideration of student characteristics associated with economic, social or educational disadvantage. Admission thresholds on entrance examinations are adjusted for disadvantaged groups in China and Iran for example (Helms, 2008). In Australia, Federal Government subsidy for the costs of undergraduate education and the provision of a deferred contribution scheme for student fees combine with student income support to help mitigate financial barriers to participation in higher education. When it comes to university selection, educational opportunities prior to university admission are also an important consideration.

Understanding prospective students as having the means to participate and succeed at university extends beyond financial means, and include those characteristics typically associated with educational disadvantage. If opportunity to participate in higher education is to be equally available to all, then universities cannot ignore those characteristics that reflect relative disadvantage, and this certainly extends to the criteria and practices of university selection.

2.4.1 Special entry programs

Compensatory processes in student recruitment and selection will always be necessary to reduce social inequalities. Special entry programs are one means of achieving this. Often such programs employ eligibility criteria based on demographic characteristics. Special entry programs employ a range of strategies, including, for example, those aimed at addressing the adverse effects of rurality, or through identifying schools with a high proportion of low socio-economic enrolments or low higher education participation rates (James et al., 2009).

Students reflecting low socio-economic status perform equally well once they enter university, and have equal prospects for course completion (Marks, 2007). Students admitted through special entry programs have rates of retention and success that are broadly comparable to those of other students. There is scope to diversify and expand such programs, providing also that patterns of academic achievement are monitored, and appropriate support measures are in place to ensure students are able to make the most of the educational opportunities available to them.

2.4.2 School-based and school rank selection strategies

In their study of secondary schooling, tertiary entrance rank and university performance, Dobson and Skuja (2005) found that students from State and Catholic schools, while overall often achieving lower tertiary entrance rank than their peers from more selective or "elite" schools, actually tend to out-perform those students with comparable entrance rank once at university. Similar evidence of a "schooling effect" had been found by other researchers both in Australia and in the UK (Marks et al., 2001, pp.58-59; Win & Miller, 2005, p.5; Birch & Miller, 2007a, p.5; Ogg et al., 2009, p.795; Kirkup et al., 2010, pp.27-28). Dobson and Skuja concluded that in light of this effect, consideration should be given to the creation of a new equity category based on school type (2005, p.61). Many universities in practice already compensate for this effect to some extent, through adding tertiary entrance rank "bonus points" for applicants from schools deemed relatively less advantaged, or those with a high proportion of students reflecting low socio-economic status (James et al., 2008). School based bonus point strategies can be an effective means of supporting the participation of disadvantaged and under-represented groups.

Technically a measure of prior academic achievement, demonstrable relative improvement in school grades is also arguably an indicator of broader characteristics such as improved proficiency in study-related skills or in motivation to study. Marked performance on this criterion implies improvement from a relatively low base, and is therefore a potentially useful means of selecting for both educational disadvantage and motivation to study.

Another means of compensating for the unequal distribution of student characteristics across schools is through employing a “class rank” selection criterion. Here consideration is given to the performance of students relative to that of their peers from the same school. While *prima facie* another means of selection based on secondary school performance, “class rank” models are in effect a means of compensating for relative educational disadvantage. While perhaps more appropriately referred to as a “school rank”, adopting a “class rank” model entails including performance *within* secondary school cohorts as a selection criterion.

Performance indices employed in class rank models may be based on tertiary entrance rank, secondary school grade average or performance on tests of aptitude and preparedness (or even a combination thereof). Cohort comparisons could be made by comparing individual scores with those of all applicants from the same school, or by comparing each score against individual school averages (Espenshade et al., 2005). Class rank is typically assessed on coursework grade average in the final 2 years of secondary school, but may also include for consideration performance in earlier years of secondary school (as is the case at the University of California) which considers the equivalent of both year 9 and year 12 grade averages (University of California, 2010b).

Class rank selection strategies have become a prominent feature of university admissions in the United States. In the State of California, class-rank strategies were proposed on a widespread basis as early as 1960 (University of California, 2010b). The early California model outlined the equivalent of a state-wide class-rank program, describing tiered admissions pools where the top 12.5% of any secondary school graduating class would be offered a place somewhere in the UC system, and the top 33.3% offered a place at California State University (CSU) (with the majority of all other graduates being eligible for Community College enrolment) (University of California, 2009).

