Determinants of Student Success at a South African University: An Econometric Analysis

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ABSTRACT South Africa needs more higher education graduates with the capability to adapt to and function in a knowledge-driven and knowledge-dependent economy and society. High dropout and failure rates, as well as the slow progression of students, have revealed themselves as complex, persistent challenges and seemingly intractable crises at South African universities. To identify determinants of management studies student success, this study fits the student records data in two different educational production functions applying two econometric approaches, namely, Ordinary Least Squares and Logistic Regression models. Results of Ordinary Least Squares and Logistic Regression analyses confirmed that key determinants of student success are total matriculation points, matriculation Maths and English I scores, and having English as home first language. Other personal and student demographic variables play some role in determining university success. Exogenous factors such as the institutional environment, intellectual leadership, a proper learning infrastructure and environment at the university, socio-economic characteristics, and psychological attitudes also play an important role in predicting student success. The contention is, these determinants of student success are not straightforward measures of student quality as they are the sum of complex and multifaceted factors, making the prediction of student success a far more complex and multifaceted process demanding further investigation. These implications should be explored and integrated into the educational policy-making process and strategic planning to reverse the trends of high dropout and failure rates at South African universities.

INTRODUCTION

South Africa needs more higher education graduates with the capability to adapt to and function in a knowledge-driven and knowledge-dependent economy and society (Council on Higher Education (CHE 2010). High dropout and failure rates, as well as the slow progression of students have revealed themselves as complex, persistent challenges and seemingly intractable crises at South African universities. On average, less than 15 percent of the cohort of school leavers (referred to in South Africa as matriculant pupils, matriculants, or "matric") gain admission to Higher Education Institutions (HEIs) (Njuguna et al. 2008), out of which less than 50 percent graduate (Macfarlane 2006; Letseka and Maile 2008; OECD 2008). Top performers stu-

dents educated in a deeply dysfunctional primary and secondary education system often arrive at university with massive academic deficits (Govender 2013). Low graduation and throughput rates at South African universities have severely limited the number of graduates eligible to pursue professional career paths and constitute wastage of much-needed skills for the South African economy. There is a need to look at the number of failures and where they are coming from in order to address the massive number of dysfunctional schools learners find themselves in (Bauer 2013).

The South African labour market demands are generally directed to attract graduates and high-level skilled workers causing a mismatch between the supply of and the demand for labour for score of Black African population. About 2.8 million South Africans are illiterate, having never been to school and about 3.9 million are functionally illiterate, having dropped out of school before completing grade seven (Statistics South Africa (Stats SA) 2007/2008).

In South Africa, the Black African population suffers from a dearth of postgraduate and high-level skills (Department of Higher Education and Training (DoHET) 2011; CHE 2010). The disparate education system organized along ra-

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cial lines during the apartheid era disadvantaged the non-white population (Black Africans, Coloureds and Indians) contributing to social inequalities (Njuguna et al. 2008). Education for the non-white population and specifically for Black South Africans systematically reinforced decades of racially and geographically segregated and financially neglected schooling, despite increasing enrolments and growing skills shortages (OECD 2008: 37). The large majority of the Black African population is uneducated, and ill-prepared for the world of work, having not acquired the skills to meet the labour market demands of the competitive and dynamic environment of modern knowledge-based economies (CHE 2010; Sedgwick 2004).

A major concern is, the high dropout and failure rates as well as the slow progression of students from previously disadvantaged population groups in South African universities may result in further racial and socio-economic disparities in future generations. Generally, students who do not complete their tertiary degree will most likely join the millions of unemployed in South Africa and have no prospects for a decent life (Gordhan 2011). Leaving a HEI without graduating implies a loss in potential earning power and livelihood, lower job prospects, and a weakened ability to accumulate assets and capital, not to mention the personal and emotional consequences (Visser and Hanslo 2005). Anecdotal evidence suggests that the opportunity cost of leaving HEIs without graduating is even higher for students from previously disadvantaged population groups. These students will more likely revert to marginalized areas where dire poverty, poor housing, limited health and welfare are the norm, educational resources are scarce, and the incidence of HIV/AIDS, alcohol abuse and unemployment are high. The education of students from previously disadvantaged population groups is considered a crucial determinant of the democratic South Africa's ability to achieve equity and the participation of all race groups in the mainstream economy.

Higher education in South Africa is being steered towards raising graduation and throughput rates, thus enhancing South Africa's human resources capacity (Gordhan 2011; Barro and Sala-i-Martin 1995; Becker 1964). To achieve these laudable goals and transform the racially divided structure of South African society, higher education is called upon to fulfil three impor-

tant roles: (1) human resource development, (2) high level skills training, and (3) production, acquisition and application of new knowledge (DoE 1997: 1.1 to 1.12). Key policies, documents and initiatives in education set out a single overall goal of transformation of South African higher education and identified five key specific policy goals coupled with the related strategic objectives for achieving the overall goal. These policy goals included: (1) producing the graduates needed for social and economic development in South Africa, (2) achieving equity in the South African higher education system, (3) achieving diversity in the South African higher education system, (4) sustaining and promoting research, and (5) restructuring the institutional landscape of the higher education system.

However, in 2012, some 18 years after the abolition of the apartheid system and the advent of democracy, the deterioration of the education system is still one of the central topics in the public opinion and policy landscape in South Africa. The landscape of student success at South African universities indicate that there are still relatively low numbers of students from previously disadvantaged population groups in higher education. This points to ongoing racial inequality in education outcomes (Rembe 2005). Enrolments in the HEIs dropped by 4 percent between 1998 and 2000, allegedly as a result of financial constraints facing students (OECD 2008).

Poor student success and South African education stakeholders' concerns have triggered renewed focus and attention on the determinants of student success. Factors influencing the university success have received a great deal of attention from education stakeholders with the view to investigate the reasons for the poor success at universities (Horn et al. 2011). CHE (2010) contracted six research projects to analyse key trends and identify the major challenges within the South African higher education landscape. These reports identified general trends and the challenges within South African higher education as illustrated in Table 1.

In Table 1, major concerns and challenges that remain include *inter alia* poor student achievements or outcomes (high dropout and failure rates, high attrition of students, slow progression, poor graduation rates, or low throughput rates), the fact that the demand for student financial aid and loans steadily exceeds the sup-

Table 1: Trends and challenges within South African Higher Education

- Overall, due to a complex set of reasons, HEIs are not performing well in the area of teaching and learning in relation to access, graduations and throughputs (Scott et al. 2007).
- The expansion of enrolments has not been accompanied by a proportional increase in the number of graduates. Only a very small number of students complete their degrees in the allotted time.
- Undergraduate students take too long to graduate (years to graduation) and comparatively few progress into postgraduate studies. The higher education system does not produce sufficient number of postgraduate students, particularly at doctoral level (Mouton 2008).
- High student drop-out rates (DoHET 2011).
- Graduates' attributes not always match employers' expectations and needs. There are insufficient graduates with the required skills in a number of strategic areas of economic development (CHE 2010).
- Success rates in higher education are skewed by race and are currently 74 percent for Black African, 76 percent for Coloured, 81 percent for Indians, and 85 percent for Whites (DoHET 2011). The participation rate of African students is disproportionately low in relation to the demographic profile of the South African population.
- There are many challenges in retaining more high level (especially Black) academics and managers who are either highly prized by the government and corporate sectors or lured away from a career in academia by fat cat salaries and the prospect of swift career promotion (DoHET 2011).
- Most university lecturers are not sufficiently prepared to respond to the variety of educational needs of a new and varied student population.
- The South African higher education system has an unusually high proportion of students dropping out, mainly at undergraduate level.
- There is uneven quality across the higher education sector (DoHET 2011; Taylor and Harris 2002 and 2004; Athanassopoulos and Shale 1997).

