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EDU004 PREDICTING AT-RISK FIRST YEAR ACCOUNTING STUDENTS: THE CASE OF NELSON MANDELA UNIVERSITY

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ABSTRACT:

It is well documented that tertiary institutions in South Africa are reporting high failure rates in accounting courses and several calls have been made to address this in recent literature. Scholars have specifically identified several factors that influence failure in accounting in the first year of tertiary education. In this context, the primary objective of this study was to develop a predictive model capable of identifying students at risk of failure in first year accounting.

The sample consisted of all students registered for the R101 first year accounting module at the Nelson Mandela Metropolitan University. Historical data, both biographical and educational, was collected on which to undertake the data analysis. The data was analysed by means of descriptive statistics and a discriminant analysis.

The findings show that the prediction value of the model developed as a whole is high, with 80.6 per cent of students being accurately classified into either the at-risk or not-at-risk category. The ability to accurately predict was both statistically and practically significant. Completion of Matric accounting at school level, and attendance at an English-speaking school were identified as the most significant factors in predicting at-risk and not-at-risk first year accounting students. The predictive model developed can be invaluable in identifying at-risk students, as interventions and support could assist them in overcoming their challenges and ultimately improving pass rates.

Key words: *accounting, at-risk, failure, first year, students, university*

INTRODUCTION

According to Degli (2009), "there is a huge demand for, and a chronic undersupply, of chartered accountants" in South Africa. The South African Institute of Chartered Accountants contends that South Africa requires more than 22 000 qualified accountants to fill the demand gap facing the industry (SAICA, 2008; SA Study, 2013; Ungersbock, 2015; Worldbank, 2013). The South African Government's National Scarce Skills List published in 2014, reports accountants as being ranked 12th of 100 occupations in the country that are considered to be in short supply (Nzimande, 2014; Ungersbock, 2015).

The level of difficulty of studying accounting at tertiary level has been identified as a reason for the skills shortage facing the country (Beck & Pelle, 2015:3; Wadee, 2009). Accounting exams are perceived as very difficult, often resulting in poor pass rates (Multisearch, n.d.). It is estimated that currently only 3 000 young people qualify in accounting at third year level each year (SA Study, 2013). Similarly, a survey undertaken in 2010 reports that "between 1999 and 2009, the total number of university enrolments in accounting was 504 068, against 60 114 degreed graduates over the same period – an 11.9% pass rate" (Keepile, 2010 cited in Winfield & Luyt, 2012:2).

Much concern exists regarding the high shortage of accounting skills and the need for more accountants to enter into the accounting profession in South Africa. It is well documented that tertiary institutions are reporting high failure rates in accounting courses (Principe, 2005:1; Van Romburgh, 2014:17; Waples & Darayseh, 2005:87). For example, statistics for the Faculty of Business and Economic Sciences at the Nelson Mandela Metropolitan University (NMMU) – in particular those of first year students – indicate that success rates of first year students require urgent attention (Nel & Neale-Shutte, 2013).

The monitoring of at-risk students is a key priority of the Teaching and Learning Improvement Plan developed for the Faculty of Business and Economic Sciences at NMMU. The current study is a direct response to the recommendation from the NMMU Office for Institutional Planning to explore systematically linking the support provided to first year students with a more coherent and overarching strategy and programme, and to develop a comprehensive, institution-wide, early warning intervention system for at-risk students (Nel & Neale-Shutte, 2013). More specifically, this study will aim to explore and describe factors that identify at-risk first year accounting students at NMMU, so that future interventions can be implemented to improve success rates.

The primary objective of this study is therefore to develop a predictive model capable of identifying students at risk of failure in first year accounting that can serve as an early warning system for identifying at-risk first year accounting students at NMMU. The term at-risk is often used to describe students or groups of students who are considered to have a higher probability of failing academically or dropping out of an institution of higher learning (Edglossary, 2013). The development of such a warning system would be invaluable to NMMU and the wider university community as once at-risk students have been identified, interventions and support could assist in overcoming their challenges and ultimately improving pass rates.