In practical terms these aims are currently given effect through what UC admissions describe as *eligibility in a local context*. This program for undergraduate admission to the University of California provides eligibility for the top 4 percent of graduates (based on coursework grade point average) from participating California schools (University of California, 2010a). Benefits cited include introducing an additional means of expanding the number of eligible students and increasing the university presence in each California high school, supporting efforts to promote university aspirations among schools reflecting lower tertiary participation rates (University of California, 2010a). After its introduction in 2001, the ELC program supported a significant jump in the number of commencements from schools with historically low participation rates at UC (Atkinson & Geiser, 2009, p.670).

In responding to state laws preventing the use of affirmative action criteria in university admissions, the State of Texas passed what became known as the “top 10%” bill, stipulating that all Texas students graduating in the top 10% of their high school class be offered a place at a Texas state-funded university (though not necessarily in their preferred course) (“Top 10% Rule Bill”, 2007). Outcomes from the class rank model at the University of Texas at Austin, in terms of graduation rates, completion times and student retention have all been positive, with the university suggesting that practical academic skills feature prominently among students selected on this basis (Leung, 2004). Studies in the United States show percentile class rank to

be a much better predictor for university grade averages than admissions tests, while also being an effective means of improving diversity of participation (Kane, 2000, pp.30, 32).

While class rank models have been an effective means of promoting diversity in university admissions, there has also been criticism. These include that those admitted on the basis of class rank were in the majority of cases likely to have been offered a place regardless, and that class rank models are therefore employed more for appearances sake (Khan, 2010). Other criticisms suggest the opposite is in fact the case, and that class rank strategies arguably have an undue influence on university selection (Attewell, 2001, p.291). In 2009 81% of the commencing undergraduate cohort at the University of Texas Austin were selected on the basis of high school class rank, prompting renewed concerns from the university that too many students talented in particular disciplines, or with other strengths, were being overlooked (Eaton, 2010). Evidence from the United States suggests however that addressing these concerns would be largely a matter of how class rank criteria are employed, provided institutions have the flexibility to adjust such programs to fit with their aims and adjust to changing enrolment patterns over time (Attewell, 2001, p.291).

A further criticism is that such approaches simply serve to redistribute relative advantage and disadvantage in different ways, and would still overlook all but the best students even in schools in the most disadvantaged areas, as almost by definition the benefits extend only to a select few in each graduating class (Attewell, 2001, p.275). An undue emphasis on class rank in admissions may also foster competition between students which may be unhelpful, and further contribute to the pressure already experienced by high school students in their final year. It may also be the case that while measures employing a simple cohort rank appear effective in promoting diversity of participation, they nevertheless still select for an imaginary kind of “aggregate ability,” as opposed to reflecting a particular set of positive characteristics or skills, or aptitude or achievement in particular disciplines or subject areas. One possible response may be to employ a class rank strategy within subject areas. While increasing the complexity of such programs, such an approach would likely yield good predictive validity for university success, especially where there was some degree of congruence between subject performance at high school and topics subsequently pursued at university.

Finally, where “class rank” selection strategies are in place, there is evidence of strategic high school enrolment behaviour, where parents select *less advantaged* schools for their children in order to maximise prospects for university admission, on the assumption that their children will have a better chance of a higher “class rank” in a less advantaged school cohort (Cullen et al., 2011, p.22). This effect accords with findings of US studies of the so-called “frog pond” effect, where a university applicant's chances of being admitted are reduced where they graduate from a high school with relatively more highly talented students (Espenshade et al., 2005), and where attending “high-ability” schools can have a negative effect on academic self-concept for some students (Seaton et al., 2010). The adoption of school-rank criteria in university selection therefore appears to have follow-on implications for enrolment patterns across school type (see also Cortes & Friedson, 2010, pp.27-28).

3 Strategic considerations in the use of selection criteria

Different strategies are required in selection for admission from among particular groups. This is notably the case for non school-leaver applicants and in selection for postgraduate study. There are also broader strategic considerations in the use of criteria in student selection, and these extend to transparency in the use of criteria and their alignment with other student engagement and recruitment activities. They also extend to anticipating and managing for the combined effects of selection criteria and practices, including the kind of incentives they create.