Source: Adapted from CHE (Council on Higher Education) (2010)

ply, inadequate educational infrastructure, unqualified educators, the huge number of learners and large classes, a biased curriculum, poor conditions of work in higher education, inadequate student support systems, and labour market relevance (CHE 2010; OECD 2008; DoE 2005).

Student success at the University of Kwa-Zulu-Natal (UKZN) is a microcosm of South African HEIs as a whole (DoHET 2011; CHE 2010). Executive managers and administrators discuss the University-wide high failure rates and poor graduation and throughput rates regularly at Board meetings in order to address the problem. In management studies, the modules students most often underachieve in over the years, are accountancy and economics subjects. Concerns are still mounting about the high dropout and failure rates in the undergraduate accounting and economics modules as these two subjects are prerequisite and gatekeepers at first- and second-year level for all students for a range of different degree programmes and qualifications in the College of Law and Management Studies (CLMS). These two subjects are becoming significant stumbling blocks affecting students' progression.

Various executive meetings have agreed that high dropout and failure rates in the undergraduate accounting and economics modules have to be investigated and commissioned research into why this is so and into how students feel about the subjects teaching and contents. Contogiannis (2005) is of the opinion that economics subject has been difficult for students and that the high failure rates are a more general problem that has to be debated.

HEIs internationally are presently focusing on the intricacies of coping with the first-year experience at university (Yathavan 2008). Other studies also stress the relevance of the need for early intervention and enhancement of first-year student success because of the overwhelming influence of schooling and the challenges that the transition from school to university presents (Leibowitz et al. 2009; Tinto 2003, 1999; Yorke and Thomas 2003). The student's final examination mark earned at the end of the first-year of university is the single best predictor of student persistence after controlling for students' entering characteristics (Pascarella and Terenzine 2005). Borg and Stranahan (2002) suggest that a student's course grade is usually the student's first (and perhaps only) indicator of how successful the student is in a subject, and that the grade received usually determines whether the student chooses to continue in the study of the subject.

Objectives

Using an educational production function approach and treating each academic year as a

separate statistical entity, the overarching objective of this study is to examine the determinants of student success that can be discovered *via* student records. More specifically, this study aims to:

1. Compare matric scores (total matric points and selected matric subjects scores) and students' final examination marks (student success) in the undergraduate accounting and economics modules.
2. Examine a cross sectional snapshot in one module - between students in first-year accounting or economics modules.

These objectives gave rise to the following research questions:

1. What are the determinants of student performance in the undergraduate modules that can be discovered *via* student records, specifically, of first-year accounting and economics?
2. Amongst these determinants that can be discovered *via* student records, which ones negatively affect (impede) or positively affect (contribute to) student success?

The measures of student success used in this study are: (1) the students' final examination marks in first-year accounting and economics modules (used as a discrete variable as explained in the methodology), (2) the students' final examination mark of 50 or above (that is, percentage eligible to pass the module, used as a dichotomous variable as explained in the methodology). Although, this study's econometric analysis deals with first-year accountancy and economics courses only, it acknowledges that the selected courses at second- and third-year level have also higher risk of failure. For example, Accounting-3 pass rate in 2004 was 40 percent and in 2005, 17.15 percent (FMS 2005). This study's conceptual model can also be extended in other studies to test non-incorporated modules at second- and third-year level.

This study expects finding the salient determinants of student success and trends which will help improve admission criteria, retention, graduation and throughput through enhancing the quality of teaching and learning processes which have been receiving renewed attention (CHE 2010).

METHODOLOGY

This study conducts a quantitative analysis that fits the students' records data in two different educational production functions applying two econometric approaches, namely, Ordinary Least Squares (OLS) and Logistic regression models, to identify salient determinants of student success in the CLMS at UKZN. Regression analysis estimate or predicts the average value of the dependent variable on the basis of the fixed values of the explanatory variables. That is, regression analysis examines whether the average performance of a student in first-year accounting or economics modules can be predicted by knowing the student's score in matric Maths, for example. Regression analysis is conditional upon the assumption that the dependent variable is random, statistical or stochastic (having a probability distribution) but the explanatory variables are fixed or non-stochastic.

To achieve this end, this study relies heavily on economics of education research issues, economic principles and methods used in the higher education studies reviewed. More specifically, this study builds on efficiency studies that have examined an educational production function using theories of a firm model. Following Tewari et al. (2008) and Van Den Berg and Hofman (2005), student success is determined by sets of determinants that are classified into three major categories: (1) characteristics of academic/non-academic (administrators/support) staff members; (2) characteristics of HEIs; and (3) characteristics of students. However, appropriate specifications of educational production functions are varied and controversial. Although studies postulate a relationship between student success (as an educational outcome/output) as dependent variable and sets of educational inputs as explanatory variables, they did not concur on the precise form of the functional relationship between them (Horn et al. 2011; Tewari et al. 2008; Parker 2006; Park and Kerr 1990). The functional form of the educational production function in this study is the following:

$$P_{ij} = f\ (S_{ij}, A_{ij}, I_{ij}, U_{ij}) \qquad (1)$$
where,

P_{ij} is the final marks of ith student at the end of the academic year, obtained in j^{th} course;

S_{ij} is (are) the ith student characteristics that can explain his/her academic performance in j^{th} course;

A_{ij} is (are) the characteristics of academic/non-academics (administrators/support) staff members that impact the academic performance of the ith student in j^{th} course; and

I_{ij} is (are) the HEIs/institutional/UKZN characteristics that can explain the performance of the ith student in j^{th} course.

U_{ij} denotes the stochastic error term.

The inclusion of the stochastic error term (U_{ij}) in the model is important otherwise the Equation (1) would have assumed that there is an exact or deterministic relationship between student success (educational output) and sets of educational inputs embedded in the educational production function. But relationships between economic variables are generally inexact making the educational production function not to be deterministic. This stochastic error term is contributing to the acknowledgment that any economic, social and personal phenomena including teaching and learning processes have many possible determinants that cannot easily be counted, mapped, measured, or modelled in an educational production function.

