

# Relating IS Student Throughput to English Proficiency

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## Abstract

*Previous research has suggested that lack of proficiency in academic English could have a significant negative impact on academic performance at tertiary level. This study examines the relationship between English proficiency and the throughput rate of university students within the specialised field of Information Systems, with particular focus on second language speakers. Quantitative methods were used to analyse the results of a cohort of 241 undergraduate students majoring in IS at the University of Cape Town. The findings suggest that while language proficiency contributes positively to academic success, overall matriculation scores remain the best available criterion for university admission.*

## Research background

### Meeting the demands of transformation

The report on Transformation and Reconstruction of the Higher Education System includes among its key objectives the need to increase access to tertiary education and produce graduates with the skills needed to meet our country's human resource needs, while redressing past inequalities and promoting equity among students and staff so as to reflect the demographic composition of society (Department of Education, 2002).

The target set by the Department of Education aims at increasing the participation rate of Black students in higher education from 15% to 20% (an additional 200 000 students) over the next 10 to 15 years; while also increasing graduation rates from 15% to 30% of enrolled students per annum (Department of Education, 2002). At the same time, Jansen (2003) claims that in order to build a more equitable student profile, universities have lowered the aggregate quality of students enrolled in their programmes.

At the University of Cape Town (UCT), Black students generally take longer than their White counterparts to complete the undergraduate IS degree programme (Nash, 2003). New teaching strategies are likely to be needed if the simultaneous objectives of increasing the number of educationally disadvantaged students being admitted to universities, while raising throughput and graduation rates, are to be achieved. This may be an opportune time to re-assess the importance of language skills in the curriculum.

### Predicting academic success

The increasing diversity of students in tertiary education in South Africa, although indicative of success in the pursuit of equity, has affected both the problem of student retention and the complexity of predicting academic success (Blewett & Achmad, 2005).

Since quality of schooling is a prime determinant of access and success in higher education, it is hardly surprising to find high failure rates at tertiary level among Black pupils emerging from an apartheid context of differential spending on Black and White education, political opposition resulting in boycotts by both teachers and pupils, bureaucratic inefficiency and corruption and under-prepared teachers (Hall, 2001). Inappropriate student selection may lead to increased

education costs, waste of limited teaching resources, and the demoralising effects of failure following unsuitable career choices (Bokhorst et al, 1990).

The important role of admissions policy has led a number of researchers to investigate the relationship between academic factors and university achievement. The value of the matriculation examination as a predictor of university performance has been supported by e.g. Bokhorst et al (1990), Lourens and Smit (2003), Stoker (1985), Van Wyk and Crawford (1984). However, other researchers have cast doubts on the usefulness of matriculation score as a predictor, claiming that it is only valid in the case of “advantaged” students (Miller et al, 2001; Shochet (1986), cited in Huysamen, 1997).

Several researchers have supported the theory that although overall school aggregate is the best predictor of academic performance, a certain threshold of English proficiency is essential to be successful at university, above which better knowledge of English does not increase the chances of success (Bohlmann and Pretorius, 2002; Eiselen and Geysers, 2003; Seelen, 2002). Other studies have suggested that language proficiency may be an important contributing factor in English-medium education (Miller et al, 1998; Nash et al, 2005; Rauchas et al, 2006; Thesen et al, 1997).

These studies suggest that while matriculation performance is probably the best generally available predictor of success at tertiary level, students with poor English proficiency, who are most likely to be second language speakers, can be expected to encounter additional difficulties in coping with the academic demands placed upon them at university, especially during the first two years of study. Foley (2004) confirms that academic literacy development is an area of urgent need in order to prevent language from acting as a barrier to success in higher education.

## **Studying IS at UCT**

The role of information systems (IS) has become increasingly pervasive within the global economy (Baskerville & Myers, 2002), and tertiary education has become the leading credential for obtaining employment within this field (ITAA, 2002). In South Africa, an insufficient supply of skilled IS graduates has been exacerbated by the exodus of those seeking employment overseas, and by the limited pool of qualified Black candidates who are available to meet organisational employment equity requirements (Conradie, 2000; SAITIS, 2000).