3.1 Selection and non-school leavers

Participation in higher education on the part of students in older age brackets has steadily increased over the last thirty years, with mature-age entry to Australian Universities significantly expanding during the late 1970s and early 1980s (West et al., 1980; Pascoe, 1999, p.19). Mature age students have been variously defined as commencing in the range of 19 to 25 years of age and above (West et al., 1986). While the overall proportion of commencing undergraduates aged over 21 has remained relatively stable over the last 10 years, the utility of classifying students based on age, and the point at which any such distinctions are made, had become less clear. In recent years it has become the norm simply to refer to this group as “non-school leavers” rather than “mature age”. This shift in understanding regarding mature-age students has been driven to a large extent by issues around the basis for admitting students other than recent secondary school graduates.

Table 5: 2009 Undergraduate applications, offers and acceptances by age group¹⁵

	Apps.	% Apps.	Offers	Offer rate	Acceptances	Accept. rate
Early Achievers (16 and under)	835	.03%	687	82.3%	551	80.2%
School Leaver (17-19)	166,430	66.6%	130,889	78.6%	111,540	85.2%
Non Traditional (20 - 24)	44,132	17.7%	31,529	71.4%	25,800	81.8%
Mature Age (25 and over)	38,346	15.4%	27,963	72.9%	23,315	83.4%
Totals / overall	249,743	100%	191,068	76.5%	161,206	84.4%

From Undergraduate Applications, Offers and Acceptances, 2009. Department of Education, Employment and Workplace Relations (DEEWR) 2009.

West et al. noted widespread doubt raised by institutions about the predictive power of traditional entry data (such as secondary school results) on forecasting mature age student performance (1980, p.26). Such doubts were and continue to be supported by the lack of apparent relevance of secondary school results for many mature age applicants. The widespread adoption of the Special Tertiary Admissions Test (STAT) in university admissions during the 1990s made a significant contribution to broadening study opportunities for mature age applicants without a senior secondary qualification, and for those wishing to supplement their high school results in order to maximise their prospects for admission to their desired course. Since that time, the distinction between mature and non-mature age students has blurred, as tests like the STAT have increasingly been employed in admissions for students in younger age groups. The increasing use of a broader range of selection criteria has also been valuable in allowing non-school leavers to demonstrate aptitude, motivation and preparedness

¹⁵ It should be noted that while Table 5 indicates that more than half of all undergraduate applicants are of school-leaving age, this information excludes a significant proportion of overall applicants (including applicants not processed by tertiary admissions agencies and cases where age data are missing).

for study through prior professional or community sector experience or other achievement relevant to their desired course of study.

3.2 Selection and participation in postgraduate study

This report has dealt largely with selection for undergraduate university study, due largely to the defining role undergraduate selection plays in the makeup of the student population (and subsequent graduates) over time. The participation agenda to date both in Australia and internationally to date has focussed largely around undergraduate university study (James et al., 2008, p.9; Thomas & McCulloch, 2010, p.50; Wakeling & Kyriacou, 2010, p.5) and there is a demonstrated paucity of evidence around equity of participation in graduate education (Stuart et al., 2008; Palmer, 2010c; Wakeling & Kyriacou, 2010). While many of the issues raised for undergraduates are also relevant to selection for postgraduate study, there are also important differences.


Undergraduate selection in Australia is characterised by admissions processed centrally by State and Territory admissions agencies, with senior secondary school results being the dominant (but by no means the only) basis for admission. While many admissions for coursework postgraduate study are managed by admissions agencies, the remainder, including admissions for some coursework postgraduate degrees, most international postgraduate applications and all research higher degrees, are managed directly by individual institutions. Research higher degree admissions are typically managed at the faculty, school or department level by individual institutions, often supported by a centralised school or office of graduate studies. In this respect schools of graduate studies are often directly involved in selection decisions in partnership with academic departments, and the nature of these arrangements varies across institutions. Selection decisions for coursework postgraduate programs are also typically managed at the faculty, school and department level.

Admission for research higher degrees often requires applicants to respond to the criteria used in the allocation of scholarships. While the criteria used for admission in Australia typically differ from those employed in the allocation of scholarships, admissions and scholarship allocation are often managed as part of an integrated admissions process, with the student requirements for both coming together in a single application. Selection criteria for postgraduate research are broadly informed by the need to show a demonstrated capacity for research. Prior academic achievement features prominently in selection for research postgraduates, with good performance in an Australian honours degree being the commonly accepted benchmark for successful candidates, relative to which judgements about the equivalence of other qualifications (including coursework postgraduate degrees) are commonly made. Other criteria may include prior publications, interviews, recommendations, portfolios, academic and professional experience or other evidence of ability or experience in producing quality research in a specific field of endeavour.