The equation (1) states that, *ceteris paribus*, student academic performance is related to conjointly the HEI's/institutional/UKZN's characteristics, characteristics of academics/non-academics (administrators/support) staff members, and characteristics of students. *Ceteris paribus*, if these three categories of determinants are dysfunctional in a single HEI, they yield poor student success. Indirectly, poor student success in the process raises the incidence of slow progression and lower retention, high dropout rates and student attrition, poor graduation rates, and low throughput rates in that typical HEI. An attempt is made below to specify an econometric model of the relationship between student success (which is an educational output) and miscellaneous educational input variables that will be transformed in the educational production function at UKZN, to educational outcome/output. Treating each academic year as a separate statistical entity and making assumptions about the probability distribution of the disturbances, two sets of quantitative models are used:

Ordinary Least Squares (OIS) Regression Method

The OLS method allows one to predict the average value of the dependent variable on the basis of the fixed values of explanatory variables (Gujarati 1995; Park and Kerr 1990). If the dependent variable - students' final examination marks - is treated as continuous variables when P_{ij} can

take on any number between 0 and 100, then the OLS method can be applied. To allow for the inexact/unspecified functional relationships in the educational production function reflected in equation (1) above, this study modifies it and suggests a linear functional form as follows:

$$P_{ij} = \grave{e} + \sum_{k=1}^{n} \partial k S_{ij} + \sum_{k=1}^{n} \beta k I_{ij} + U_{ij} \qquad (2)$$
where,

P_{ij} denotes the academic performance (for example, final examination marks) of ith student at the end of the academic year, obtained in j^{th} course;

S_{ij} denotes the ith student characteristics that can explain his/her academic performance in j^{th} course;

A_{ij} denotes the characteristics of academic/non-academic (administrators and support) staff members that impact on the academic performance of the ith student in j^{th} course;

I_{ij} denotes the HEIs/institutional/UKZN characteristics that can explain the performance of the ith student in j^{th} course; and

U_{ij} denotes the stochastic error term.

$\grave{e}$ denotes the constant

∂, $\ddot{e}$ and $\hat{a}$ denote the unknown parameters of the model to be estimated.

Theoretically speaking, determinants of students success across the HEIs in South Africa can be econometrically examined by estimating this all-encompassing econometric model of educational production function reflected in Equation (2) using various estimation techniques. However, this study focuses, specifically, on examining the likely determinants of student success at UKZN and the econometric model in Equation (2) is then modified to be fit for estimation within an individual HEI. This is discussed in more detail below.

Following Van Den Berg and Hofman (2005) (See endnote 2), who stressed the dominance of individual student factors in study success at university, in this study, the HEI's/institutional/UKZN's characteristics (I_{ij}) and characteristics of academic/non-academic (administrators and support) staff members (A_{ij}) in Equation (2) are treated as constant. This assumption is also justified on the ground of two additional rationales. The first rationale recognizes that the characteristics of academic/non-academic (administrators and support) staff members and HEIs/institutional will vary significantly when compared across HEIs rather than within the same HEI. Also, no data are systematically collected by South Afri-

can HEIs on the characteristics of academic/non-academic (administrators and support) staff members (or if collected, they are kept secret and not easily accessible). The second rationale is that within an individual HEI, the same lecturer teaches the same class, there are the same administrators and support staff members, and students' records data are only for a single year. So it is hence better to treat this information as constant.

From Equation (2), *ceteris paribus*, the following Equation (3) suggests the final revised econometric educational production function model for predicting the performance of the ith student in j^{th} course or module within a single HEI, which contains the student characteristic S_{ij} now differentiated into three broad subcategories S_v, S_x, S_z representing respectively the school-related characteristics, non-school related characteristics, and personal, student demographics, socio-economic and others backgrounds.

$$P_{ij} = è + \sum_{k=1}^{n} \alpha kSvij + \sum_{k=1}^{n} \beta kSwij + \sum_{k=1}^{n} \partial kSxij + U_{ij} \quad (3)$$

where,

P_{ij} denotes the final marks of ith student at the end of the academic year, obtained in j^{th} course;

S_V denotes the matrix of different school-related characteristics that include *inter alia* students' knowledge gained during the high school years (matric subject scores or total matric scores). It measures the influence of school-related characteristics on academic performance;

S_w denotes the matrix of different non-school related characteristics seen as giving a measure of students' ability, ambition, aptitude, attitude, motivation or other intangible characteristics of students to successfully pursue their university studies;

S_x denotes the matrix of different and controversial issue of biographical and personal characteristics, student demographics such as age, race, and gender; socio-economic characteristics of a student such as income group; and other backgrounds such as university endowments:

θ denotes the constant;

α ,β, and ∂ denote the unknown parameters to be estimated;

U_{ij} denotes a vector of stochastic error terms.

Therefore, in the educational production function reflected by the following Equation (4), the "students' final examination marks" is the dependent variable and hypothesized influencing educational inputs variables selected amongst the three major categories of determinants discussed earlier are the explanatory variables that the UKZN transforms in the educational production function to educational output (student success). The suggested linear regression model has the following format:

$P_{ij.} = \beta_0 + \beta_1$totalmatric-points $+ \beta_2$matric-accounting $+ \beta_3$ matricbusiness-economics $+ \beta_4$ matric-economics $+ \beta_5$matric-english $+ \beta_6$matric-math $+ \beta_7$management $1 + \beta_8$information-systems and technology $1+\beta_9$quantitative-method $1+ \beta_{10}$ totalmatricpoints-equal-above $36 + \beta_{11}$ student-age $+ \beta_{12}$student-gender $+ \beta_{13}$ student-race $+ \beta_{14}$ homelanguage $+ \beta_{15}$ interaction-variables $+\beta_i$

$$(4)$$

where,

P_{ij} denotes the percentage scores of the students' final examination marks (the dependent variable when it is continuous).

Stud-race denotes the race of the students.

Stud-age denotes the age of the student at the point of admission.

Stud-gend denotes the gender of the student.

Totalmatric-points denote the total matric points (or Admission Point System (APS))**.**

Matric-accounting, matricbusiness-economics, matric-economics, matric-english, and matric-Maths denote respectively the selected matric subject scores.

Home language denotes a student who declared English as their home first language and therefore has received instruction in his/her own home first language. In this study student home first language is a dichotomous variable, that is students recorded as having English as home first language were coded with the number equals 1, and number equals 0 otherwise (for students recorded as having non-English as home first language).

Interaction (or dummy) variables denote some of the interaction effects or non-readily quantifiable variables which influence the performance of students. In regression analysis, the dependent variable is frequently influenced not only by variables that can be readily quantified on some well-defined scale, but also by interaction variables that are essentially qualitative in nature (Gujarati 1999:499). Since such interaction qualitative variables usually indicate the presence or absence of a "quality" or an attribute such as male or female, Black or White, rich or poor, pass or fail, one method of "quantifying" such attributes is by constructing an interaction

variable (also referred to as artificial, dichotomous, dummy, proxy, or surrogate variables).

Due to poor primary and secondary schooling resulting in unpreparedness of matriculants for university studies, the Education Unit in the CLMS supports teaching and learning, and administers fully-fledged student support programmes. The Education Unit thrives to fill the gaps and help prepare these unprepared students from high schools for mainstream accountancy and economics disciplines with support and bridging programmes which have foundational, augmented and mainstream modules contents.

This study has generated dummy variables for selected non-quantifiable and qualitative in nature variables that are coded on values of 1 or 0. Coding of 0 indicates the absence of an attribute and coding of 1 indicates the presence (or possession) of that attribute. These interaction variables that include *inter alia* attitudinal, motivational, and psychological characteristics of students, and their socio-economic backgrounds perceived as influencing student success do enhance the scope of the regression model. Prior knowledge acquired either in private, public, or independent schools can give a proxy measure of the student's socio-economic background. Private schools are assumed to be expensive and generally, they accommodate only students from wealthier backgrounds. Interaction variables also measure the student's effort for example, in terms of hours spent studying and how to account for the likelihood that one student's hour will be more effective than another student's hour.