What follows is firstly a description of several studies undertaken in higher education to identify the factors that contribute to the failure of first year students followed by the reasons for failure in first year accounting. Thereafter, a discussion of each of these reasons will take place. A research hypothesis which is subjected to empirical testing in this study is then formulated. The research design and methodology adopted will then be elaborated on and the methods used for analysing the data discussed. Finally, the empirical results will be presented and interpreted.

LITERATURE OVERVIEW

Several studies (Bokana & Tewari, 2014; Bone & Reid, 2013; Zekarias, Aba-Milki & Mikre, 2015) have been undertaken to identify the factors that contribute to the failure of first year students in general. Investigating the factors specifically influencing the high failure rates and poor academic performance of students studying a first year course in accounting has generated considerable research attention in recent years. Several of these studies are described in the paragraphs that follow.

Baard, Steenkamp, Frick & Kidd (2010) conducted a study to determine the correlation between specific factors and students' success. The target population consisted of 2 103 registered first year accounting students of 2007 and 2008 registered at a South African contact university. The simultaneous effect of the most important factors in determining success in students was then determined by means of a multivariate technique to derive a profile of successful and at-risk students. Their results found that the most important factors in determining the success of students in first year accounting were average grade 12 mark, whether students had accounting as a subject at secondary school or not, class attendance, home language (either Afrikaans or English), and the programme for which students were enrolled (Baard *et al.*, 2010).

In another study, Barnes, Dzansi, Wilkinson & Viljoen (2009) conducted a correlation analysis to make inferences. Their study tracked 71 students enrolled in first year accounting at a South African university. Their results found that the most important factors in determining success of students in the first year accounting were university entrance score, matric accounting, matric English, matric first language, class attendance and deep and surface learning approaches. The aforementioned all reported a significant influence on performance in accounting at first year level (Barnes *et al*., 2009).

In their study, Du Plessis, Muller & Prinsloo (2005) examined how several predictors influence the pass rates of first year students in an accounting course and also how these predictors interacted with one another. They did this by extracting the required data from the university student information database and analysed the data by means of two-way frequency tables and chi-square tests. Their study tracked 10 194 students registered for first year accounting at a South African open and distance learning institution. The factors reported as most important in predicting the success of students in the course were motivation (as reflected in the degree programme followed), time management (as reflected in occupational categories of full-time and part-time students), whether the student is repeating the module and the age group of the student (Du Plessis *et al.*, 2005).

Gul and Fong (1993) employed stepwise regression to develop a subset of independent variables that was useful in predicting the accounting examination results of students and a multiple regression model to test seven factors that can affect introductory accounting students' performance. Their study tracked 455 students in the introductory accounting class of a Hong Kong university. They reported that the most important factors in determining success of students in the course were having an English secondary school education, certificate level English grade, personality, being enrolled for a business degree, previous knowledge of accounting, certificate level mathematics grade and self-expectation of examination result (Gul & Fong, 1993).

In their study, Smith, Therry & Whale (2012) also extracted data from a university's student information database and used regression analysis to model the impact of individual factors on accounting performance. The study tracked 325 students who completed a first year accounting course in an Australian university during 2010. They reported age, gender, course of study and first language as being significant predictors of performance (Smith *et al.*, 2012).

From above it can be seen that several international and South African accounting education scholars have examined and identified demographic and educational factors which influence a student's performance in their first year of accounting (Baard *et al*., 2010; Barnes *et al*., 2009; Du Plessis *et al*., 2005; Gul & Fong, 1993; Smith *et al*., 2012). Table 1 provides a summary of these factors and a brief discussion of each follows.