Factors associated with supporting and promoting diversity of participation in research degrees are somewhat different from those associated with undergraduate study, the most obvious being that recruitment for research degrees is typically among candidates with prior university study. Table 6 below shows the relative population share for equity groups across undergraduate and postgraduate study. In certain respects the stakes are also higher in research student admissions, with many years of study already invested and more to come, adult workplace opportunities and income forgone, and significant resources often invested in support of each research higher degree place (House of Representatives Committee on Industry Science and Innovation, 2008; Palmer, 2010a). The high stakes entailed in research degrees directly informs the application of criteria in selection: too lenient and students may be

done a disservice through being admitted to a program they do not have a reasonable chance of completing; too strict and an undue number of potentially successful students may be denied an opportunity to progress their studies through research, and potentially, from pursuing an academic career.

Table 6 Proportion of equity group within broad course level for commencing and all domestic students 2009 (based on Palmer, 2010c)

 Commencing Domestic Students	all		undergrad		postgrad	
	#	%	#	%	#	%
Students from a Non English speaking background	12,739	4.1%	7,133	3.5%	5,606	5.2%
Remote	3,803	1.2%	2187	1.1%	1,616	1.5%
Indigenous	4,797	1.5%	3,006	1.5%	1,791	1.7%
Students with a disability	11,213	3.6%	7,654	3.8%	3,559	3.3%
Low SES (CD measure)	46,806	15.1%	32,178	15.9%	14,628	13.6%
Regional	57,163	18.4%	39058	19.3%	18,105	16.8%
Low SES (postcode measure)	49,341	15.9%	34,402	17.0%	14,939	13.9%
Women in Non-Traditional Area	49,273	15.9%	36,012	17.8%	13,261	12.3%
All Commencing Domestic Students:	309,948		202,229		107,719	
All Domestic Students	#	%	#	%	#	%
Students from a Non English speaking background	29,244	3.7%	18,241	3.1%	11,003	5.2%
Remote	8,397	1.1%	5635	1.0%	2,762	1.3%
Indigenous	10,400	1.3%	7,551	1.3%	2,849	1.3%
Students with a disability	33,636	4.2%	26,106	4.4%	7,530	3.6%
Regional	140,702	17.6%	108179	18.4%	32,523	15.4%
Low SES (CD measure)	114,154	14.3%	89,166	15.2%	24,988	11.8%
Women in Non-Traditional Area	139,833	17.5%	108,209	18.4%	31,624	15.0%
Low SES (postcode measure)	120,652	15.1%	95,080	16.2%	25,572	12.1%
All Domestic Students:	799,531		588,016		211,515	

Compiled by the Centre for the Study of Higher Education (CSHE) from 2009 Selected Higher Education Statistics.
Department of Education, Employment and Workplace Relations (DEEWR): www.deewr.gov.au.

It is through unduly narrow or strict application of criteria in selection for research higher degrees that under-represented groups are potentially disadvantaged. A first class honours degree may well be a good predictor of success, but patterns of participation in honours programs are likely to be uneven. The issue of equivalence comes to the fore in selecting for prospects for student success in research degrees from among the broadest possible field of candidates. Greater attention to evidence of ability and potential to succeed is needed in research higher degrees admissions for applicants without an honours degree as a straightforward proxy for research potential. Considering a broader field of qualification types can facilitate additional pathways to research degrees, supported by additional criteria such as publications and prior research experience in helping to demonstrate research potential.

In other respects efforts to promote diversity of participation in research degrees mirror those directed to mitigating student attrition, and supporting good completion rates and time to completion. These stem from the need to ensure that undertaking a research degree appears as a viable option for people from under-represented groups, including through income support (in the form of scholarships), support services and through the kind of “fit” that allows them to balance a research degree with other demands including work, family and carer commitments (Stuart et al., 2008, p.70; Palmer, 2010b).

Selection practices for coursework postgraduate programs is often specific to the program and discipline in which they are based. Prior degree completions are an important criterion in selection for coursework postgraduate study as with research degrees, however there is

greater flexibility in the recognition of prior qualifications and how they are weighted among other criteria. The consideration of relevant personal and professional experience often plays a significant role in coursework postgraduate selection, and the use of interviews, portfolios and application statements and essays is also common. The use of admission tests is also common in disciplines such as law, medicine and health.¹⁶

The use of selection criteria in admissions for coursework postgraduate study has implications for under-represented groups much in the same way as is the case with research degrees. Criteria may be taken into consideration which require some qualitative judgement on the part of the institution, particularly in regard to the recognition of prior workplace or community sector experience. Among challenges in selection for coursework postgraduates is to balance identification of ability and preparedness for the program of study with recognition of as broad a field of abilities and experience as possible (and thus broadening opportunities for a broader range of educational and career pathways).