ε_i denotes a vector of stochastic error terms.

The parameter vectors $\beta_1,..., \beta_z$ denote regression coefficients to be estimated to determine their weights – their estimates (i= 1.....z where z is the number of independent predictors variables) and β_0 denotes the constant.

The contention in Park and Kerr (1990) is that the OLS regression method procedure to estimate the above parameters is not appropriate and cannot be used because basic assumptions of the OLS regression method will be violated. To circumvent the violation of these basic assumptions of OLS regression method there are three other approaches to estimating such a model: (1) the Linear Probability Model (LPM), (2) the Logit (Logistic) Model, and (3) the Probit Model. Of these three, the LPM is the least satisfactory as it violates some of the assumptions of the OLS although easy computationally. The Logit (Lo-

gistic) and the Probit, because of the reason discussed earlier, are the models most frequently used when the dependent variable happens to be discrete. Gujarati (1995: 497) explains that from a theoretical perspective, formulation of Logit (Logistic) and Probit approaches is comparable but their estimates of the parameters are not directly comparable as their variances have different values. The difference being that the Logit Curve (also referred to as the Logistic Curve) has slightly flatter tails, that is, the Probit Curve approaches the axes more quickly than the Logistic Curve. Therefore, the choice between the Logistic and Probit formulation is one of mathematical convenience. On this score, the Logistic Model is generally used in preference to the Probit Model because of its relative computational ease. The Logistic regression model is also applied to predict the probability of university student success at UKZN.

Logistic Regression Method

In this method, the dependent variable - students' final examination marks - is treated as discrete or dichotomous variables and P_{ij} takes either the coding 1 (to denote a pass or success) or a coding 0 (to denote a failure) with the same independent variables as in Equation (5) that is, here, the observed students' final examination marks (as the dependent variable) are treated as discrete variable or dichotomous and are converted into the probability of getting a pass (a student's final examination mark of at least 50 = 1) (to denote a pass or success) or a fail (a student's final examination mark below 50 = 0) (to denote a failure).

The following Equation (5) represents what is known as the Cumulative (Logistic) Distribution Function (CDF) as Student Performance$_{ij}$ (P_{ij}) is nonlinearly related to the right hand side of the equation.

$$P_{ij} = (\frac{p}{q}) = P(\frac{event}{X1,...,Xz}) = \frac{\exp[\alpha_0 + \beta_1(X_1) + ... + \beta_z(X_z)]}{1 + \exp[\alpha_0 + \beta_1(X_1) + ... + \beta_z(X_z)]} \quad (5)$$

The Equation (5) can be logarithm-transformed to convert the nonlinear relationship into linear one so that the framework of linear regression model can be applied. Therefore, taking the natural logarithm (log) of Equation (5) makes it in a linear form model in X_i and also in the parameters as presented in the following Equation (6).

$$Logit\,(P_{ij}) = \log(\frac{p}{q}) = Log\,P(\frac{event}{X1,...,Xz}) = Log\,\frac{\exp[\alpha_0 + \beta_1(X_1) + ... + \beta_z(X_z)]}{1 + \exp[\alpha_0 + \beta_1(X_1) + ... + \beta_z(X_z)]} = x_i\,\beta + \varepsilon_i \quad (6)$$

where,

p denotes the probability of observing a pass/success (the dichotomous or discrete dependent variable),

q (equals to 1-p) denotes the probability of observing a failure,

Event denotes a dichotomous variable coded 1 for pass/success and coded 0 for failure,

X_1, ..., X_z denote the independent predictors variables similar as in Equation 4 discussed earlier, p/q denotes the odds ratio of the probability of observing a pass or success divided by the probability of observing a failure, that is, the odds ratio in favour of passing the final examination in first-year accounting and economics modules to the probability that he/she will not pass the final examination.

$Exp = e = 2.71828$ denotes the base of the natural logarithm.

ε_i denotes the disturbances error having a logistic distribution with mean equals 0 and variance equals $\eth^2/3$.

The parameter vectors β_1,..., β_z denote beta logistic regression coefficients and are the parameter vectors measuring the regression weights – the estimates ($i = 1, ..., z$ is the number of independent variables).

Conventionally, in Equation (6), each estimated coefficient is the expected change in the logarithm odds of students achieving the final examination marks for a unit increase in the corresponding predictor variable holding the other predictor variables constant at certain values. When exponentiated, each estimated coefficient become the ratio of two odds or the change in odds in the multiplicative scale for a unit increase in the corresponding predictor variable holding variables at certain values (See endnote 3). Roncek (1991) argue that interpreting logistic coefficients for dichotomous dependent variables remain a problem in sociological research because of lack of consistency as illustrated by the variation in the ways that logistic coefficients are used. The study's contention is that the logarithm of the odds ratio is not easily related to probabilities because the logarithm is a nonlinear function of the odds ratio, which itself is a nonlinear function of the probability of being in the category of interest. In terms of interpretation in this study, estimated beta logistic regression coefficients (â$_i$), indicate by how much the natural logarithm of the predicted odds ratio, that is, the log $\left(\frac{p}{q}\right) = $ Logit (P_{ij}), changes as a result

of a one unit change in a specific independent variable holding the other predictor variables constant at certain values (Roncek 1991). That is (β_i) tells how the logarithm of the predicted odds ratio in favour of a student passing the final examination changes as the corresponding independent variable changes by a one unit, holding the other predictor variables constant at certain values. Negative logistic coefficients give odds ratios less than unity, and positive ones give odds ratios more than unity. Odds larger than one show that it is more probable to observe a pass (a university student success), whereas coefficients 0 mean that the odds are the same between groups. Results of previous studies provide *a priori* expectations about the signs of the predicted coefficients of the independent variables.

The variables attached to the general characteristics of students reflected in regression models in equation (4) using OLS regression method and equation (6) using logistic regression method are the ones estimated in this study.

A series of 16 regression models was run and the t-statistics tests of significance and their corresponding two-tailed p-values to test whether a given coefficient in the educational production function's regression equation is statistically significant and different from zero (0) using the conventional 0.05 alpha level that reflect 95 percent confidence interval were conducted. However the 0.01 and 0.10 alpha levels are also reported as statistically significant just extending the confidence interval to include 90 and 99 percent confidence intervals (confidence limit for lower bound and upper bound) for the coefficients. The confidence intervals selected in this study are related to the p-values such that the coefficient will not be statistically significant if the confidence interval includes zero (0). This allows putting the estimates from the coefficients in the regression equations into a broader perspective by inferring how much their values could vary. A two-tailed p-values test of significance suggests that the null hypothesis is stating for empirical purposes as one of no predicted relationship between the specified student success – the dependent variable and the corresponding independent or predictor variable, *ceteris paribus* and the alternative hypothesis is stating otherwise. Each regression equation will also present the R-Square (R^2) value (OLS regression) or Pseudo R-Square (pseudo-R^2) val-

ue (logistic regression), which is an indication of the 'goodness of fit' of the regression equation to the data.

