

## RESEARCH PAPER

### **An exploratory study of the factors associated with an initial testing process: Testing the testing**

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The Skills for Tertiary Education Preparatory Studies (STEPS) enabling program has always used an entrance testing program to identify prospective students' competence in writing, mathematics and computing, alongside a statement describing their perceived readiness for university. The rationale behind the current testing process is that it allows staff to identify those students who appear ready and able to undertake, and complete the STEPS program successfully. It sits in contrast to an open entry system used by other enabling programs. The researchers in this project explore whether the current testing process is actually an accurate indicator of students' capacity and state of readiness for study and whether it is a true indication of future success in the program. Anecdotally, some students attain a high score on the testing and yet struggle to complete the program; others students may produce lower scores but successfully complete the program. This research project collected students' testing results over a two year period and through various forms of data extraction, subsequently analysed and collated the results. The research demonstrates that, within the present testing process, the literacy element is a highly significant indicator to whether students are likely to complete the program, and subsequently, other elements of the testing proved to be of less importance in their predictive value.

*Keywords:* Tertiary preparation studies; enabling education; testing; assessment

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#### **Introduction**

Enabling programs have become increasingly important in the Australian tertiary sector and are one way higher education institutions have responded to the changing needs of educators and students. The notion that Australian universities are there to provide opportunities for all its citizens has been a stated fact for years (Barff, 1902, as cited in Anderson, Boven, Fensham, & Powell, 1980); however, in regional areas in Australia, university study has not been an option available for many due to fiscal circumstances. Nevertheless, over many decades, there has been a consistent commitment from the federal government and tertiary institutions to provide opportunities for the disadvantaged to access university through a range of programs and courses (Ramsay, 2004). In 1990, the National Board of Employment, Education and Training alongside the Department of Employment, Education and Training (DEET) issued the *Fair Chance for All statement* (DEET, 1990), which focussed on equity objectives, strategies and targets for Australian universities (Ramsay, Turner, Sumner & Barrett, 1996). The statement clearly outlined the responsibilities universities have to increase access opportunities to people from socio-economic disadvantaged backgrounds. Many enabling programs were instigated from this point in time. A significant change came in 2003 when The Australian Higher Education Support Act (2003) provided universities with access to funding for the *Fair Chance for All* target groups. Post 2005, this funding was targeted towards a much broader group of potential students via enabling programs. However, James (2007, p. 2) reported that those from low SES backgrounds and rural and remote communities remained "significantly under-

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represented” in Australian higher education and figures had remained static for over 15 years. The release of the Bradley Review into Higher Education in 2008 (Bradley, Noonan, Nugent & Scales, 2008) identified that, whilst Australia was at the forefront of equity programs in the 1990s, it now lagged behind other OECD countries with regard to the inclusion of under-represented groups (Ryan, 2011). The Australian government’s response was to introduce the Higher Education Participation Partnerships Program (HEPPP). This new funding program provided a fee-free program to assist with increasing the participation rates of targeted equity groups into enabling programs and also to improve retention and completion rates (Ryan, 2011).

As a result, enabling programs are designed specifically to offer a fee-free, alternative access to tertiary education for students. In other words, they provide students with the opportunity to become sufficiently academically literate so that they enter undergraduate studies better equipped to complete a degree. This research specifically investigates the testing process that prospective enabling students undertake when entering the STEPS enabling program. The testing process aims to identify a prospective student’s competence in writing, mathematics and computing skills alongside a statement describing their perceived level of readiness before their enrolment within the program is approved. This project explores whether the current testing process is actually an accurate indicator of student’s capacity and state of readiness for study and whether it is a true indication of future success in the program, thus contributing positively to retention and completion rates. Therefore, the viability of an entrance test for an enabling program with entrance testing is a key concern for this research. Whilst entrance testing does not ascertain students’ understanding of academic rigour, it is often justified by educators as indicating whether potential students have the capacity to meet the standards required in undergraduate programs.