At the University of Cape Town (UCT), students are expected to take a minimum of three years to complete a ‘mainstream’ BCom degree in Information Systems. Students who do not meet the admission criteria for a mainstream degree, but who are accepted under the university’s Academic Development Programme (ADP), are expected to register for an extended period of (at least) four years. The degree curriculum for IS majors includes a number of general commerce courses, in subjects such as accounting, economics, statistics and law, together with ten undergraduate IS courses covering both theoretical concepts and the development of technical skills.

The various aspects of an IS education involve a broad range of language skills: programming relates to formal grammatical and syntactic structures; the description of theoretical concepts in information systems depends heavily on the use of technical jargon; the eliciting of system specifications requires accurate verbal comprehension and the unambiguous use of language; business models are described in terms of logical abstractions; while interpersonal communication skills are essential for effective management. Thus students who are linguistically under-prepared, are likely to encounter difficulties throughout the IS curriculum.

Despite consistent ratios of Black, Coloured, Indian and White students in the Commerce Faculty intake from 2000 to 2002, an increasing proportion of White students is found in each successive year of the IS major: in 2002, 62% of the third year class was White, compared with 43% of the first year class (Nash, 2003). In order to meet the equity requirements of both tertiary education and

industry, it is essential that the progression rates of Black students should be improved. The first step towards doing so is to identify factors affecting student performance, particularly those who have been previously disadvantaged, so that positive interventions can be provided. Linguistic competence in English may be one of these factors.

## **The research topic**

This research study was undertaken in order to investigate the relationship between English language skills and student throughput in the IS major curriculum at UCT. Previous research has suggested that language proficiency may be an important factor in achieving academic success at tertiary level, and appears to support the claim that this is particularly relevant in the case of students with weak language skills. Since IS as an academic subject has strong communication and syntactic components, it seems likely that language skills could play an important role in student performance.

For the purposes of this research project, student throughput in IS was measured in terms of the time taken to complete all ten undergraduate IS courses required for the BCom(IS) degree at UCT, giving rise to the following hypothesis:

*H<sub>0</sub>: There is no association between matriculation English scores and the time taken to complete an IS major at UCT.*

*H<sub>1</sub>: There is a significant negative association between matriculation English scores and the time taken to complete an IS major at UCT.*

## **Value of the research**

Linguistic proficiency is one of a number of factors that could affect student performance in IS and thus influence progression rates through the undergraduate degree curriculum. If this is indeed the case, then early intervention programmes based on English language proficiency at the time of admission could be of benefit to under-prepared students. This would be of value not only to ADP students, but also to the many second-language English speakers who are admitted into mainstream programmes.

Since IS as a discipline has links with a number of other academic subjects, these findings could also be of value within other degree programmes. According to the University of Queensland (1998), problems of English language proficiency are not isolated to any one cohort of students, and as such deserve University-wide attention. However, the potential impact on IS graduation rates would be particularly valuable in view of the local need for employment equity skills and the importance of IS within the global economy.

## **Limitations of the study**

This study addresses only one of many factors that may affect student throughput rates in IS and within tertiary education in general. It does not attempt to examine the relationship between language proficiency and factors such as previous educational environment, social and economic background. In addition, data relating only to a single cohort of students has been collected and analysed, and changes in course content or teaching methods could affect the generalisability of these findings.

Of greater concern is the question of how best English proficiency can be measured. Several studies have indicated that the matriculation examinations are not a good predictor of student performance, especially for those with lower range scores (Miller et al, 2001), and a number of tertiary

institutions require applicants to write alternative admissions tests in order to assess language proficiency. Since no alternative source of data was available for the purposes of this study, matriculation English results were used as the basis for determining English language skills. The extent to which this variable in fact measures language proficiency will affect the validity of the research results.

## **Research methodology**

### **Data sample**

In this study, a single cohort of students was used to investigate the relationship between English language proficiency and student throughput in Information Systems. The reliability and accuracy of the data were assured through the use of institutional records rather than personal recollection, and since the entire cohort of students was included, the representivity of the sample was not a cause of concern. There could however be significant effects of time or context when comparing the performance of these students with other cohorts, due to differences in admissions criteria, curricula, lecturers, and teaching and assessment methods, which affects the generalisability of the present findings across other courses or with regard to other institutions.