TABLE 1: FACTORS INFLUENCING STUDENT PERFORMANCE IN THEIR FIRST YEAR OF ACCOUNTING

Predictor	**Reference**
Gender	Baard *et al.* (2010); Barnes *et al.* (2009); Du Plessis *et al.* (2005); Smith *et al.* (2012).
Age	Barnes *et al.* (2009); Du Plessis *et al.* (2005); Smith *et al.* (2012).
Home language	Baard *et al.* (2010); Du Plessis *et al.* (2005); Gul and Fong (1993); Smith *et al.* (2012).
Ethnicity	Baard *et al.* (2010); Joubert, Viljoen and Schall (2013); Negash (2002).
Nationality	Barnes *et al*. (2009); Rankin, Silvester, Vallely and Wyatt (2003:365).
School category	Tho (1994).
Matric performance	Baard *et al.* (2010); Barnes *et al.* (2009); Du Plessis *et al*. (2005); Muller, Prinsloo and Du Plessis (2007).
Matric subject scores	Baard *et al.* (2010); Gul and Fong (1993).
Matric year	Baard *et* al. (2010).
Degree programme	Baard *et al.* (2010); Gul and Fong (1993); Smith *et al.* (2012).
Prior exposure to subject at school	Baard *et al*. (2010); Barnes *et al.* (2009); Du Plessis *et al.* (2005); Muller *et al.* (2007).
Repeating the course	Du Plessis *et al*. (2005); Smith *et al.* (2012).

Class attendance	Baard *et al.* (2010); Barnes *et al.* (2009); Steenkamp, Baard and Frick (2009).
Personality type	Bealing, Staley and Baker (2009); Du Plessis *et al*. (2005); Gul and Fong (1993).
Motivation	Du Plessis *et al.* (2005:690); Eskew and Faley (2008); Muller *et al.* (2007); Steenkamp *et al.* (2009).
Learning approach	Barac (2012); Barnes *et al.* (2009).

Studies have noted the influence of *gender* on performance at first year level in general (Alanzi, 2015; Joubert *et al.*, 2013) as well as on first year accounting in particular (Baard *et al*., 2010; Barnes *et al*., 2009; Du Plessis *et al*., 2005; Smith *et al*., 2012). In their studies, Smith *et al.* (2012:99) and Baard *et al.* (2010:137) found that female students were significantly more successful than male students in introductory accounting, suggesting that male students are most at risk of failure. However, Du Plessis *et al.* (2005:696) found in their study of the performance of first year accounting students at an open and distance learning institution, that male students were more successful than females. Du Plessis et al. (2005:696) suggests that this impact of gender on success may be influenced by the fact that males may be more prepared to seriously pursue careers in the male-dominated accounting profession and the results indicate that the performance of males was best explained by taking school accounting (Du Plessis *et al*., 2005:689). In their 2009 study, Barnes *et al*. (2009:51) found no significant difference in the performances of males and females and that gender had no significant influence on the performance of students in first year accounting.

In the study of Du Plessis *et al*. (2005:694), South African students in the *age* range of 17 to 30 were more likely to pass a first-year accounting distance course than those older than 30 years of age. On the other hand, in their study on first year accounting students at an Australian university, Smith *et al*. (2012:99) reported that students younger than 25 years were more at risk of failure. However, Barnes *et al*. (2009:51) found no significant difference between age and performance in first year financial accounting. Joubert *et al.* (2013:254) also found the association of age with performance in a first year accounting course was significant with an inverse relationship between age and performance in first year accounting. This meant that younger students performed better in first year accounting than older students. Joubert *et al.* (2013:253) explained that a possible reason for the better performance of younger students might be that older students tend to be full-time employees with families and that, because they have more responsibilities, they have less time to study.