### **Theoretical Background**

As part of its commitment to “making Australia one of the most educated and highly skilled workforces in the world in order to secure national long term economic prosperity”, the Australian Government has set targets for increased participation rates of low socio economic students (LSES), also referred to as under-represented groups (Department of Education, Employment and Workplace Relations, 2009). The stated aim is to increase the numbers of students from LSES areas enrolled in higher education by 20 per cent, on the premise that this would ensure Australia remained highly competitive in the global economy through a skilled, educated work force, referred to as a “Knowledge Nation”. Consequently, alongside the massification of higher education in Australia has come an increase in the socio-economic diversity of the student cohort (Huntly & Donovan, 2009). Unfortunately, one of the challenges that tertiary institutes have subsequently identified is that some students who are now enrolling are not prepared to meet the academic and social challenges of tertiary study (Schrader & Brown, 2008). Additionally, in the past decade, Australia has experienced an increase in the number of mature age students who are currently being attracted to higher education and who have not been involved in academic study for some years (Henderson, Noble & De George-Walker, 2009). Burton, Taylor, Dowling and Lawrence (2009) substantiate this and affirm that a typical class today may consist of both school leavers and increasing numbers of mature age students who come from a diversity of educational and work based backgrounds. Reports such as that of Clark and Ramsay (1990) identify that, despite targeted efforts by staff, students who entered the university

sector with marginal entrance scores are unlikely to graduate unless they are provided with “significant assistance”. Therefore, with the consistency of Federal funding available, the opportunity for universities to offer alternative pathways, such as enabling programs, has become a viable option to better prepare students for entry into university studies, and subsequently gaining a degree.

The Department of Industry, Innovation, Science, Research and Tertiary Education (2012, p. 26) defines an enabling course as, “a course of instruction provided to a person for the purpose of enabling the person to undertake a course leading to a higher education award”. The term enabling program is used to describe programs that are otherwise known as bridging, foundation, pathway or university preparation programs (Department of Education, Training and Youth Affairs, 2000). The purpose of such programs is to offer a second chance for prospective students to enter university who, for a variety of reasons, have not followed the more traditional pathway from secondary schooling directly into higher education. Through these carefully designed programs, a greater number of people from a wider range of demographics are able to gain access to higher education, thereby addressing the criteria applied to the HEPP funding system (James, 2007, p. 1.) In an extensive examination of enabling programs in Australian higher education settings, Clarke et al. (2000, cited in Hodges, 2013) found that these programs “provide or support alternative pathways for non-traditional students” with the intention of developing core skills such as critical thinking, academic writing, math and computing competencies. Flinders University (2007) observed another consideration. It found that many of these new students do not understand the academic rigour required when entering an enabling program, providing enabling educators with significant challenges. There are a variety of reasons that students seek alternative pathways into university. Firstly, for many, choosing an enabling program represents a “re-emergence of individuals into a system that has previously rejected them” (Hodges et.al. 2013, p. 15). Munns and McFadden (1997) describe past negative educational experiences as cultural fractures; yet, they state that healing can happen and these students could conceivably still gain an education through the right program and support. Additional reasons for entry via an enabling program include geographical remoteness (Ellis, Cooper & Sawyer, 2001) and lack of opportunity (Willans & Seary, 2007).

CQUniversity, a multi campus university located across a number of Australian states, offers an enabling program known as STEPS at a number of its locations. STEPS is currently offered internally at the Mackay, Rockhampton, Gladstone, Bundaberg, Noosa, Brisbane and Sydney campuses, as well as in Distance mode, thus addressing the widening accessibility of access put forth in the Bradley Review (Bradley et al., 2008). The aim of this enabling program is to equip learners with lifelong learning skills, self confidence and academic rigour (Doyle, 2006). Doyle (2009) adds that a central tenet of STEPS is its underlying philosophy of transformational learning. Cranton (2006) describes this as “deep, powerful shifts in the way they [students] see themselves and the world.” Through a deeper understanding of themselves as students in relation to their skills, temperament, learning styles and self efficacy, and their individual and unique place in the world, they are not only influenced by those around them, but are an influence on their world. Willans and Seary (2011, p. 138) point out that, while this transformational learning can often come at a high cost for mature students, “the process of enduring the struggle, and successfully overcoming the