The sample used for this study consisted of all students intending to major in Information Systems at the University of Cape Town, who registered for the first time in 1999. This particular group was selected because they were the first group to follow a new semesterised curriculum. Since the ten undergraduate IS major courses can be completed in a minimum of three years, a number of students could have been expected to do so by the end of 2001, while those following an extended four-year programme should have completed their IS studies by the end of 2002. The use of this cohort thus ensured that data across all years of the IS major programme would be available even for those students who took longer than the minimum period to complete their degrees.

Academic records for a total of 241 students, encompassing the period from 1999 to the end of 2002, were downloaded from the central university database. Matriculation results and demographic data for the same students were obtained from the student records office, and linked to the corresponding academic records by means of the unique student number.

### **Variables included in the study**

Data relating to student admissions criteria that was obtained from the central UCT database included:

- type of matriculation English examination that was written
- matriculation English result (symbol)
- total (unweighted) matriculation score
- whether the student had been accepted under the Academic Development Programme.

In addition, the researcher calculated for each student the total number of years taken to complete all ten IS undergraduate semester courses required by the BCom(IS) curriculum. The type of English examination written and the symbol obtained allow the calculation of the *English score* which is used by the faculty to determine whether minimum language requirements have been met, and provides a measure of linguistic proficiency that is consistent across the sample.

Since total matriculation score forms the current basis for admission to the University of Cape Town, any correlation between academic performance and English results would need to be considered relative to the equivalent correlation between academic performance and the matriculation score excluding English. In order to do so, the *Net matriculation score* was calculated by subtracting the English score from the total unweighted matriculation score.

A number of demographic variables (*Race*, *Sex*, and *Home language*) were included in the data that was collected, in order to investigate their possible influence on the association between English proficiency and academic performance. Based on the literature review, it appeared possible that both *Race* and *Home language* could be associated with English proficiency. There was no reason to expect a significant relationship between *Sex* and either English proficiency or IS throughput rates. Students accepted in terms of the ADP programme could be expected to have lower matriculation and English scores and also take longer to complete the IS courses; their inclusion also made a useful contribution by extending the lower range of matriculation and English scores within the sample.

## Statistical analysis

The data set was analysed using the Statistica™ package. Frequency counts were produced for each of the categorical variables, and used as the basis for redefining some variables in order to eliminate low response counts. Final categories used for these variables were as follows:

<i>Sex</i> :	Male / Female
<i>Race</i> :	Black / Coloured / Indian / White
<i>Home language</i> :	English / Other
<i>ADP student</i> :	Yes / No

The collapsing of *Home language* into two alternatives, “English” or “Other”, was necessitated by the fact that altogether 16 different home languages were spoken by the students included in the study, with all of these languages except English having a frequency of less than 5% of the total sample. An additional variable, *Race group*, with values of “White” and “Other”, was derived from *Race* to cater for multidimensional analyses which otherwise would have resulted in inadequate cell frequencies. The matriculation *English score* was calculated based on the type of examination written and symbol obtained, and the *Net matriculation score* (excluding English) was also derived.

Descriptive statistics were calculated for each of the numerical variables: total unweighted *matriculation score*, *English score*, and *Net matriculation score* (excluding English). Histograms were plotted for each the continuous variables and compared to the expected distribution under the normal curve.

Statistical analysis of the research hypothesis was based on an additional calculated variable indicating the number of years taken for the student to complete all 10 undergraduate IS courses. Much of the subsequent data analysis was based on a subset of records comprising only those students who had completed the IS major within the four years of the study.

Of the total sample size of 241, 193 students completed all 10 undergraduate IS courses within four years. Their demographic characteristics were as follows:

<i>Sex</i> :	Female 32%; Male 68%
<i>Race</i> :	Black 11%; Coloured 8%; Indian 11%; White 70%
<i>Home language</i> :	English 84%; Other 16%
<i>ADP student</i> :	No 98%; Yes 2%

When comparing students who completed IS3 with those who failed to do so, a chi-squared test showed significant differences between the two groups in respect of all the above variables except for sex. Fewer Black students and more White students completed the IS courses; more English speakers completed the courses; and fewer ADP students completed the courses (although low numbers of ADP students make this result statistically unreliable).