Smith *et al.* (2012:96) reported that the variable providing the most prominent differentiation between passing the course and failing the course is *home language*. Students with their first language the same as the language of instruction indicated a significantly higher pass rate compared to those with another first language. These authors found that studying with English as second language makes the student a more at-risk candidate in first year accounting. Similarly, Baard *et al.* (2010:137) contend that the home language of a student being the same as their language of instruction is a significant predictor of academic success in first year accounting. In the study by Baard *et al.* (2010:137), the majority of respondents who specified their home language upon registration to be the same as the language of instruction were more successful in the first year accounting course than those showing a

language different to the language of instruction. This led Baard *et al.* (2010:141) to conclude that home language is one of the most important factors in determining success of students in an accounting first year course. Barnes *et al*. (2009:50) indicated that there was a significant positive correlation between the students' performance in their first language (other than English) and their performance in first year accounting. The medium of instruction at the university was not the first language of most of the students in this study. Du Plessis *et al.* (2005:696), however, found language not to be a significant predictor of academic performance in first year accounting.

Both Joubert *et al*. (2013:253-254) and Baard *et al.* (2010:136) found no relationship between *ethnicity* and success in a first year financial accounting course. However, a study by Negash (2002:1-8) revealed that white students score significantly higher grades than their black counterparts in accounting despite the provision of identical lectures, tutorials and learning materials.

Rankin *et al*. (2003:365) investigated the impact of student diversity (in terms of *nationality*) on performance in first year accounting and reported that on average international students studying on campus perform better than local students. This was in contrast to the study of Barnes *et al.* (2009:52), who found that nationality was not a determinant of performance in first year financial accounting. When examining the influence of *school category* on academic performance in first year accounting, Tho (1994:338-339) expected that students who attended schools in urban areas would perform better in the first level tertiary accounting course at university than students from non-urban areas. This, he believed, would be a result of urban areas having educational facilities that are well developed and easily available, in comparison to non-urban areas which lack such facilities. However, his study found that urban/rural residential status exerted no significant influence on introductory accounting performance.

Both Baard *et al.* (2010:138) and Barnes *et al.* (2009:48) reported *Matric performance* to be an important significant predictor of performance in financial accounting at first year level, confirming the view that students with high university entry scores are likely to continue this high achievement at university. Contrary to the above conclusions, Muller *et al*. (2007:29-30) and Du Plessis *et al.* (2005:692) found no significant influence of Matric performance on student success in a first year accounting course in higher education. In their study, Baard *et al.* (2010:138) found that *Matric accounting and mathematics scores* significantly influenced a student's performance in first year financial accounting, while the Matric science score did not significantly influence student performance in first year accounting. This influence of Matric accounting and mathematics scores was confirmed by the findings of Gul and Fong (1993:38) who found that high school exposure to accounting and aptitude in mathematics have positive and significant effects on student performance in introductory accounting courses. Gul and Fong (1993:38) also found certificate level English grade to be a significant variable in predicting academic success in first year accounting. These studies suggest that students' scores in secondary school examinations specifically in language, accounting, mathematics and numeracy (LAMN) have an influence on first year academic performance in general as well as in first year financial accounting.

The year in which a student writes Matric examinations is significant in South Africa as there have been numerous changes in the country's school curricula since 2008 (Baard *et al*.,

2010:137). Some of these changes may have resulted in a downward trend of the Matric pass rate since 2008 influencing first year academic performance at tertiary level in general (South African Government News Agency, 2014; SABC: Broadcasting for Total Citizen Empowerment, 2016). After 2008, there were concerns that the results of the National Senior Certificate grade 12 examinations were not very good indicators of the ability of students (Baard *et al*., 2010:132). Jansen as cited in Mashige, Rampersad and Venkatas (2014:561) acknowledged this decline in competency levels of students when he stated that "university lecturers always say that in their experience, students over the years have become weaker even though the matriculation results appear stronger". Although no studies could be found relating Matric year to the performance of accounting at first year level, it is assumed that if the year a student writes Matric influences their performance at university level in general, it would influence their performance in first year accounting.

