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# Success and Failure in Tertiary Education, with Reference to School Attended: A Re-Examination

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## *Abstract*

The first part of this paper reviews the research evidence accumulated to date which bears on the question, "How useful is information about a student's secondary school for an assessment of his likelihood of succeeding in tertiary studies?" Knowledge of whether a student entering university or college comes from a State, Catholic or other Private school appears to be useful to personnel making admissions decisions. The differing academic performance of students from these three types of schools is largely, unrelated to faculty choice, tertiary entrance qualifications, aptitude and intelligence. The way a student approaches his University or college work seems to depend instead on how he has been taught and the way he has been expected to study at school, given adequate ability and opportunity.

The second part of the paper re-examines this idea and presents the results of a multi-variate study of University Arts and Science students, and student teachers in a College of Advanced Education. Information about a student's school of entry was useful when added to matriculation score for selected faculties but the location of the school should also be taken into account. It is tentatively suggested that this latter variable modifies to some extent the "school" or "teaching" factor first proposed by Hohne in 1951.

## *Review*

Considerable attention has been drawn to the associations which appear to exist between school of entry and tertiary academic performance. Two studies by Hohne (1951, 1955) of the academic careers of students entering the University of Melbourne in 1943 were the first investigations in Australia which tested an entire university first year population (in fact, two of them) and examined the record of every student for his complete academic career.

The first of these studies on academic success in the Faculty of Arts revealed the existence of a consistent pattern. Students from non-Catholic private schools were most successful in Arts courses, those from State schools were less successful and students from Catholic schools were considerably less successful than either of the other two groups. Hohne postulated the existence of a "school" or "teaching" factor to account for these findings.

The second report showed that the pattern established for Arts students applied even more markedly in the Science Faculties. Notably, students from Catholic schools in both the "easier" (medicine had the highest pass rate) and the "harder" (Engineering had the lowest pass rate) faculties had very high failure rates. When the final number of graduates was broken down into school of entry groups it was found that students from non-Catholic private schools represented 43% of the full-time intake and the eventual graduates and 50% of the minimum-time graduates. State school students formed 33% of the intake and 33% of both the total and minimum-time graduates. Catholic schools, however, although they provided 17% of the full-time intake, produced only 14% of the eventual graduates and little more than 10% of those who graduated in minimum time.

The differing graduation rate among students from the three main types of school could not be explained by faculty choice, matriculation score, nor any of the psychological tests used (an intelligence test and tests of verbal and mathematical aptitude were administered). The only factor on which the school groups differed was their Rorschach test scores in that 40% of Catholic school students fell into the test category "seriously maladjusted". Only 23% and 18% of the Private and State school students, respectively, came into this category. Hohne points out that the small sample size for the Catholic students precludes any attempt to generalise this particular finding to other Catholic schools.

The poorer tertiary academic performance of students from Catholic schools has been repeatedly demonstrated in Australian research since Hohne's investigations, the only exception being a study of students at the University of Adelaide by Jordan (1966). In this study, however, tests of statistical significance were not employed.

Hogben (1961) followed through the academic performance of 85 Science students at the University of Western Australia over four years of their course. He found that State schools produced proportionately three times the number of minimum-time graduates produced by either the Catholic or the Independent schools although there was no difference between the school groups at the first year level. Anderson (1961) at the University of Western Australia also supported Hohne's earlier conclusions for first year students and found that Catholic school students performed poorly in the Faculties of Arts, Science and Medicine. The three successive intakes which were studied showed no significant differences between school groups in intelligence and reading test scores. Similarly, Hughes (1961) at the University of Tasmania found that for six consecutive full-time student entries (1950-1955), of those from Catholic schools 43% eventually graduated as compared with 76% for the whole entry. The difference between performance of State and non-Catholic private schools was not significant.

The findings for the relative superiority of State or non-Catholic private school students differ from one Australian State to another but students from Catholic schools have consistently been found to perform below the general average.