The results of this study run into thousands of pages since models were run and re-run for different first-year accounting and economics modules separately to ascertain the degree of consistency between different regression model results (Taylor and Harris 2004) and detect also any possible discrepancy and distortion in the results. To control the challenge of summarizing the above results and findings in the most efficient displays, two indicator academic years have been chosen (2004 and 2008). These measurement academic years have the merit of catching 2004 which is the academic year of the merger (the initial year) which brought with it all the legacies of pre-1994 and the year 2000 which is the academic year when some Faculty re-organization took place at UKZN. These measurement academic years also have the merit of catching one mid-year, 2006, during what some studies at UKZN refer to as "the academic year of the merger chaos or hiatus" when the physical articulation and re-organization of Faculties to a single UKZN campus occurred. These measurement academic years also have the merit of catching 2008 which is the most stable and complete year for which complete student trends data are available. Therefore, the records of active students of the cohorts of 2004 (the initial year) and 2008 (the end year that will capture any change if occurred) are the ones fitted in the two econometric educational production function models (OLS and Logistic) and estimated within a single HEI – at UKZN. This does not however suggest that major changes and policies at UKZN did not occur out of these indicator years.

Considering the breakdown of variance in the students' final examination marks, the total variance is partitioned into the variance which can be explained by the independent variables in a specific equation – the model – and the variance which is not explained by the independent variables but explained by the stochastic error terms – the residual. It is cautioned that the relationships reflected in these two above equations are not exact; they are subject to individual variation that is, student success also depends on other factors apart from the ones incorporated in the econometric educational production function models. This is relevant in the South African context where many students claim that a certain proportion of their academic performance is determined by one or two predictor variables in this study's proposed models but the remainder of the factors is to be found in their belief systems. These belief systems or unknown causal factors either were not incorporated in the model, and thus not counted, or even conceptualized in "non-conventional belief" such as the spirit of Ubuntu, cleansing, ancestors' prayers, divine and fasting prayers, superstition, guardian angels' wings, or lucky charms.

RESULTS AND DISCUSSION

A perusal of both the OLS and Logistic regression analyses consolidated in Tables 2 and 3 reveals that on aggregate, each estimated equation mapped acceptable diagnostic statistics and trends across time can be discerned.

In many instances the estimated coefficients that attained statistical significance were found to be of the expected signs conforming with the *a priori* expectations. Explaining why other coefficients were found to be of signs not conforming with the *a priori* expectations is purely speculative and the researcher felt that it is pointless to speculate on these signs. Some of the salient variables are found from the OLS regression analysis but not in the Logistic regression analysis and *vice versa*. Although some of the other variables had coefficients with the expected signs, none proved to be statistically significant at the 0.01, 0.05, or 0.10 levels to be considered as salient determinants of student success.

A brief discussion of the usefulness of all the statistic tests and salient predictors of students success from the regression analysis follows (Table 4). Salient predictors are discussed together (See endnote 4) since either one of the two models can be used for prediction the students success because as has been discussed, the accuracy of prediction of both models is good and they are both fairly equally used in the existing literature.

(a) Total Matric Points (β_1 & β_{10}) and Matric Subject Score (β_2, β_3, β_4, β_5, β_6)

The quality of the matriculation examinations has been hypothesized to be a predictor of university student success. Visser and Hanslo (2005) noted that in South Africa the matriculation certificate examination serves as the primary gate-

Table 2: Characteristics of the student influencing university success in first-year accounting and economics modules, 2004 and 2008, OLS Regression, UKZN

Characteristics of the student	Ac101-2004	Ac101-2008	Ac102-2004	Ac102-2008	Ec101-2004	Ec101-2008	Ec102-2004	Ec102-2008
Total Matric Points	x	0.08*	0.4*	-0.04*	x	-0.05*	x	x
Matric Maths Scores	x	-0.25*	-0.16*	x	-0.30*	x	x	-0.2*
Matric English I Scores	x	x	x	x	x	x	x	x
Matric English II Scores	x	x	x	x	x	x	x	x
Matric Accounting Scores	0.12	x	0.25*	x	x	x	x	x
Matric Business Economics Scores	x	x	x	x	x	x	x	x
Matric Economics Scores	x	x	x	x	x	x	x	x
Total matric points equal or above 36								
At least HG D in Matric Maths	x	x	x	x	x	x	x	x
At least HG D in Matric English I	x	x	x	x	x	x	x	x
At least HG D in Matric English II	x	x	x	x	x	x	x	x
At least HG D in Matric Accounting	x	x	x	x	x	x	x	x
At least HG D in Matric Economics	x	x	x	x	x	x	x	x
Age	x	x	x	-0.07*	x	x	0.20*	x
Gender	x	x	x	x	x	x	x	x
Race	0.26*	x	x	x	x	x	x	x
English as home first language	0.26*	x	x	x	-0.32*	x	x	x
English as home first language by Matric Maths Scores	x	x	x	x	x	x	x	-1.2*
English as home first language by Matric Accounting Scores	x	x	x	x	x	x	x	x
Non-Black by Matric Maths Scores	x	x	x	x	x	x	x	x
ACCT101	x	x	x	x	x	0.70*	x	x
ACCT102	x	x	x	x	x	x	x	x
ECON101	x	0.58*	x	x	x	x	0.13*	0.78*
ECON102	x	x	x	x	x	x	x	x
ISTN101	x	x	x	x	0.29*	x	0.17*	x
ISTN102	x	x	x	x	x	x	x	x
MATHS134	x	x	0.23*	x	x	x	x	x
STAT181	x	x	-0.46*	x	x	x	x x	x

*Statistically significant.
x Statistically insignificant.

keeper to selective HEIs. Due to the high failure and dropout rates, the quality of matriculants who are admitted as students into HEIs is questioned at times in the South African public debate.

Whether total matric points (or APS) is a good predictor of student success at the intake level in South African universities is a controversial issue. There is a need to investigate how well South African matrics are doing instead of how many are passing because it is not strictly a sign of an improving education system (Baur 2013). UKZN's Admission Points Score (APS) calculation based on the students' proficiency in matric subject scores at school leaving level determines the entry requirements for candidates to be eligible to apply for the different ranges of degree programmes offered. In the CLMS, with certain minima, matric Maths score and English score are designated in the minimum requirements for

Table 3: Characteristics of the student influencing university success in first-year accounting and economics modules, 2004 and 2008, Logistic Regression, UKZN

Characteristics of the student	Ac101 -2004	Ac101- 2008	Ac102- 2004	Ac102- 2008	Ec101- 2004	Ec101- 2008	Ec102- 2004	Ec102- 2008
Total Matric Points	x	x	0.08*	x	x	x	x	x
Matric Maths Scores	x	x	-0.22*	x	x*	x	x	x
Matric English I Scores	x	x	x	1.27*	x	x	x	x
Matric English II Scores	x	x	x	x	x	x	x	x
Matric Accounting Scores	x	x	x	x	x	x	x	x
Matric Business Economics Scores	x	x	x	x	0.34*	x	x	x
Matric Economics Scores	x	x	x	x	x	x	x	x
Total matric points equal or above 36	0.51*	1.85*	x	x	x	x	x	x
At least HG D in Matric Maths	0.47*	x	x	x	-0.43*	x	x	x
At least HG D in Matric English I	0.51*	x	x	x	x	x	x	x
At least HG D in Matric English II	0.82*	x	x	x	x	x	x	0.70*
At least HG D in Matric Accounting	-1.20*	x	x	x	x	x	x	x
At least HG D in Matric Economics	x	x	x	x	x	x	x	x
Age	-0.03*	x	0.08*	0.98*	0.03*	x	0.02*	x
Gender	x	x	x	x	x	x	x	x
Race	x	x	x	1.98*	x	x	1.10*	x
English as home first language	1.12*	x	x	x	x	x	-10.0*	0.64*
English as home first language by Matric Maths Scores	x	x	x	x	x	x	x	x
English as home first language by Matric Accounting Scores	x	x	x	x	x	x	x	x
Non-Black by Matric Maths Scores	x	x	-0.84*	x	x	x	-0.4*	x
ACCT101	x	x	x	1.16*	x	4.01*	x	x
ACCT102	x	x	x	x	x	x	x	1.06*
ECON101	x	6.18*	x	x	x	x	0.01*	1.15*
ECON102	x	x	x	x	x	x	x	x
ISTN101	x	x	x	x	1.27*	x	0.17*	x
ISTN102	x	x	x	x	x	x	x	x
MATHS134	x	x	x	x	x	x	x	x
STAT181	x	x	x*	x	x	x	xx	x