Baard *et al.* (2010:137) found that the *degree programme* that students followed significantly influenced their success in first year accounting. Students who followed a specialised programme, for example a Bachelor of Commerce Actuarial and Mathematics (91% passed), Management Accounting (85% passed) and Financial Accounting programmes (81% passed), were significantly more successful than the students who followed a Bachelor of Commerce general programme (69% passed). Similarly, in the study of Smith *et al.* (2012:99), the outcome was that students who enrolled in a non-business major were more at risk of failure in the first year of accounting than those who enrolled in a business major. Gul and Fong (1993:39) also found the intention to obtain a business degree to be a significant variable in predicting success in introductory accounting.

In the study of Barnes *et al.* (2009:49), a significant positive relationship between performance in *high school accounting* and performance in introductory accounting at tertiary level was confirmed. The reason for this was believed to be the close correspondence between high school and the first year university curricula, and the foundation provided by high school accounting for the first year accounting course. Baard *et al.* (2010:141) found that students with a background in accounting were more successful in the first year financial accounting module at university than students who did not take accounting as a subject at secondary school. This contradicts the studies done by Muller *et al.* (2007:24-25) and Du Plessis *et al*. (2005:692-694) who found that prior knowledge of accounting does not significantly influence performance in first year accounting at higher education institutions.

The findings of Du Plessis *et al.* (2005:694) were that students who made a *second attempt* at first year accounting at university were more likely to fail, compared with those who had attempted the course for the first time. Similarly, Smith *et al.* (2012:96) found that students who passed the first year accounting course on the first attempt were more successful than those who passed it on a second or later attempt. Barnes *et al.* (2009:50) found *class attendance* to also be positively related to performance in first year accounting. Accounting is taught in a progressive way, with each week's lecture providing a foundation for the next week's lecture. For this reason, missed classes can lead to problems in catching up. Regular class attendance is therefore important for success in first year accounting. Similarly, Steenkamp *et al.* (2009:133) concluded that students who on average attended more classes in financial accounting had a significantly greater chance of success in the module in comparison to students who did not on average attend many classes. However, in a later

study, Baard *et al.* (2010:136) found that satisfactory attendance of tutorials did not significantly influence success in introductory accounting. This may be due to the fact that tutorials were compulsory for at-risk students identified after the first and second tests.

Bealing *et al.* (2009:333) found that the *personality type* of a student influences their ability to perform well in an accounting programme, and suggested that students with introverted personalities performed better than extraverted students. Gul and Fong (1993:38) anticipated that the introverted personality type would be more likely to establish a study style necessary for learning accounting. Extraverts who are more sociable and often do not enjoy solitary activities may therefore not perform as well as introverted students when working on accounting problems which require patience, regular practice, and highly concentrated work patterns. However, Gul and Fong (1993:38) found no significant differences in any of the measures comparing extraverts and introverts (Du Plessis *et al*., 2005:688) as the variety of work in the accounting environment requires both personality types.

Steenkamp *et al.* (2009:127) noted in their study comparing lecturers' assumptions with students' perceptions of the factors that influence success in first year accounting, that a lack of *motivation* was one of the main student-related factors perceived to hinder success in first year accounting at university. Eskew and Faley (2008:145) as well as Du Plessis *et al.* (2005:694) reported effort or motivation as being significantly related to student examination performance in a first year financial accounting course at university. Muller *et al.* (2007:25) found that motivation, as reflected in the degree for which a student is registered, emerged time and again as a major factor in predicting success in an introductory accounting course. In terms of *learning approach*, Barac (2012:19-20) and Barnes *et al.* (2009:52) both found that a deep learning approach rather than a surface approach is conducive to academic achievement in first year financial accounting. Barnes *et al.* (2009:52) found a tendency among students to rely more on surface learning than on deep learning in first year accounting. Their finding could be attributed to the notion that students with prior knowledge of accounting are inclined to use more surface approaches or that teaching and assessment methods in first year accounting at university level encourage surface rather than deep learning approaches.