One other large-scale study by Hogben (1964) of the performance of six consecutive first year intakes of medical students at the University of Western Australia bears mentioning. In this study each entrant group over the years 1957 to 1962 was compared in terms of intelligence, reading ability, matriculation standard and first year examination performance. The results showed that within any one school of entry group there was an insignificant variation from year to year in the above measures. When all six entry groups were combined and between-schools differences investigated the following patterns emerged:

- (a) Intelligence—no significant differences, based on A.C.E.R. B40 test.
- (b) Reading ability—State school entrants were better than Catholic but correlation of this factor with examination performance was very low (0.09 to 0.20). The Co-operative Reading Test, Form Y was used.
- (c) Matriculation standard—State school entrants were better than Independent school entrants. No difference between State and Catholic school groups.
- (d) First year average mark—both State and Independent schools were better than Catholic school entrants. No differences between the State and Independent entrants.
- (e) First year overall pass rates—State, 75%; Independent, 72%; Catholic, 51%.

By the time students reached their second and third years, however, there was no difference between the three groups in academic performance, that is, the Catholic school students who experienced no failure in first year performed as well as students from the State and Independent schools.

From the evidence reviewed so far there appears to be no satisfactory explanation, apart from school practice, which could account for the difference in academic performance between State and Catholic school students. Both schools seem to prepare their students equally well for the matriculation examination but not, however, for later tertiary studies. It might be suggested that factors such as the faculty entered and vocational choice have some influence on the results but the relationship has been demonstrated for many different faculties and vocational preparations, as has been discussed. Other factors such as family background and motivation may help to explain the superior performance of the Independent school entrants over the Catholic school group but this does not seem relevant to the lower performance of the Catholic school students when compared with students from State schools. Once again, we seem to be faced with the "school" or "teaching" factor first postulated by Hohne over twenty years ago.

In a comprehensive review of the literature, Miller (1970) found that the traditions and current interests of the school a student attends and the effectiveness of teachers in developing favourable attitudes toward education are factors that significantly influence not only secondary school achievement but also later academic performance. The way a student approaches his university or college work depends on how he has been taught and the way in which he has been expected to study at school. The research seems to suggest that, just as in the home, it is not the material circumstances of the school or the classroom that are of major importance but rather the motivational aspect, including the attitudes of the teachers. The level of performance that children produce in school is governed to a large extent by factors which motivate them to work. One of these motivating factors is the expectation that a teacher has of the level of performance his pupils are capable of achieving. Teacher expectations, however, are in turn influenced by such factors as the information made available to them about their students and by curriculum demands (Pidgeon, 1970).

The combined effects of educational preparation and student endeavor may be such as to produce a scholastic performance superior to that expected from scholastic aptitude as measured by tests. Sanders (1961) found that students in the lower intelligence groups competed successfully against those of higher measured intelligence in a sample of first year Science students. This produced a very low predictability of success in those ranges of intelligence test score, falling between 111-120 and 121-130. This observed phenomenon was said to be due to an "education factor". One fact to be kept in mind, though, is that intelligence test scores are not absolute guarantees that a student will perform at a certain level. Indeed, a difference between two individual's scores of up to 20 points or more may not be significant. Furthermore, intelligence test scores serve more to indicate whether a student has the required numeral level of ability rather than to forecast whether one student will perform better than another. Other factors apart from ability operate when relative levels of tertiary academic performance are considered (Otto, 1976).

Schonell (1962) compared the performance of students from "directive" schools, where teachers took their pupils through texts in great detail and rehearsed answers to specific examination questions, with those from "permissive" schools, where pupils did much of the work under their own initiative. While the "directive" schools had superior matriculation results, their results in the first year at university were inferior to those obtained by the "permissive" schools. Similar findings were obtained by Jordan for the University of Adelaide, in that schools with more "liberal" teaching techniques tended to produce students who performed least well in the matriculation examination but did best in first year university studies.

The British evidence also suggests that there are differences between schools in the way they teach. The Public School student (equivalent to our private school student) does less well than someone from the Grammar School (our State school) at university

studies. This difference in one study was particularly noticeable in the Faculties of Economics and Law (Himmelweit, 1963). Psychological test score comparisons showed that such results were not due to any ability differences. It was suggested instead that the Public school student does less well either because he may have had a less broadly based education or else because he may be less highly motivated for tertiary work. Kelsall (1963) went even further to suggest that when applications for tertiary entry are considered, the quality and quantity of sixth-form teaching received should be considered in conjunction with A-level results, so that those whose relatively poor performance arises partly from handicaps of this kind are not penalised.