obstacles that have previously blocked the learner's progress, results not only in academic progress and the development of resiliency, but also in personal transformation for those who persist". Many of the students who undertake STEPS are mature age and many of them may have been out of the education arena for some time. In addition, they are diverse in age, cultural background and life experience. Most of these students are from a LSES background and may not have fully utilised the opportunities afforded to them in high school (Henderson et al., 2009). The purpose of STEPS is to offer a holistic program that enables them to acquire skills in mathematics, computing, academic writing, as well as the opportunity to understand and experience tertiary culture delivered through a particular course known as Preparation Skills. Confirming the value of this approach, Willans and Seary (2009) contend that the "establishment of a learning environment in which mature age learners can build resiliency that empowers them to cope with the numerous challenges they face whilst studying" is an essential element. Therefore, the ideal outcome would be that all STEPS students undertaking the program would complete the program successfully, having acquired the skills and resilience necessary to complete the courses that will give them the prerequisites to undertake, and succeed in a degree of their choice.

However, Clarke et al. (2000, cited in Hodge et al., 2013) agree that what constitutes success within the framework of enabling programs has been a source of conjecture since their introduction. The most common definition of success is completing the full suite of courses within an enabling program, but given that this is simply a pathway to a degree program, it does not predict further success and eventual graduation from a bachelor degree, which is the preferred outcome suggested by the Bradley Review (Bradley et al., 2008). McInnis, Hartley, Polesel & Teese (2000), in a study of non-completion in VET and Higher Education at the University of Melbourne, point out that non-completion of a program does not necessarily equate with failure. They state that it is important to distinguish between "positive" and "negative" attrition. For instance, students who do not complete the full enabling program at their first attempt may have temporarily discontinued their studies until a more appropriate time. The significance of completion "depends on the view of the stakeholders" (McInnis et al. 2000) and some students who do begin a program discover that it is too much for them at that period in time and drop out, but later return to study when their external circumstances change. Hodges et al. (2003, p. 16) hold the view that the major purpose of enabling programs is to "allow individuals who may have a desire to undertake university study to discover not only if they are capable of studying at that level, but also if that is actually what they want to do".

In Australia, there are 35 university-based enabling programs (as at February 2013) and a majority of these are open to primarily domestic students, with some accepting international students (Hodges et al. 2013). These programs differ in terms of academic entry requirements, mode of delivery, course offerings per year, and expected time of completion. One notable variance between these programs is the terms of the nature of the model governing student entry. Open entry models allow all students, over a set age, to enrol in the program no matter their prior educational or skill level. The underlying assumption explained by Hodge et al. (2013) is that the "student should try the program if they think they *might* be able to do it and if they *might* be interested in tertiary study." Open entry "eschews any preliminary filtering of entering students on the basis of currently demonstrated academic ability or of level of commitment"

(Hodges et al. 2013. p. 28). On the other hand, closed entry models only allow those who have demonstrated a sufficient academic standard to enrol in their program. The assumption is that students want to enter must demonstrate their capacity to meet the academic requirements of the program.

### **Aim**

The STEPS program has always employed the closed entry model through entrance testing to ascertain whether a student has the required level of skills needed to successfully complete the program. In addition, the testing process has a consequential impact on staff workloads due to the considerable time and effort required from a number of the staff to mark, review and interview prospective students. STEPS utilises diagnostic testing instruments to grade literacy and numeracy, and then individual interviews are conducted in an effort to determine if a student is in an appropriate state of readiness. The aim is that such readiness would give the students the ability to devote themselves both emotionally and cognitively to the educational purposes and outcomes of the STEPS courses. Consequently, the present testing and interviewing process is the method by which staff accept students based on assessed skill levels and perceived emotional, psychological and motivational readiness. However, as students journey through the program, many elements associated with these aspects may play a part in students' completion or non-completion of the program, and may have a bearing on students' final grades. Attrition/retention is a central concern for the STEPS program, because, even though retention rates compare favourably compared to a number of other programs (see Hodges et al. 2013), and with the entrance testing process used as a filter, students still fail to finish the program and proceed to undergraduate study. Therefore, this research endeavours to respond to these concerns and is asking the questions:

1. Can we predict students' success/non-success from their initial testing results and the responses they provide during the interview process?
2. As well, within the existing testing process, what elements can be identified as contributing to students' success/non-success?