It is clear from the literature review that contradictory evidence is provided in terms of several demographic and educational variables influencing the performance of students in first year accounting. It is against this backdrop that the research hypothesis of this study is formulated.

HYPOTHESIS DEVELOPMENT

The literature has identified several factors as influencing failure, and it is these factors that serve as the independent or predictor variables in the model for predicting first year accounting at-risk students. The accounting semester result will serve as the dependent variable.

Dependent variable

In order to calculate the dependent variables in this study, namely the *R101 semester result*, it is important to clarify the composition of this result. First year accounting at NMMU is assessed by means of two semester tests, a group assignment and concept tests. The two semester tests contribute 40 per cent each towards the 100 per cent semester mark. The remainder of the semester mark is made up of the group assignment contributing five per cent and the concept tests contributing 15 per cent. Only students who obtain a semester mark of at least 35 per cent and meet the other duly performance (DP) requirements of 75 per cent tutorial attendance and 75 per cent assignment hand-in, are allowed access to the June examination. For students who miss one of the two semester tests, a heavier weighting is applied to the examination mark. The semester mark contributes one third, and the examination mark two-thirds of the final first semester accounting mark.

Based on the semester result achieved, participants in this study are classified as being either at-risk or not-at-risk students. The at-risk group refers to students who obtained a semester mark in accounting of less than 60 per cent, while not-at-risk refers to students who achieved greater than 60 per cent as their semester mark in accounting. In order to pass first year accounting, a student must achieve a semester mark of 50 per cent. In this study, in order to avoid a false positive (allowing students to be under the impression that they are doing well when they are actually at risk), 60 per cent will be used rather than the pass mark of 50 per cent to distinguish between the two groups.

Independent (predictor) variables

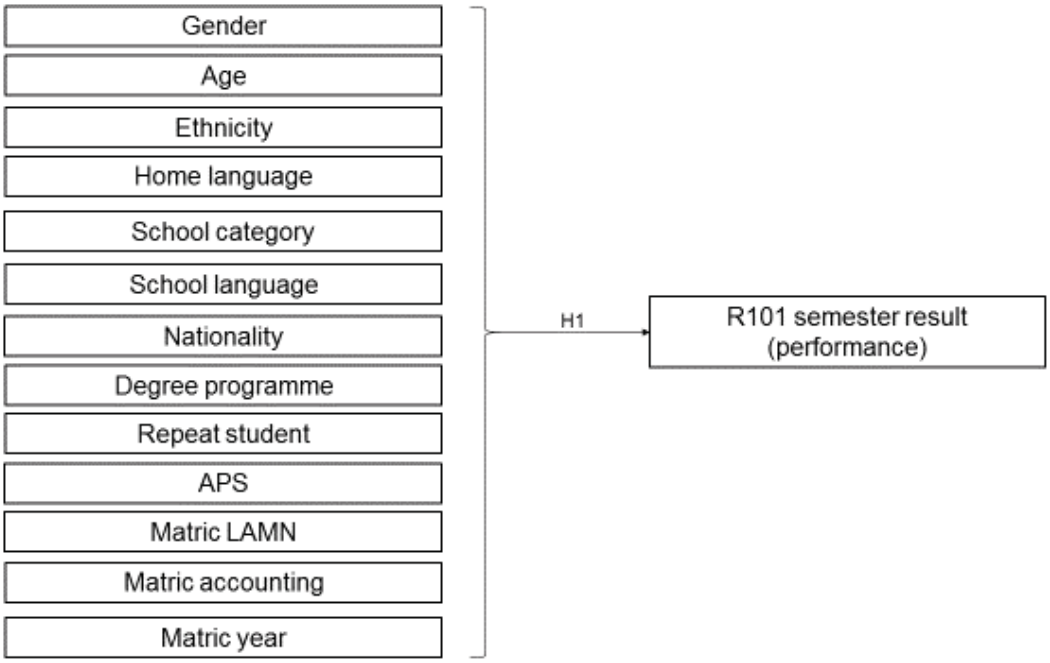
Taking into account previous research findings on the factors that determine the success or failure of students in academic achievement in first year accounting (see Table 1), it was decided to focus this study on several factors commonly found to influence student performance in the first year. Furthermore, selection was determined by the availability of information on the student information database of the School of Accounting and the NMMU student information database. Even though prior literature suggests that class attendance, students' learning approach and personality types influence performance, these factors were not considered because they were not recorded on the student information systems available. Lecture attendance in first year accounting at NMMU is not monitored as a result of large class sizes. Although tutorial attendance is monitored through the year, it was not considered useful for the study as it is cumulative data. It would be necessary to identify at-risk students at the start of the year when they enter the accounting course in order to introduce interventions as early as possible to assist students to succeed in first year accounting.