In teaching methods then, there appears to be a difference between State operated schools and private schools. In Australia, Britain and the United States the evidence supports the view that students who enter tertiary education from State schools or their equivalent and from direct grant schools do best (Miller, 1970). The question then follows as to what schools can do to help those students who wish to undertake tertiary studies to develop appropriate study techniques and attitudes. The answer seems to be that those schools which give opportunity and encouragement to their students to develop independent learning habits and do not impose straight-jacketed thinking, nor confine their preparation for further study to a search for the "right answer" seem to produce better undergraduates.

Since the quality of teaching provided in secondary school is so important for tertiary academic performance, it would seem appropriate to search for some possible correlates of the "teaching factors" which might be more easily measured than teaching quality itself. Lee (1969) in a study of Cambridge University students concluded that graduation class size could be taken as a fair indication of teaching effectiveness. It was found that regular tertiary admission of candidates, and, to a lesser extent, examination performance, were associated with sixth-form size. Although other variables besides class size are obviously associated with the quality of student's work, such as the number and quality of staff, pupil ability and size of teaching groups, the conclusion was that for a sixth form to be effective it must offer a wide variety of subjects and that larger classes were more able to provide such a range of choices. These classes were also considered to be more likely to attract more experienced and better qualified teachers. This situation would seem to apply almost equally well to Australian schools. In this country the larger matriculation classes occur in the larger metropolitan schools rather than in schools located in rural areas and this could mean that rural schools produce matriculants handicapped to some extent for adjustment to university life and studies. However, it is possible that smaller class sizes in such schools might bring other benefits, both social and educational. There are opportunities here for further research.

#### Method Sample:

Questionnaires were distributed to a randomly selected sample of 209 students newly enrolled in the University of Adelaide Faculties of Arts and Science and another random sample of 93 students attending Salisbury C.A.E., both samples being taken in 1971. Table I indicates the magnitude of the populations and the questionnaire returns by faculty. The study group was a sub-group of a larger investigation concerning the academic progress of students who matriculated for university and college entry at the 1970 South Australian Matriculation Examination (Otto, 1974) and commenced tertiary studies in 1971.

TABLE I

Course	Population <sup>1</sup>	Sample	Returns	
			No.	%
Arts <sup>2</sup>	233	144	76	52.8
Science <sup>2</sup>	316	180	70	38.9
Dip. Teach <sup>3</sup>	234	234	180	76.9

1. Comprising all 1971 full-time tertiary entrants.
2. University of Adelaide.
3. Salisbury C.A.E.

#### Data Collection and Procedure:

Examination results were obtained for the first, second and third years of a course and the academic performance criterion chosen was the average of the examination marks (percentages) obtained in each year of the course. The matriculation score was also obtained for each student and his score on the Australian Scholastic Aptitude Test (ASAT) completed the test data collected. From the questionnaire, details concerning the student's school of entry and location of school were derived.

#### Statistical Analysis:

Multiple regression and cross-tabulation analysis were performed separately for males and females to control for the effects of sex of student upon academic achievement (Otto, 1976). All tests of statistical significance are two-tailed and only relationships which were significant at a level of 10% or better have been reported, a level which is considered satisfactory for an exploratory study of this kind.

The test of association which was considered most appropriate for the cross-tabulation analysis was Lambda (asymmetric). As there was no independent test of significance for Lambda, the significance level obtained from application of the Chi-square test to the data was taken as indicating the significance of Lambda. Although this procedure is open to error, the inaccuracy is not so great as to render the method inappropriate for the exploratory nature of this study.

#### Results and Discussion:

TABLE II

School Location	COMPOSITION OF STUDY GROUP		
	Arts	Science	Salisbury CAE
Metropolitan	61	26	137
Rural	14	12	31

School Type			
State	49	33	157
Catholic	17	1	14
Independent	9	3	13

Table II contains the proportions of students in Catholic, State, Independent (non-Catholic), metropolitan and rural schools. Taking each of these categories in turn, the results were as follows;

(a) Type of school—knowledge that a student came from a State school was useful in improving prediction over that afforded by a knowledge of the student's matriculation score alone. When, however, information about the school of entry was added to the student's matriculation score and academic aptitude score, no useful improvement in prediction of examination performance resulted (Table III).