While the use of dedicated places or quotas for students from under-represented groups can be an effective way of promoting diversity of participation in coursework postgraduate study, participation in coursework degrees needs to be seen by potential students as a viable proposition in much the same way as research degrees. In Australia, access to income support for coursework postgraduate study will be significantly improved as of 2012 (Department of Education Employment and Workplace Relations (DEEWR), 2010). Another key factor in promoting diversity of participation is the availability of government-funded places relative to full fee places. These factors combine to determine the feasibility of postgraduate study for many among under-represented groups, along with their ability to balance the demands of the degree program with other challenges they face. Different strategies are required and more research is needed to support the development of policy and practice in this area.

3.3 Other considerations in the use of selection criteria

3.3.1 Transparency and alignment of diversified selection criteria with engagement, outreach and recruitment activities

It is important to acknowledge that any improvements in equity of participation yielded through reforms to selection practices would be of little use where they were not also complemented by effective outreach and engagement programs, and effective student support measures. Universities face a number of challenges in recruiting, selecting and retaining students from socio-economically and educationally disadvantaged backgrounds. Both institutions and students benefit where there is a degree of alignment between selection measures, support strategies and outreach activities. This could also be said to extend to alignment across the broader activities of the university, including curriculum development and with institutional mission and goals. Such measures are given a greater sense of coherence where that alignment is reflected in the public message conveyed by that institution, including through its recruitment efforts.

Transparency in the kind of criteria used in university selection, and the manner in which they are applied, is instrumental in conveying that the way institutions select their students is fair and based on merit. This is of particular importance in selecting for courses where the number of applications significantly exceeds the number of places available.

¹⁶ Selection strategies comparable to those for coursework postgraduate study are also employed for admission to many graduate entry bachelor degrees, as is the case for example with graduate entry medical programs.

3.3.2 Managing for un-planned features of selection frameworks

Selection criteria and practices combine to set the agenda for university admission. In doing so, incentives emerge for individuals to change their behaviour in order to improve their prospects for admission, particularly in the case of admission to courses for which there is high demand. This can in some senses be interpreted as a positive “signalling effect” for prospective students, where prospects for admission may be improved through focussing on studies in the final year of secondary school. This effect can also take on negative connotations, where incentives can emerge for individuals to change their behaviours simply to “look as good as possible on the numbers”, otherwise referred to as “gaming” the admissions system (Attewell, 2001, p.268).

Pascoe (1997) observed that selection measures in practice function at both a formal and informal level; the former being planned features of selection practices and the latter being the way these intersect to drive the strategies used by applicants to maximise their prospects for admission to their desired institution and course. Andrich and Mercer (1997) describe this effect as “the politics of selection,” found in the way students and their parents interpret and respond to admissions procedures and requirements. They offer the example of families reflecting high socio-economic status positioning themselves more strategically than other groups for the selection practices associated with institutions they perceive as prestigious, and often doing so for their children from a very early age. Such efforts extend beyond fostering academic aptitude and preparation for university to specifically include those criteria taken into account as measures of selection for their desired institution (1997, p.15). Not only does this demonstrate yet another link between socio-economic status and prospects for university admission, it also serves to reinforce that university selection practices, rather than simply being a passive means of assessment, can in fact be a powerful driver of behaviours. On one view, assessment should follow standards, not the other way around (Atkinson & Geiser, 2009, p.668). However, it is clear that standards have and will continue to follow assessment, and preparatory behaviours will respond to changes in the use of selection criteria, and this is an important consideration in any review of selection practices.

There is a risk that widespread reliance on subject tests would potentially have an homogenising effect on secondary school curriculum. This effect is already evident in the United States, in the case of Advanced Placement courses. These in many respects fulfil the function of the Australian year 12 in the US context. AP courses have been found to increasingly “teach to the test,” through narrowing their subject choices in attempts to “streamline” their curriculum to reflect the demands of the AP exams (Hammond, 2008, in Atkinson and Geiser, 2009, 670).