Against this background, the factors influencing failure at first year level accounting, which serve as the independent variables in this study, are the following: *Gender*, *Age*, *Ethnicity, Home language, School category* (whether urban or rural, model C, non-model C or international), *School language* (language of instruction at school attended), *Nationality, Degree programme* for which the student is registered (which has bearing on the motivation of the student), whether a student is *Repeating the course*, *APS* (admission point score based on Matric results), *Matric LAMN* (a combined score for individual relevant Matric subjects of language, accounting, mathematics and numeracy), whether the student did *Accounting in Matric*, and *Matric year* (the year the student completed Matric).

Hypothesised relationship

The hypothesised relationship subjected to empirical investigation in this study is depicted in Figure 1:

FIGURE 1: PREDICTOR VARIABLES AND PERFORMANCE



* LAMN = language, accounting, mathematics and numeracy

The hypothesised relationship is as follows:

H^1: A selected subset of the demographic and educational variables investigated in this study (*Gender, Age, Ethnicity, Home language, School category, School language, Nationality, Degree programme, Repeat student, APS, Matric LAMN, Matric accounting, Matric year*) acts as predictor of at-risk R101 students (first year first semester course for students majoring in accounting).

RESEARCH METHODOLOGY

This study adopted a positivistic research paradigm and implemented a quantitative research approach which was deductive and cross-sectional in nature.

Population and sample

For the purpose of this study, the population included all first year students enrolled for first year accounting at NMMU in 2015. First year accounting at NMMU is categorised into several module codes, namely R101, RNC101, R102, RG102 and RNC102. The students doing R101 served as the sample for this study. This sample was selected based on convenience and because this module had the most students registered in comparison to the other modules. The R101 students are also the students most likely to continue with their studies in accounting, and are thus likely to benefit the most from a prediction model.

Data collection

Historical data was collected on which to undertake the quantitative data analysis. This data included the results and demographic information of all students enrolled for first year first semester accounting in 2015. This information was accessed from the School of Accounting's database. Moreover, this data was supplemented with personal data for each student which was obtained from the Information Technology System (ITS) at NMMU. The data obtained from the School of Accounting's database and NMMU's ITS was combined into one database using Microsoft Excel. The coding of the data collected is summarised in Table 2. Using institutional data, as was done in this study, is not uncommon among studies of this nature (Smith *et al*., 2012; Barnes *et al*., 2009; Du Plessis *et al*., 2005).