TABLE III

SUMMARY TABLE FOR THE INFLUENCE OF SECONDARY SCHOOL TYPE ON THE PREDICTION (R) OF TERTIARY EXAMINATION PERFORMANCE (full-time students)

	Multiple Correlation Coefficient (R)					
	Arts		Science		Salisbury CAE	
	State Schools	All Schools	State Schools	All Schools	State Schools	All Schools
A.S.A.T. only						
First year—Males	.52	.45*	.16	.40*	na	na
—Females	.37	.27*	.55	.30*	.41	.42
Second year—Males	na	.56*	.28	.34*	na	na
—Females	na	.10	na	.17	.38	.25
MATRICULATION only						
First year—Males	.20	.65*	.33	.68*	na	na
—Females	.53	.51*	.78*	.63*	.53*	.53*
Second year—Males	na	.48*	.59*	.53*	na	na
—Females	na	.33*	na	.28*	.58*	.55*
A.S.A.T. and MATRICULATION combined						
First year—Males	.66	.70*	.37	.69*	na	na
—Females	.58	.51*	.78	.64*	.53*	.61

Second year—Males	na	.62*	.59	.53*	na	na
—Females	na	.33*	na	.28	.58*	.56

\* statistically significant at 10% level or better 'na'—figures not available as sample too small for analysis.

The improvement in prediction obtained with the State school students was not due to their having higher matriculation or aptitude scores than students from Catholic or Independent schools. The benefits derived from considering school of entry were relatively specific in that in some cases the prediction improvements were evident for males but not for females, and in other cases for some faculties or courses but not for others. The regression analysis was only performed for State school students because there were insufficient numbers in the Catholic and Independent groups.

Since the regression analysis did not yield a direct comparison between the three school groups, a cross-tabulation analysis was also conducted. Second year college males from State schools obtained better examination marks than either Catholic or Independent school students, although the relationship was weak (Lambda 0.05, sig. level 10%, N = 63). Similar results were obtained for first year college females (Lambda 0.01, sig. level 10%, N = 117). This superiority of the State school students was not due to any differences between them and the other school groups in matriculation or in aptitude score (t-test for significance of a difference between sample means).

(b) School location—information that a student came from a metropolitan or rural school was more valuable for prediction of academic success than whether he came from a Catholic, State or Independent school. Useful improvements in prediction were obtained when school location was added to aptitude test score, to matriculation score and also to a combination of these two scores (Table 4).

TABLE IV

SUMMARY TABLE FOR THE INFLUENCE OF SECONDARY SCHOOL LOCATION ON THE PREDICTION (R) OF TERTIARY EXAMINATION PERFORMANCE (full-time students)

	Multiple Correlation Coefficient (R)					
	Arts		Science		Salisbury CAE	
	State Schools	All Schools	State Schools	All Schools	State Schools	All Schools
A.S.A.T. only						
First year—Males	.58	.45*	.27	.40*	na	na
—Females	.33	.27*	na	.30*	.59	.42
Second year—Males	.41	.56*	.33	.34*	na	na
—Females	.44*	.10	na	.17	.25	.48

MATRICULATION only						
First year—Males	.52	.65*	.34	.68*	na	na
—Females	.55*	.51*	na	.63*	.57	.53*
Second year—Males	.20	.48*	.61*	.53*	na	na
—Females	.47*	.33*	na	.28*	.68*	.55*

A.S.A.T. and MATRICULATION combined						
First year—Males	.85*	.70*	.44	.69*	na	na
—Females	.55*	.51*	na	.64*	.57*	.61
Second year—Males	.48	.62*	.65	.53*	na	.61
—Females	.47*	.33*	na	.28	.68*	.56

\* statistically significant at 10% level or better 'na'—figures not available as sample too small for analysis.

Furthermore, these improvements were not influenced by any differences between metropolitan and rural school students in either entry qualifications or academic aptitude (t-test for significance between sample means).

A direct comparison was made between metropolitan and rural schools, using cross-tabulation analysis. It was found that males from metropolitan schools obtained higher examination marks in second year Arts than their counterparts from rural schools (Lambda 0.33, sig. level 10%, N = 14).

Similarly, first year males doing Science achieved better marks if they came from metropolitan schools (Lambda 0.13, sig. level 5%, N = 24), as did first year Arts females (Lambda 0.14, sig. level 5%, N = 45). Generally, however, the relationships are not very strong.