*Statistically significant.
x Statistically insignificant.

admission at UKZN. A survey carried out at UKZN pointed out that total matric points (or APS) of at least 45 were a good predictor of student success but below 45 were not (HDC 2006). Another study conducted at UKZN concurred that there has been a gradual deterioration in the value of matric scores so that a total matric points (or APS) of 45 several years ago (pre-2004) is not the same as a total matric points of 45 now (2004 onward). If the rate of depreciation was known, and UKZN compensated for it by raising the required total matric points entrance requirement (or APS), then the quality of student would not have changed – although their matric scores would have (HDC 2006). The students' total matric points are available in the UKZN's student records. This study expects the coefficient of total matric points, β_1, to be positively related to student success.

Table 4: Characteristics of the student influencing university success in first-year accounting and economics modules, 2004 and 2008, OLS and logistic regressions, frequency distribution, UKZN

Characteristics of the student	Relative frequency in %
Total Matric Points	31
Matric Maths Scores	31
Matric English I Scores	6
Matric English II Scores	0
Matric Accounting Scores	13
Matric Business Economics Scores	6
Matric Economics Scores	60
Total matric points equal or above 36	0
At least HG D in Matric Maths	13
At least HG D in Matric English I	13
At least HG D in Matric English II	6
At least HG D in Matric Accounting	6
At least HG D in Matric Economics	6
Age	44
Gender	0
Race	25
English as home first language	38
English as home first language by Matric Maths Scores	6
English as home first language by Matric Accounting Scores	6
Non-Black by Matric Maths Scores	6
ACCT101	25
ACCT102	6
ECON101	38
ECON102	0
ISTN101	13
ISTN102	0
MATHS134	13
STAT181	6

Source: Computed from Tables 2 and 3.

Debates at UKZN suggest also that the overall total matric points need to be disaggregated in order to be a useful predictor of student success. In other studies matric Maths score was found to be the most useful predictor of university student success, specifically for students who are majoring in the BCom (Accounting) and BCom (General) degree. Mitchell et al. (1997) have established robust and positive relationships between university student success in economics courses/modules and matric Maths scores. A satisfactory and well-rounded knowledge of Maths is considered a requirement for completion of many of the degree programmes and qualifications offered at UKZN (would-be students are required to achieve at least level 5 in their matric Maths scores for management studies). This is because accounting and economics modules are quantitative-based with a specific dis-

course. Students who have difficulties with Maths often have difficulties in grasping abstract concepts in accountancy and economics modules. In addition to matric Maths score, matric English score also was generally found to be a useful predictor of university student success.

In America and Europe, studies have found that having high Maths scores in the American College Test (ACT) or having taken Maths in high school, or mastery of very basic Maths concepts are positively and statistically significantly related to student success, and have a significant and beneficial effect on student grades in economics courses (Ballard and Johnson 2004; Johnson and Kuennen 2006). Maths requirements or recommendations for admission to universities have been increasing over the years (Becker 1997). Increasing the Maths requirement in economics degrees produced a dramatic change in the mix of students taking courses and majoring in economics (Kasper et al. 1991; Kasper 1996). Some studies provide evidence that one cannot compensate for low matric Maths scores by remedial Maths at university (Tewari et al. 2008; Edwards 2000). Neither university Maths courses nor the score on a Maths skills test had any significant benefit for achievement in economics at university level (Cohn et al. 1995). A few other studies confirm that prior exposure to and proficiency in a course before university improves performance in the course done at the university (Tewari et al. 2008; Attiyeh et al. 1971).

Since a satisfactory and well-rounded knowledge of Maths and proficiency in English that is used as medium of instruction are hypothesized to be predictors of student success and requirements for the completion of the BCom (Accounting) and BCom (General) degree, this study is interested particularly to test if the matric Maths score and matric English score have a predictive power on the student success at UKZN. Matric English and Maths scores are included among the predictors to be tested in the regression analysis. Important potential non-random differences between students in terms of proficiency in the English language are the differences in English skills possessed by each of them. These differences include: students for whom English is their home first language (who attempted matric English I), students for whom English is their home second language (who attempted matric English II), and students from where English is not spoken at home. Under *ceteris paribus* con-

dition, this study expects the coefficients of selected individual matric subjects scores (β_2, β_3, β_4), English (β_5) and Maths scores (β_6)) mainly, to have positive relationships with the students success in courses/modules for which they are designated or prerequisites. This is of interest as selected HEIs and programmes in South Africa require one or combinations of these designated matric subject scores as minimum entrance requirements, while others require these designated matric subjects as prerequisite to their undergraduate modules.

Evidence emanating from the empirical analysis indicates that total matric points (or APS) have positive causal effects (31 percent in relative frequency) on students success for first-year Accounting (ACCT) (101 and 102) and Economics (ECON) 101 modules only. This trend is consistent over the years.

Other key findings are that matric Maths scores have positive causal effects (31 percent in relative frequency) on students' success for all the first-year accounting and economics modules. Matric Accounting scores have positive causal effects (13 percent in relative frequency) on students' success for all the first-year accounting modules only. This trend is consistent over the years.

The empirical analysis reveals that good total matric points and quantitative method skills help students do well in accountancy and economics modules at UKZN. Thus, premised upon this finding, the admission process is expected to play a vital role in highlighting the differences in the pool of student populations being educated at UKZN. This must be borne in mind when student success is interpreted and discussed in the recommendations.

These results are in line with national and international studies. Matric Maths scores and English I scores are salient predictors of student success (Mitchell et al. 1997). Higher Grade (HG) Maths scores as well as the aggregate matric points were confirmed predictors of student success at the Stellenbosch University (Horn et al. 2011). Total matric points (a student's high school aggregate) is the most influencing variable and Matric Maths and English scores are all related to success at the University of the Witwatersrand (Yathavan 2008). Student success in school examinations is a strongest predictor of first-year success and progression at university (Duff 2004). Final examination marks in first-year

Maths at university is a good predictor of subsequent success in economics (McNabb et al. 2002); Smith and Naylor 2001). Success in the first-year is an important determinant of success in the second-year and most matric subjects become statistically insignificant as contributors to academic success for second-year students (Horn et al. 2011).