The use of achievement tests is almost by definition intimately tied to both secondary school and university curricula, in different ways. Given conclusions about the signalling effect inherent in university selection practices, ongoing development of subject-test based assessment should look to base their ongoing development on surveys of curriculum *upward*, through what is likely to be expected of students in the university curriculum, rather than simply reflecting the current state of play among secondary school curricula. The former would yield positive ongoing effects where subject testing in selection in effect performs a bridging function between university and secondary school curricula. The latter by contrast would have a stultifying effect, echoing only the prevailing features of school curricula, and doing that more or less well, regardless of the prospects and expectations of students on graduation.

The signalling effect of selection measures lends weight to the use of measures of achievement and preparedness, particularly as means of selection has such a powerful influence on the attention focussed on the final years of secondary school. Beyond (potentially) exerting upward pressure on the quality and standards of secondary school curriculum, there are potentially broader implications where selection measures are understood as a driver of preparatory behaviours. Caution should be taken however in assuming that thoughtfully devised, robust and comprehensive selection measures once in place will automatically yield improvements in secondary schools where it is anticipated they will “teach to the test.” There is a danger in the widespread use of standard subject tests for example that this effect has the potential to significantly reduce secondary school subject availability. In other words, undue reliance on subject tests in admissions creates a strong incentive to prepare only within those subjects that are assessed for admission, regardless of the broader interests and abilities of the student.

4 Summary

The challenge in university selection is to identify propensity for student success while also ensuring equality of educational opportunity. There is scope for a more considered approach to selection practices, informed by recognition of the limitations inherent in prevailing approaches, by a broader view of selection criteria and their use, and by how they combine to determine prospects for university entry.

While prior academic achievement remains a reliable predictor of success at university, there is scope for broader consideration of evidence of prior study in addition to secondary school results. Tests of both aptitude and preparedness play an important role in helping to identify student potential, and they are particularly effective when used in conjunction with other criteria. Using a broader range of criteria enables the evaluation and comparison of a broader range of characteristics associated with student success. Alternative selection practices can also offer a useful means of evaluating student aptitude and preparedness specific to particular fields of study. Finally, student selection strategies have a direct influence on patterns of participation over time: selection and participation are directly linked. Strategies promoting equity of participation which also serve to identify students with good prospects for success are therefore central to university admissions that are defensible, sustainable and fair.

Other measures of prior academic achievement are available as selection criteria in the absence of tertiary entrance rank, or as a supplement to the use of secondary school results. These include performance in technical and vocational education and performance in university foundation studies or prior university study. Each have been found to be a good predictor of student success, particularly in the case of prior university study. They are important criteria in selection for non-school leaving applicants, and in supporting multiple pathways to university study.

Tests of aptitude and ability can also be useful as a predictor of student success when used in conjunction with other criteria. In making the best use of available criteria, institutions may consider expanding their selection options through adopting a common voluntary test of aptitude and preparedness for university study in conjunction with evaluating prior academic achievement. This option is already broadly available through the STAT for those who have not completed secondary schooling, completed their school qualification some time ago, or who choose to supplement their secondary school results in order to maximise their prospects of gaining entry to their preferred course. Such tests are also commonly used for supporting opportunities for those entering tertiary education via alternative pathways.

There are also a broader range of attributes associated with university success, and broader means of identifying student potential. This is particularly the case when evaluating the “fit” between student attributes and the demands of particular disciplines. Specific criteria may be more or less appropriate in selection depending on the discipline. It is difficult to account for this sort of variation by means of a single aggregate measure, and universities are encouraged to employ the suite of criteria in selection that offers the best chance of identifying the student characteristics associated with success in students’ chosen field of study and in view of the institution’s particular mission. Portfolios stand out as one of the means by which students are able to demonstrate preparation, aptitude and motivation for study that is specific to their chosen field of endeavour. Such criteria have also been found to be an equitable means of promoting educational opportunity for prospective students from a diverse range of backgrounds.

University selection criteria and practices should come together to support an environment where academic achievement and potential are identified and rewarded, but this should not come at the expense of equality of opportunity in educational participation. Conversely, efforts to promote opportunities for university study should not come at the expense of selection practices that are fair, transparent and defensible. Both issues go to the heart of what is at stake in university selection, and both can be appropriately managed by the strategic use of student selection criteria and practices. There are a range of equity measures available to institutions that are effective in promoting opportunities in higher education for under-represented groups, and which are also consistent with the aims of identifying and rewarding excellence.