### **Definitions**

For the purpose of this research, success will be defined as those students who successfully passed four courses: Preparation Skills for University, Essay Writing for University, Fundamental Mathematics for University and Computing Skills for University. The successful completion of these four courses allows students to gain entry into an undergraduate degree at CQUniversity, provided the pre-requisites are being met for the desired program of entry. For the purpose of this study students who completed three or fewer courses are regarded as unsuccessful, together with students who withdrew after census date.

### **Method**

The authors collected mixed forms of data, including quantitative testing results and qualitative open-ended interview data. Consequently, this study is approached from a mixed methods perspective. Hossler and Vesper (1993) call this mixed method approach a 'concurrent triangulation method design' which indicates a triangulation of data collection, separate data analysis and the integration of data bases at the analysis stage of the research. Hartas (2010, p. 278) explains further that the use of mixed method enhances "multiplism, triangulation and complementarity". In terms of this

research, these statements would indicate that the researchers are asking questions in different ways, using different methods and sources of data collection and appropriate methods are being used to evaluate different aspects of the data. In general terms, the goal of the analysis is to integrate both qualitative and quantitative data in order to explicate a more substantial analysis.

Prospective students are currently assessed on three elements: mathematics, writing, and computing. Each student is required to fill out a computing survey which helps to identify and quantify their perceived level of ability in that area. The mathematics test is approximately equivalent to the current Year 8 level of Education Queensland's curriculum, while the writing piece evaluates basic writing skills, as well as the ability to compose a written discussion on a given topic. Each element is graded and this is used as a guide by the Access Coordinator, an academic lecturer who has the task of deciding whether the student has a sufficient skill level to handle the rigours of the program. This quantitative data is extracted from the individual student's records, de-identified so that only the student number aligned to their results, and then entered into an Excel document.

The qualitative data is sourced from student's personal writing where they write their 'story' prior to the actual formal entry testing. Students are asked to respond to questions about their background, goals and commitment to undertaking the program. These stories are meant to be a 'visual' representation of the student's personal perspectives, state of readiness and prior experiences before undertaking university. The philosophy behind these stories is to give the Access Coordinator a chance to view students through their personal lens and to identify the level of self perceived competence from the student perspective in order to identify if they believe that they have ability to meet the demands of the program (Fazey & Fazey, 2001). The Access Coordinator uses the personal writing, alongside the testing results to make an informed decision as to whether to accept the student into the program.

In order to quantify the personal writing data, the process of intercoder reliability is utilised. Lombard, Synder-Duch and Bracken (2002) define the Intercoder Reliability technique as the "extent to which independent coders evaluate a characteristic of a message ... and reach the same conclusion". Tinsley and Weiss (2000, p. 98) qualify this definition by explaining that intercoder reliability actually refers to the degree of agreement arrived at by different researchers. Research seems to show that this technique is suitable when subjective opinions will be used to rate segments of data because it produces a level of objectivity in relation to the results. Two of the research team have had previous experience assessing the written component of the supervised testing and it was decided they would undertake this task. Hartas' explanation (2010, p. 73) guides the process and states that they would need to agree upon coding themes and a coding scheme. The strategy employed to arrive at this consensus involves the two coders initially using 25 per cent of the gathered data in order to arrive at an agreed codebook. The data referred to comprises the personal writing completed by prospective students in response to a series of questions posed. These questions are categorised into four components – effort of response, comprehension of questions asked, quality of written expression and expressed confidence. Once it is determined that the markers assessed at a similar level, each of the writing pieces is scored by both markers. The mean scores of the two markers for

each of the four components are used in the analysis of the data. This is done to ensure higher levels of reliability.