(c) Variables combined—as the influence of factors in isolation is often different from their combined influence, the variables of school entry, location of school, matriculation score and academic aptitude were all considered simultaneously by means of multiple regression analysis. The following groups were considered; metropolitan State schools, metropolitan Catholic schools and "all schools combined". The only significant improvement in prediction obtained when all these variables were considered simultaneously was for female students in their second year of the Arts course, who came from metropolitan Catholic schools (R = 0.77 versus R = 0.10, in Table 5).

TABLE V

SUMMARY TABLE FOR THE INFLUENCE OF SECONDARY SCHOOL LOCATION AND TYPE ON THE PREDICTION (R) OF TERTIARY EXAMINATION PERFORMANCE (full-time students)

	MULTIPLE CORRELATION COEFFICIENT (R)					
	Arts		Science		Salisbury CAE	
	Metropolitan State	Catholic Schools	All Schools Combined	Metrop. State Schools	All Schools Combined	Metrop. State Schools

A.S.A.T. only							
First year:							
Males	.50	na	.45*	.21	.40*	na	na
Females	.37	.22	.27*	na	.30*	.59	.42
Second year:							
Males	na	na	.56*	.19	.34*	na	na
Females	na	.77*	.10	na	.17	na	.25
MATRICULATION only							
First year:							
Males	.11	na	.65*	.26	.68*	na	na
Females	.53*	.41	.51*	na	.63*	.57	.53*
Second year:							
Males	na	na	.48*	.49	.53*	na	na
Females	.35	.35	.33*	na	.28*	na	.55*
A.S.A.T. and MATRICULATION combined							
First year:							
Males	.76	na	.70*	.35	.69*	na	na
Females	.53*	.57	.51*	na	.64*	.57*	.61
Second year:							
Males	na	na	.62*	.54	.53*	na	na
Females	na	.77*	.33*	na	.28	na	.56

\*statistically significant at 10% level or better 'na'—figures not available as sample too small for analysis.

CONCLUSION

Catholic schools appear to produce students for whom the first year of tertiary studies is a critical one. In subsequent years, however, there is little difference between students from Catholic schools and other schools.

Metropolitan school students seem to perform better in their tertiary courses than students from rural schools and this finding does not appear to be influenced by matriculation qualifications nor by academic aptitude.

Information about a student's school of entry, together with the location of that school and the marks the student obtained in his matriculation year appear to be useful in combination for predicting tertiary examination performance. The gains in predictive efficiency achieved in considering school location in addition to or even instead of school type (that is, Catholic, State or Independent) appear to modify somewhat the "school" or "teaching" factor proposed by Hohne, although only for selected tertiary courses.

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## Mathematics Education, English Technological Universities and Variety of Entry into the Teaching Profession

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The purpose of this paper is to raise the issue of genuine variety of entry into the teaching profession in Australia. The author's interest in mathematics and technological institutions has been used to focus the discussion on specific features, but his experience as a member of the Course Assessment Committee of the NSW Board of Teacher Education has made him aware of wider implications beyond the features peculiar to mathematics.

Mathematics education itself is a term which can include the teaching of mathematics, studies about the learning of mathematics, and the preparation of mathematics teachers. The various aspects of mathematics education are interwoven, and whether technological universities have anything distinctive to offer depends to what extent they have taken seriously their role of being "equal but different" in terms of course content and structure, and of course in so far as that political phrase has any educational meaning.

History, geography and politics can force a role upon an institution in isolation from any discussion of the educational issues involved, and many of these issues apply to colleges of advanced education in general. An overseas visitor can sometimes see things which those with their noses to the grindstone might miss, even allowing for the oversimplifications likely to be made by one who is not personally involved. It is an appropriate time for such an exercise when institutions both in England and Australia are being forced to reassess their activities.

The preparation of mathematics teachers will form the unifying thread through this paper. Readers might compare the situation in their own fields of study and in their own institutions to see what extent they are contributing to a genuine choice.

The preparation of mathematics teachers is a responsibility of the whole mathematical community, a point of view which has been forcefully expressed within the Canadian context by the main professional associations with interests in mathematics (Beltzner et al, 1976). However, the preparation of teachers is a responsibility of the whole educational community, since what educators and academics do, affects teacher education either directly or indirectly. It is thus arguable that this journal is an appropriate medium to air these views.

The preparation of mathematics teachers in a university cannot be isolated from the general structure and content of other courses. Nor should it be if those who contend that prospective teachers should mix with fellow students in a variety of disciplines. Of course a mathematics department might have no commitment to the preparation of