Universities face the challenge of identifying student potential by means of selection criteria in an open, fair and defensible way. They also face the challenge of ensuring all those who have the ability to benefit from university study have the opportunity to do so. At the system level it is a challenge to ensure that the diversity of participation in higher education reflects that found in the broader community. While still an important and valuable indicator of prospects for student success, institutions may consider developing the strategic use of a range of selection criteria beyond secondary school performance, in a manner that fits their context, mission, and priorities. These include:

- Expanding the use of aptitude and achievement tests in university admissions, in particular for “middle band” entrance ranks;
- Developing strategies for the evaluation of, and selection for, student characteristics associated with success in particular fields of study, including through discipline-specific tests of aptitude and achievement;
- Continuing to develop pathways from TAFE and VET courses;
- Increasing opportunities for participation in foundation studies and other forms of preliminary university study, as a pathway for undergraduate admissions;
- Consider the incorporation of aspects of foundation programs as undergraduate topics, as part of either broad-based or conditional admissions initiatives;
- Consider expanding the practice of offering credit for certificate and diploma level study toward undergraduate degrees;
- Expanding the use of portfolio entry in admissions where appropriate to the discipline and intended course of study;
- Broadening the range of selection criteria used in assessing non-school leaver applications;
- Developing alternative school-based criteria through the adoption of “school rank” selection strategies.

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Appendices

Appendix I Types of University (as grouped in Undergraduate Applications, Offers and Acceptances 2009)

UNIVERSITY TYPE	
<p>Group of Eight Member Universities (Go8)</p> <p>Monash University The Australian National University The University of Adelaide The University of Melbourne The University of New South Wales The University of Queensland The University of Sydney The University of Western Australia</p>	<p>Former New Generation Member Universities - Metropolitan</p> <p>Australian Catholic University Edith Cowan University University of Canberra University of the Sunshine Coast University of Western Sydney Victoria University</p>
<p>Innovative Research Member Universities (IRU)</p> <p>Flinders University of South Australia Griffith University James Cook University La Trobe University Murdoch University The University of Newcastle</p>	<p>Former New Generation Member Universities - Regional</p> <p>Central Queensland University Southern Cross University University of Ballarat University of Southern Queensland</p>
<p>Universities of Technology (ATN members plus Swinburne)</p> <p>Curtin University of Technology Queensland University of Technology RMIT University Swinburne University of Technology University of South Australia University of Technology, Sydney</p>	<p>Non Aligned Metropolitan Universities</p> <p>Bond University Deakin University Macquarie University The University of Notre Dame Australia University of Tasmania University of Wollongong</p> <p>Non Aligned Regional Universities</p> <p>Batchelor Institute of Indigenous Tertiary Education</p> <p>Charles Darwin University Charles Sturt University The University of New England</p>

From *Undergraduate Applications, Offers and Acceptances, 2009*. Department of Education, Employment and Workplace Relations (DEEWR) 2010.

Appendix II University of California “Comprehensive Review” Selection Criteria

“Comprehensive review” criteria employed in selecting for admission to a University of California system institution including the following (University of California, 2010b):

- Academic grade point average;
- Scores on the ACT With Writing or SAT Reasoning Test and two SAT Subject Tests;
- Number of, content of and performance in academic courses beyond the minimum requirements;
- Number of and performance in UC-approved honors and Advanced Placement courses;
- Identification by UC as being ranked in the top 4 percent of the their high school class at the end of junior year ("eligible in the local context" or ELC). [As of 2012] students need to be ranked in the top 9 percent of their high school class to be ELC-eligible;
- Quality of a student's senior-year program, as measured by the type and number of academic courses in progress or planned;
- Quality of their academic performance relative to the educational opportunities available in their high school;
- Outstanding performance in one or more academic subject areas;
- Outstanding work in one or more special projects in any academic field of study;
- Recent, marked improvement in academic performance, as demonstrated by academic GPA and the quality of coursework completed or in progress;
- Special talents, achievements and awards in a particular field, such as visual and performing arts, communication or athletic endeavours; special skills, such as demonstrated written and oral proficiency in other languages; special interests, such as intensive study and exploration of other cultures; experiences that demonstrate unusual promise for leadership, such as significant community service or significant participation in student government; or other significant experiences or achievements that demonstrate the student's promise for contributing to the intellectual vitality of a campus;
- Completion of special projects undertaken in the context of a student's high school curriculum or in conjunction with special school events, projects or programs;
- Academic accomplishments in light of a student's life experiences and special circumstances; and
- Location of a student's secondary school and residence.