### Participants

The participant group consists of students who completed the testing prior to entry into study in Term One and Term Two of 2012. The group was restricted to those who were enrolled in internal mode on the Bundaberg campus of CQUniversity. As well, prospective students who produced low scores in all areas are excluded from this research project and consequently were not included in the data. This sample group consists of 140 (87 female and 53 male) students, which will allow for the possibility of drawing clear inferences from the data and allow credible explanations. Students' ages ranged from 18 years of age to 79 years of age. The average age was calculated at 30.4 years, with a standard deviation of 12.9, which confirms a wide spread of ages.

Data showed that 20 students or 14.3 per cent of the 140 students, who tested, did not start the program. These students were excluded from the data analysis. Data collected at the end of the program found that 40 students or 28.6 per cent of the sample completed fewer than 3 courses and did not plan to continue with the program at the time. In addition, 10.7 per cent of the students being investigated, or 15 students, only completed 3 courses. Less than 50 per cent (46.4 per cent) of the total students completed 4 courses or more.

### Analysis and results

The researchers were interested in determining the relative utility of the current STEPS entrance testing methods in terms of (a) differentiating students who successfully completed the STEPS program from those who did not, and (b) the efficacy of the combined set of testing methods in predicting success or failure. It is to be noted that, as this is an operational program, the sample comprises only students who were accepted into STEPS on the basis of the entrance test results. Therefore, this sample is truncated in that students who did not meet the minimum criteria for entry into the program are excluded from the sample. All analyses, therefore, amount to explaining variability in success rate *among students who met the minimum criteria for program entry*. Table 1 summarises the numeric variables used as predictors in the study, comprising 6 test scores, and age. Gender is also included as a potential explanatory variable.

**Table 1 Univariate descriptives**

	Personal Writing						
	Age	Maths	Literacy	Effort	Compre- hension	Quality Writing	Confidence
Min	18.3	6	3.2	1	1	1	0.5
Max	79.7	20	9.8	5	5	5	5
Mean	30.4	14.7	6.2	3.8	3.8	3.8	3.9
Stand Dev	12.93	3.4	1.4	0.7	0.8	0.75	0.9

**Table 2 Comparisons between successful and unsuccessful students**

IV	Success		Non-success		<i>t</i>	df	<i>p</i>
	M	SD	M	SD			
Age	31.81	13.64	27.54	9.64	2.00	114.5	.047
Maths	14.29	3.32	13.73	3.67	0.87	110.0	.382
<b>Literacy*</b>	29.63	11.45	20.31	11.42	4.45	114.8	<.001
<b>Effort*</b>	4.04	0.71	3.70	0.82	2.39	108.0	.018
Comprehension	3.97	0.76	3.70	0.74	1.94	115.6	.054
<b>Writing Qual.*</b>	4.02	0.80	3.64	0.67	2.89	117.9	.004
Confidence	4.01	0.74	3.85	0.95	0.97	100.8	.333

Two-tailed independent samples t-tests are undertaken comparing the mean test score of each evaluation method among students who did (N=65) or did not (N=55) meet the criteria for program success. These results are summarised in Table 2. Of evaluation methods, **writing quality, effort, and literacy (see\*above)** show significant differences in the expected direction. Maths, comprehension, and confidence do not show significant differences between the two groups. A chi-square test indicates that males and females did not differ significantly in terms of their likelihood to successfully complete the program;  $\chi^2(1) = .31, p = .57$ .

Next, a multivariate model is considered, with a set of evaluation scores and demographics as candidate predictors of course success. A logistic regression model is implemented with backwards variable deletion on the full set of predictors, using the Akaike Information Criteria (AIC) for model selection. The regression coefficients for the final model with optimal AIC is summarised in Table 3.

**Table 3 Coefficient summary for AIC-optimised logistic regression model**

	B	SE(B)	<i>z</i>	<i>p</i>
(Intercept)	-4.15	1.419	-2.93	.003
<b>Literacy*</b>	0.07	0.019	3.76	<.001
Comprehension	0.60	0.332	1.77	.076
Writing Qual.	0.64	0.357	1.81	.069
Comprehension	-0.58	0.337	-1.75	.081

As the table shows, when shared explanatory variance is accounted for, **literacy (see\*above)** is confirmed as the most effective indicator of success. The logistic regression model correctly predicts 67 per cent of participants' success in completing the course (using a 0.5 probability threshold). The threshold independent Area Under the Curve (AUC) measure of classifier performance was 0.75, indicating moderate classification performance.