(b) University Modules ($\beta 8$ and $\beta 9$)

It is worth mentioning that there is a relationship between the student success in accountancy and economics modules and other modules taught concurrently at university. In the OLS and Logistic regression analyses, the student success in the ECON101 module has been found to have causal effects (38 percent in relative frequency) on their success in the ACCT101 and ECON102 modules. This possibly indicates that first-year students who pass do better in both the accountancy and economics modules. The student success in the ACCT101 (25 percent in relative frequency), and MATHS134 and STAT181 modules (both have 13 percent in relative frequency) has also been found to have causal effects on the student success in the ACCT102 module. The students' final examination marks in ACCT101, ISTN101 (13 percent in relative frequency), and the quantitative method MATHS 134 modules have been found to have causal effects on the student success in the ECON101 module. This possibly means that knowledge of Information Systems and Technology 101 helped students to understand Economics 101 and Economics 102 better.

Of interest to this study is that, evidence emanating from the empirical analysis reveals that there is a fairly consistent relationship between student success in ECON101 and ECON102 modules. Although the ECON101 module is not a prerequisite for ECON102, students who do better in ECON101 are more likely to also do better in the ECON102 module. Knowledge of Information Systems and Technology for business and having well-rounded quantitative MATHS134 skills helped improve final examination marks in the ECON101 and ECON102 modules. A further deduction that can emanate from the empirical results is that passing students are more likely to do extremely well when they progress to second-year modules. Alternatively, struggling students are more likely to do extremely badly. There-

fore, student performance in first-year ECON101 and ECON102 modules, as well as in the quantitative method course are good predictors of whether the student will perform well in the second-year economics modules, but they are inconclusive in predicting third-year modules.

(c) Age of the Student (β11)

In some studies, students who were relatively older when admitted to university did not perform as well as younger students did (Van Den Berg and Hofman 2005). In others, however, students of more than 25 years of age performed as well as or better than younger students (Attiyeh et al. 1971; Bonello et al. 1983). The age of the students at the time of university entrance is available in the data-bases and this study expects the coefficient of the student's age, β11, to be negatively related to the student academic performance.

A perusal of results reveals that the age of student at the point of admission has negative causal effects (44 percent, the highest relative frequency) on students success. As hypothesized, that is, the predicted final examination marks for younger students would be higher than for older students, ceteris paribus. Since the national average age at which students complete their matric in South Africa is between 17 and 20, it may be assumed that an older student or returning student of above 25 years of age at the point of university entrance would more likely not perform well or achieve slower progress than their peers of between 17 and 20 who just entered the higher education. Underperformance might have been caused by the fact that the students repeated some years in primary and secondary education (delayed educational career). The student may also have taken a significant break after completing secondary education, or may not have studied for a period of time (educational career break or a gap year). It might be because the student followed an alternative or longer educational route (for example enrolled *via* an access/foundational or extended programme) before attending university. Therefore, studying at a later age can be assumed to have a negative causal effect on students' success.

(d) Gender of the Student (β12)

Many professions (for example: accountancy, economics, law, etc.) in South Africa are male-

dominated. In addition, the stereotyped roles females have been assigned in different races and cultures of South Africa are perpetuating male dominance and women's under-representation in professions and in broader society. The role of gender as one of the determinants of students success is a contentious issue (McNabb 2002; Edwards 2000). Several studies have reported that male students also outperform female students in economics and business courses (Dynan and Rouse 1997; Anderson et al. 1994; Tay 1994). Other studies found that although males outperformed females on both essay and multiple choice questions (MCQs) types of assessment, females did relatively better on just essays (Ferber et al. 1983; Lumsden and Scott 1987; Harris and Kerby 1997). These differences between the sexes and the definite gap that appears during the high school years continue to persist at university level (Siegfried and Fels 1979). However, some studies found that student gender had no significant effect on academic performance (Borg and Shapiro 1996). Gender wise, Williams et al. (1992) found no evidence to support the hypothesis that significant and consistent gender differences exist in student performance in economics exams. Although positive correlation coefficients between student performance at university and males students are generally found (Anderson et al. 1994), Edwards (2000) found no conclusive evidence that females are at a disadvantage in university performance (Siegfried and Fels 1979). The gender of the students is available in the UKZN's student records from which this study generated a dichotomous gender of the student variable. That is male students are coded with the number equals 1, and number equals 0 otherwise (for female students). In these data generation, female students constitute the omitted category. This study expects the coefficient of gender of the students (β12), to have a positive relationship with the student performance.

The gender of the student is intricately related to the student's performance suggesting that a crude measure of gender of the student does not have a significant causal effect (zero percent in relative frequency) on students' performance. Premised upon the empirical results, it is not, however, possible to draw any strong conclusion regarding the effectiveness of gender of the student. Male students seem to not perform better than female students and *vice versa*. There-

fore, gender of the student at UKZN is to a large extent fixed. As hypothesized, even without any additional information, this finding provides strong evidence that important educational inputs (that is, characteristics of the student at the time of admission) can be influenced after the time of university entrance in the educational production function regardless of the gender of the students.

(e) Ethnic Group (Race) of the Student ($\beta 13$)

South Africa has a history of apartheid which created racially based unequal expectations and individual subjectivities. Students at UKZN are generally classified according to four race groups: White (with coding of number 1), Coloured (with coding of number 2), Indian (with coding of number 3), and Black African (with coding of number 4). Access to quality schools in the past political system erected institutional barriers to non-whites and undoubtedly affected their school education. Race is a factor in determining socio-economic background, family income, and quality of schooling in South Africa (Parker 2006). As shown by descriptive statistics, for the entire sample of first-year students presented earlier, the majority of students are Black Africans, followed by Indians. However, the majority of academic staff members are white. Existing studies surveyed have been inconclusive concerning the effect of the race of the student on academic performance. A handful of studies surveyed found that in a multiracial HEI, non-whites students performed relatively poorly, which might be due to poor preparation, learning styles gained during the high school years (generally in poorly endowed high schools), and lack of academic role models (same race graduates) (Lopus and Maxwell 1995; Watts and Bosshardt 1991; Borg and Stranahan 2002). However, other studies have found no significant effect of race on students success (Sosin and McConnell 1979).

This study did not stick with the traditional four categories as per UKZN's student records but generated a dichotomous variable of the race of the student. In these data generated, white students are coded with the number equals 1, and number equals 0 otherwise (for non-white students: Blacks, Coloureds, and Indians). Because of the positive causal effect of own race (match between white students and educators

of the same race since there are few Black academic staff members to serve as role models for Black students), this study expects the coefficient of race of the students, $\beta 13$, to have a positive relationship with the student performance.

The perusal of results is indicating that race of the student has causal effects on students success (25 percent in relative frequency). As hypothesized, the predicted students' final examination marks for all the first-year accounting and economics modules would be higher for white students than for non-whites, ceteris paribus. Non-white students (Black Africans, Coloureds, and Indians) are likely to perform less well than white students. This later results on race does not imply that all Black African, Indian, and Coloured students are not competent good and that it will be impossible for them to cope or do well. There are non-whites students who are outperforming their white peers at UKZN.