Appendix III Studies of the predictive validity of tertiary entrance rank in Australia

Table 7 Estimated coefficients for the predictive validity of tertiary entrance rank-selected Australian studies^a (Birch & Miller, 2005b)

Study	Dependent variable ^b	Explanatory variables ^c	Estimated coefficient for tertiary entrance score ^d					
West (1985) Data from 1975, 1980 and 1982	Credit rate	Higher School Certificate (HSC) (mark out of 100) and school type		1975	0.47			
				1980	0.48			
				1982	0.52			
Farley and Ramsay (1988) Data from 1981, 1982, 1984, and 1985	Students' grade for the theory component of the unit, grade for the math component of the unit and aggregate grade in the first-year accounting unit	HSC (mark out of 100), whether completed accounting in school, whether completed maths in school, and grades in accounting at school	Theory	1981	0.16			
				1982	0.13			
				1984	0.08			
						Maths	1981	0.04
					1982		0.05	
					1984		0.01	
						Final	1985	0.02
					1981		0.33	
					1982		0.35	
				1984	0.14			
				1985	0.18			
Ramsay and Baines (1994) Data from 1981, 1982, 1984, 1985 and 1993	Students' grade for the theory component of the unit, grade for the math component of the unit and aggregate grade in the first-year accounting unit	HSC (mark out of 100), whether completed accounting in school, whether completed maths in school, grades in accounting at school, and gender	Theory	1981	0.17			
				1982	0.13			
				1984	0.08			
						Maths	1985	0.09
					1981		0.04	
					1982		0.05	
						Overall	1984	0.01
					1985		0.02	
					1981		0.34	
		1982	0.35					
		1984	0.14					
				1985	0.18			
				1993 S1	0.88			
				1993 S2	0.88			
Auyeung and Sands (1994) Data from 1991	Students' essay mark, multiple choice mark and aggregate mark for the first-year accounting unit	University entrance score (mark out 990), grades in accounting at school and grades in two maths subjects at school (maths I and social maths)	Essay	All students	N.S			
				Males	N.S			
				Females	0.20			
			Multiple choice	All students	0.14			
				Males	N.S			
				Females	N.S			
Aggr. mark	All students	0.32						
	Males	N.S						
	Female	0.37						
Evans and Farley (1998) Data from 1997	Students' final grade in each of the compulsory first-year business units for two different campuses	TER score (rank out of 100), whether attended a 'disadvantaged' school, school type, whether studied English at school, grades for English at school, whether studied basic maths at school, grades for basic maths at school, whether studied advanced maths at school, grades for advanced maths at school, whether studied the same subject in school as studied at university, and grades in the same subject in school as the subject studied at university	Campus 1 Sample 1	Economics	N.S			
				Bus. Com	N.S			
				Management	N.S			
				Accounting	N.S			
				Statistics	N.S			
						Campus 2 Sample 1	Marketing	N.S
					Economics		0.72	
					Statistics	0.97		
					Management	0.49		
		Accounting	0.64					
			Campus 2 Sample 2	Economics	0.61			
		Statistics		0.63				
		Management		0.38				
				Accounting	0.45			
Win (2003) Data from 2001	Students' average weighted first-year mark	TER score (rank out of 100), gender, locality of residence, socioeconomic status, school type, school population, schools' locality, co-educational school status, proportion of students with high TEE scores, proportion of students graduating from school, and the proportion of students taking four or more TEE subjects at school		Model 1	1.00			
				Model 2	1.02			
				Model 3	1.04			

^a OLS for all studies examined, data samples are from single universities. ^b Credit rates refer to the number of subjects in which students obtained a credit or higher grade, as a proportion of the number of first-year units taken. ^c The metric for the tertiary entrance score is in parentheses. ^d N.S. refers to not significant at the 10 per cent level. Evans and Farley (1998) estimated the model using two different samples for the second campus considered. In Win (2003), model 1 refers to the inclusion of only personal characteristics explanatory variables in the estimating equation, model 2 refers to the inclusion of personal characteristics and school type explanatory variables in the estimating equation and model 3 refers to the inclusion of all explanatory variables in the estimating equation.