## Discussion

Overall, the analyses lend support to the validity of the evaluation methods used to determine entry into the STEPS program. It is important to keep in mind that the analysed sample is truncated, in that students who do not meet the criteria for program entry based on the evaluation methods, are necessarily excluded from the sample, together with students who were accepted, but did not attempt to start. Thus, test scores are subject to a restriction of range, which would certainly decrease the statistical power. Three of the six test measures show significant differences between successful and non-successful students, indicating that among those admitted to the program, those who tested higher through each of the tests are more likely to be successful in the program. This result may be an indication that if students are more competent in literacy and mathematics prior to entry, they will be more likely to engage successfully with the new knowledge presented through the program. Bivariate analyses indicated that literacy scores are the best indicator of success, and this is confirmed in the multivariate analyses. These findings align to McHardy's (2009) findings that there is "a strong relationship between educational attainment and literacy". Given that many tasks set in undergraduate programs require written responses that are academically rigorous, the alignment between literacy and success seems quite justified.

Not surprisingly, the various test scores show a significant degree of co-variability, and this is reflected in the multivariate analysis in which other test measures, apart from literacy, do not provide significant discriminate power over and above that of literacy scores. The evaluation of the personal writing piece did not show any significance in predicting success or non success; however, when taken into account in the interview process, it does help the Access Coordinator to ascertain the student's readiness to undertake a program such as STEPS. Interestingly, the comprehension section of this evaluation referred only to how well the students illustrated that they had understood the questions posed. However, literature on the importance of comprehension in extracting and constructing meaning through interaction and involvement with the written language infers that it is a complex, cognitive process that is required in a higher level of education (Hannon, 2012; Harvey & Goudvis, 2007; Ness, 2009). Therefore, in light of the strong literacy/ success correlation, it seems there is scope for inclusion of more vigorous testing of comprehension.

It should be noted that there are some limitations to this study. Firstly, the participants' results used in the data collection did not take into account students who did not meet the entry criteria to be accepted into the program, based on the current evaluation methods; therefore, these students results are excluded from the sample. Further limitations are identified in the methodology as the mean score for the math was significantly higher than the mean score for literacy. This could be an indication that the level of difficulty of the math test is possibly lower than the level of difficulty in the literacy assessment. Additionally, using intercoder reliability with the aim of quantifying a qualitative piece of writing also raises some questions about the interpretation of the criteria. In the two tailed independent samples t-tests, comprehension and confidence did not show any significant differences to success. Therefore, the subjective nature used within intercoder reliability may not be a true indication of each student's actual level of comprehension ability.

## **Conclusion**

In contrast to other enabling programs, CQUniversity has always used a closed entry model of entrance testing as a basis for selection of prospective students. The researchers aim is to investigate whether this pre-testing model can predict student's success/non-success in the STEPS program and what elements are the most significant contributors to that result. The findings indicate that, of all the areas tested, the literacy component gives the highest indicator of student success as per the definition given in this paper. Writing quality and effort are also indicators of success. In addition, it is confirmed that those students who tested higher in the pre-tests are more likely to be successful in the overall program. This result may be an indication that if students are more competent in literacy and mathematics prior to entry, they will be more likely to engage successfully with the new knowledge presented through the program. Areas such as math, comprehension and confidence did not show any significant correlation within the analysis. It was noted, however, that some important and relevant areas of literacy such as comprehension are not currently being tested adequately. Also, the discrepancy between literacy and mathematics as indicators, points to the need for a review of the present level of mathematics testing. In general terms, these outcomes may suggest that there is scope for the design of a more tailored testing process that may increase the numbers of students who succeed in completing four courses, and therefore, the STEPS program. This knowledge may be useful for enabling programs throughout Australia in conjunction with other findings in order to redress the present rates of attrition associated with these programs. If such programs are to achieve the Australian Government's aim to have a highly skilled workforce, then these findings may become part of the tertiary sector's revised approach to student entry into government funded programs.

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