The results of a t-test showed that students who completed the IS major curriculum differed significantly from those who did not in terms of their *English score* (6.4 vs. 6.1,  $p=0.033$ ) and their

Net matriculation score (31.4 vs. 28.4,  $p=0.000$ ). In view of the limited range of the *English score* variable, a chi-square test was also used to measure its association with completion of IS3, and gave a similar result ( $p=0.038$ ).

The focus of this area of the analysis was to identify differences between those students who completed their undergraduate IS courses within the minimum period of three years compared to those students who took four years to do so, with particular interest in the role played by matriculation English scores. The following tables compare the demographic characteristics of the two groups.

Sex	3 Years		4 Years	
Female	43	34%	19	29%
Male	85	66%	46	71%
Total	128		65	

Table 1. Sex by Years Taken to Complete IS3

Race group	3 Years		4 Years	
White	100	78%	35	54%
Other	28	22%	30	46%
Total	128		65	

Table 2. Race Group by Years Taken to Complete IS3

Home language	3 Years		4 Years	
English	115	90%	47	72%
Other	13	10%	18	28%
Total	128		65	

Table 3. Home Language by Years Taken to Complete IS3

Chi-squared tests showed significant differences between the two groups in the case of both *Race group* and *Home language* ( $p<0.01$ ), but not in the case of *Sex* ( $p=0.54$ ). The association between *Race group* and *Home language* was highly significant for the complete group of students who completed IS3; however, this association was considerably weaker within the group who took four years to do so ( $p=0.04$ ), than for those who took three years ( $p<0.001$ ).

A one-way ANOVA showed that although the relationship between English score and the average period taken to complete IS3 was statistically significant ( $F=3.402$ ,  $p=0.018$ ), in practical terms the difference between the minimum and maximum group means was slightly less than three months (Table 4).

	F statistic	P value	English score			
			4/5	6	7	8
Yrs to IS3	$F(3, 189) = 3.402$	0.018	3.5	3.4	3.3	3.2
N			27	84	57	25

Table 4. ANOVA for Years taken to complete IS3 and English score

T-tests demonstrated significant differences in the value of English score and net matriculation score for the two groups (Table 5).

Variable	Mean (3 Yrs)	Mean (4 Yrs)	t-value	p
English score	6.55	6.12	-3.13	0.002
Net matric score	32.4	29.4	-5.43	0.000

Table 5. Matric scores by Years Taken to Complete IS3

Although for this subset of the data sample as a whole, the correlation between *English score* and *Net matriculation score* was 0.466 ( $p < 0.001$ ), it was slightly higher for those who completed the IS courses within 3 years ( $r = 0.484$ ), and considerably less significant for those who took four years ( $r = 0.261$ ,  $p < 0.05$ ).

An ANCOVA computing the effect of *English score*, *Race group* and *Home language* on the years taken to complete IS3, found that both *English score* and *Race group* had a significant impact ( $p < 0.05$ ), although the low value of  $R^2$  (0.120) makes this of little practical value. When *Net matriculation score* was added to the model, it became the only variable to make a significant contribution, while increasing the value of  $R^2$  to 0.185.

It could also prove useful to examine the characteristics of those students who did not complete an IS major during the four years of this study, since student throughput rates are an issue of concern for students, parents, the university administration and the Department of Education. Students who failed to complete IS3 differed significantly from those who succeeded in terms of both *Race group* and *Home language*, with Black students and non-English speakers less likely to complete the full IS curriculum within four years. They also differed slightly on the basis of *English score* (completers scoring on average about 3½ % more than non-completers), but much more significantly on the basis of *Net matriculation score*, with a difference of three symbols across the five subjects excluding English. Once again this suggests that for weak students in particular, matriculation English results are not a reliable predictor of academic performance (Huysamen, 2000; Miller et al, 2001).

## Discussion of results

Within the time frame of this study, students could have completed an IS major within the minimum period of three years, or within an extended period of four years. In fact, 20% of the initial cohort of 241 students had not completed the IS major by the end of 2002, and were excluded from the analysis.