(f) Home First Language (β_{14})

In countries where the language of instruction and the students' home first language are the same, there is no need to expect students to demonstrate their proficiency in the language for education purposes. In South Africa, this is not an insignificant problem with 11 different official languages (more than any other country in the world). English language is the medium of instruction for most of the HEIs in South Africa and university success is likely to be influenced by proficiency in English language which is the second or third language of the majority of students and of academic and non-academic (administrators/support) staff members. The language of management studies represents a discourse very different to that encountered by students in other mainstream disciplines. Second language students experience particular difficulty in developing the grasp of the vocabulary and discourse of courses (Lubben et al. 2010). Language ability or proficiency in the language used as the medium of instruction improves student academic performance (Mamogethi 2009; Du Plessis et al. 2005). It is therefore reasonable to expect that students who enter the CLMS have to demonstrate the requisite proficiency in the English language or have to acquire it to pursue any of the different degree programmes and qualifications offered. Mamogethi (2009) from a de-

cade-long study of schools in three provinces of South Africa (Gauteng, Limpopo, and North West) suggests a perspective on multilingualism in Maths education. Not the development of a Maths register or terminology in South African languages but local languages used alongside English to develop learners' proficiency in Maths. This study expects the coefficient of the proficiency in English declared to be student's home first language and medium of education, β_{14}, to be positively related to the students' final examination marks.

The empirical results of the OLS and Logistic regression analyses taken together provide a definite statistically significant support for proficiency in English. Of interest to this study is that, evidence emanating from the empirical analysis reveals that, as hypothesized, English as the home first language has positive causal effects on first-year accounting and ECON102 modules but not on ECON101 (38 percent in relative frequency). Proficiency in English as home first language (not students who have taken English (I or II) at the school leaving level) helps students do well in accountancy and economics modules. This trend is consistent over the years.

Research within the higher education sector in South Africa confirms the poor reading levels of students. A study conducted jointly by the Human Sciences Research Council (HSRC) and the Council on Higher Education (CHE) confirmed that about 77 percent of students who dropped out of seven South African universities indicated that the reason for their withdrawing was the difficulty with English as the language of instruction at their institutions (Ngcobo 2009). Nel and Nel (2009) concurred that about 83 percent of faculty stated that the lack of analytical reading skills contributes to students' lack of success in a course. Many of students who were tested at the University of Pretoria had reading levels of Grades 7 and 8 pupils (Webb 1999).

(g) Interaction Effects Variables (β_{15})

In the Logistic regression analysis, total matric points equal or above 36 or APS (was the entrance requirement for the BCom (Accouting) and BCom (General) degree prior to 2009) has causal effects (13 percent in relative frequency) on students success for ACCT101 only. This is giving support to a marked improvement in university success and pass rates at the upper end

of total matric points (or APS) when using a typical total matric points threshold. HG symbol D in matric Maths has causal effects (13 percent in relative frequency) on students success for ACCT101 and ECON101 only.

Non-White students having English as first home language, students with English and matric Maths scores, students with economics and matric Maths scores, students with matric Accounting and matric Maths scores, a symbol D in matric Maths HG and the age of the student are tested. This study expects the coefficient of the interaction variable ($\beta15$) to have a positive relationship with the student academic performance.

The predicted final examination marks in ECON101 for students who declared having English as their home first language sorted by matric Maths at the school leaving level would be higher than others who do not have these attributes. Positive causal effects in ACCT101 would stem from students having English as their home first language sorted by matric Accounting at the school leaving level. The predicted final examination marks in ECON102 for white students sorted by matric Maths would be higher than those who do not have these attributes.

CONCLUSION

Predictors of student success confirmed in this analysis are total matric points, matric Maths score, English I score, and English as home first language. In some extent, non-designated matric subjects scores that include matric Accounting score and matric Economics score play some role. These results confirm that students are generally more likely to do better in first-year accountancy and economics modules if they have been previously exposed to these subjects at high school level. Other personal and student demographic variables such as age and race play some role in predicting university success.

The BCom (Accounting) and BCom (General) degrees are the more mathematical degrees in management studies and the importance of mathematical skills to student success has been supported in this study. Students who meet minimum requirements in terms of total matric points, have quantitative skills and English language proficiency, are sorted by other student personal and demographics such as age and race of the student are more likely to perform better. Alter-

natively, struggling students are more likely to do extremely badly. Students whose the home first language is not English and who wrote matric English II, are more likely to perform less well even at the second-year level. Student success in introductory economics, as well as in the quantitative method course are good predictors of whether the student will perform well in the second-year economics modules, but they are inconclusive in predicting third-year economics modules. Findings factorized above are not wearing off as the student progresses. Therefore, to some extent, these determinants are also predictors of student success after the intake level.

This study, however, cautions that all the predictors identified play only a minor role since they predict only a very small proportion of the entire variance in student success and alone are not enough to explain entire variances in the performance of students demanding further investigation. Thus, additional mechanisms to be used in conjunction with the total matric points (APS) to select candidates are needed and should be considered in the selection and admission of candidates and their placement into appropriate curricular routes where they are more likely to be successful. These results shed some light on the issue and are in line with the findings of the few existing institutional studies commissioned within UKZN and international studies.

RECOMMENDATIONS

Predicting student performance is the sum of complex and multifaceted factors and not easily represented by student characteristics measures that can be discovered *via* student records alone. Hypotheses focusing their educational policy-making process and strategic planning for admission, retention and graduation rates based solely on student characteristics are challenged. Instead, an integrated holistic approach run parallel to appropriately targeted educational investments to enhance student success is imperative. HEIs in South Africa are becoming innovative in screening and admitting their would-be students and placing them into appropriate curricular routes demanding that several other contextual factors might also substantively influence the variance in the relationship between the institution, lecturers, students, and student achievement. One example in case is the need to develop new curricula for students exhibiting a lower lev-

el of academic ability as measured by their performance in the matric examination or their placement into appropriate existing curricular routes different from the BCom (Accounting) and BCom (General) degrees where they can be more likely to succeed. This is a problem that advocates of multidisciplinary curricula have to address since presently, it is a challenge to offer the same standard of accountancy and economics courses to all students admitted in the BCom (Accounting) and BCom (General) degrees.

Other perennial challenges that need to be addressed include *inter alia*: (1) late registration (often after an appeal process that runs till late in the semester), and failure in the first test which knocks the students' confidence and minimize their chances of their best marks being considered for the duly performed (DP) certificate, (2) absenteeism or sporadic attendance of lectures, while trying to get their heads around managing the time table, (3) lack of prescribed textbooks, and (4) lack of financial resources. These recommendations, if explored and integrated into the educational policy-making process and strategic planning, will go a long way to help reverse the trends of student attrition and slow progression, improve the retention of substantial numbers of students on the graduation path and ultimately increase the pass rates, graduation, and throughput rates.

ACKNOWLEDGEMENTS

NOTES

1. English First Language is referred to as English I, and English II denotes English Second Language.
2. Van Den Berg and Hofman (2005) suggest that 95 percent of the total variance in student success at university is ascribed to student-related factors, where the other 5 percent of the total variance is due to course factors.
3. See explanation at http://www.ats.ucla.edu/stat/ mult_pkg/faq/general/odds_ratio.htm and http:// www.ats.ucla.edu/stat/spss/output/reg_spss.htm (Accessed on 11/04/2011).
4. OLS and logistic coefficients are not directly comparable as discussed in this study, since in the OLS model, the dependent variable is a continuous stu-

dent success, while in the logit model it is a discrete student success.

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