A chi-squared test revealed a significant association between the value of *English score* and the number of years taken to complete IS3 ( $p = 0.009$ ), while a t-test comparing the *English score* of those who completed IS3 within 3 years as opposed to 4 years resulted in a value of  $p = 0.002$ . The mean *English score* for those completing IS3 within 3 years was 6.55, compared with a mean *English score* of 6.12 for those taking 4 years (implying a difference of half a matriculation symbol).

In assessing the impact of other demographic variables on the time taken to complete IS3, *Race group* and *Home language* both played significant roles. The interaction between these two variables was also highly significant for those who completed IS3 within 3 years (mainly White English speakers), while the weaker association between *Race group* and *Home language* within the 4 year group suggested greater demographic diversity.

The contribution of *English score* in determining the time taken to complete IS3 was overshadowed by the stronger association with *Net matriculation score*. In practical terms, students completing IS3 within 3 years scored on average only half a matric symbol higher than the 4 year group in the English examination (6.6 points vs. 6.1). In contrast, the mean *Net matriculation score* for students completing IS3 within 3 years was 32.4, and mean *Net matriculation score* for the 4 year group was 29.4, implying a difference of three symbols across the five matriculation subjects excluding English. In the light of this result,  $H_0$  cannot be accepted, and we conclude that there is a small but significant negative association between matriculation English scores and the time taken to complete an IS major at UCT.

When examining the demographic characteristics students who completed the IS major, the retention rate of Black students within this cohort seems more promising than had previously been reported, with the proportion of non-White students decreasing only slightly from 35% in year one to 30% by the final year. One must however bear in mind that the cohort under investigation entered UCT in 1999, a period of substantial growth in the IT industry. More recent admission figures reflect a lower proportion of White students entering the IS major programme, and it is possible that the admission of increasing numbers of under-prepared Black students could negatively affect retention rates.

### **Areas for future research**

Data relating to only a single cohort of IS majors at UCT has been analysed, and different results might be obtained based on a different group of students or different lecturers. This study also does not take into account the effect of changes to the IS curriculum or to UCT admissions criteria, or different practices in the teaching of IS at other tertiary institutions.

- Further research carried out over a longer time period and encompassing a range of different institutions would be useful in ascertaining the extent to which English proficiency is related to IS achievement within the discipline as a whole.
- It would also be useful to examine more closely the role of language skills within specific areas of IS, such as business analysis, system development and IT management.
- By assessing English proficiency in terms of the actual percentage obtained in the matriculation examination, rather than in terms of a symbol, a more accurate measure of linguistic skill across a wider range of values would be obtained, which would increase the power of the calculated correlation statistics.

A potential weakness of this study is the reliance on English matriculation score as an indicator of language proficiency. Several researchers have previously cast doubt on the reliability of the matriculation examination as a predictor of student academic ability, particularly for underprepared and second language students. Alternative admissions tests are already being used at a number of tertiary institutions to provide an independent assessment of language and mathematical ability, and as from 2006 all students entering the Faculty of Commerce at UCT have been required to write these tests.

- Future studies based on the data emerging from the alternative testing process could provide additional insight into the nature of the relationship being investigated here.

Finally, the research methods used in this study have been exclusively quantitative in nature.

- A qualitative investigation into student perceptions and experiences of the role of English language within the IS curriculum would make a valuable contribution to our understanding of this relationship.
- Since student performance is a complex and multivariate phenomenon, research is also needed to understand the contribution of other factors affecting IS performance; for example social background, levels of self-discipline and the ability to co-operate within groups.

Equity in education is a vital element in the quest for social transformation in South Africa. Further investigation into issues affecting student performance is essential if we are to translate affirmative admissions practices into increased numbers of Black graduates.

## Conclusion

Tertiary institutions are under pressure to meet the demand for IS specialists within both local and global economies. At the same time, social transformation within South Africa depends on increased numbers of Black graduates. If students emerging from academically disadvantaged backgrounds are to succeed within the field of information systems, then research is needed to identify problem areas and ways of redressing them.

This study investigated the relationship between English language skills and the throughput rate of IS majors at UCT, based on demographic and academic data for a cohort of students following the IS curriculum between 1999 and 2002.

The time period within which students completed all ten undergraduate IS courses was relatively shorter for those with higher English scores; however, in practical terms this difference translated into only a few months. Overall, net matriculation score was more strongly associated than English score with the time taken to complete IS3.

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