TABLE 2: CODING OF DATA COLLECTED

Variable	Description
Gender	Female? Yes (1) or No (0)
Age	Age 20-24? Yes (1) or No (0) Age 25+? Yes (1) or No (0)
Ethnicity	Race.Coloured? Yes (1) or No (0) Race.Indian? Yes (1) or No (0) Race.White? Yes (1) or No (0)
Home language	Language.Afr? Yes (1) or No (0) Language.Eng? Yes (1) or No (0) Language.Oth? Yes (1) or No (0)
School category	Urban Non-Model C? Yes (1) or No (0) Rural Model C? Yes (1) or No (0) Urban Model C? Yes (1) or No (0) Overseas School? Yes (1) or No (0)
School language	English school? Yes (1) or No (0)
Nationality	Local student? Yes (1) or No (0)
Degree programme	BCom C2? Yes (1) or No (0) BCom C3? Yes (1) or No (0) BComRat? Yes (1) or No (0)
Repeat student	Repeat? Yes (1) or No (0)
APS	Actual scores captured with the minimum number of marks captured per student being 1 and maximum being 5
Matric LAMN	Actual scores captured and averages determined with the minimum number of marks captured per student being 1 and maximum being 7
Matric accounting	Matric Accounting? Yes (1) or No (0)
Matric year	Matric 2008-2013? Yes (1) or No (0) Matric <2008? Yes (1) or No (0)
Accounting 1 semester result	Actual results captured or imputed

In order to perform the statistical analysis, the following adjustments were made to the data in this study. First, because of the DP requirements – students have to write all semester tests, obtain a semester mark of at least 35 per cent, they must have a 75 per cent tutorial attendance and 75 per cent of assignments must be handed in – some students did not have a June examination mark because they did not obtain DP and were not allowed to write the examination. In order not to lose the data of these students, most of whom had poor results, a regression equation was used to predict or impute examination marks based on the known semester mark. Second, in order to use mathematics, accounting and language marks from school, regardless of whether a student did mathematics (nationally or internationally) or mathematical literacy and regardless of which language taken as first language or second language, the marks for these subjects were combined into an average mark referred to as Matric LAMN.

Trustworthiness and ethical considerations

Trustworthiness refers to concerns about the extent to which research is to be trusted and believed (Struwig & Stead, 2013:136). In the research process, "rigour" means that the researcher uses rigorous, precise and thorough methods to collect, record and analyse data. The researcher also takes steps to remain as objective as possible throughout the project (Leedy & Ormrod, 2001:164). By increasing rigour, the issues of validity and reliability were addressed in this study.

Recently, researchers (Struwig & Stead, 2013:137; Leedy & Ormrod, 2001:106) have suggested that words such as "credibility, dependability, confirmability, verification and transferability" be used instead of the term "validity". Ary, Jacobs, Sorensen and Walker (2013:531–532) assert that credibility involves how well the researcher has established confidence in the findings based on the research design, participants and context. Confidence in the data for this study was established as data was obtained from the NMMU ITS, which was downloaded from the Department of Education's database and which one would assume has been captured correctly. Furthermore, each student's details appear on their student record, which is made available to each student when they register for their courses at the beginning of a year. Each student has the opportunity to confirm the accuracy of the data captured or to have any errors corrected.

Data available from the student information database of the School of Accounting is known to be accurate and credible as it is made available to students throughout the semester to confirm its accuracy. Demographic data is confirmed by students at the beginning of the year. Semester test results are published during the semester, and students are asked to confirm these published semester test results against the test scripts which are handed back to them with a marking memorandum. DP performance is published at the end of each semester as per university policy, giving students sufficient time to query the accuracy of their captured results. Semester results are made available to students at the end of each semester. Students also have an opportunity to view their examination scripts if they are uncertain of the accuracy of their examination and semester results.

Because all the data used in this study was secondary in nature (as obtained from the School of Accounting's database and NMMU's ITS), it was possible for it all to be

meticulously combined into one Excel database. This was done by a person other than the researcher, with excellent data capturing skills and with a reputation for accuracy in their work. To ensure that the data used for the statistical analysis was captured into the database correctly, it was verified during the capturing process by the data capturer, and again after the data had been captured, by both the data capturer and the researcher.

Ethical considerations are also of great concern for all researchers. Given the nature of the study, ethics approval was obtained via the normal channels of the NMMU.

Statistical analyses

The data was analysed by means of descriptive statistics and a discriminant analysis using Statistica. Discriminant analysis is a classification technique which can be used to classify respondents into groups, where the groups are defined by the categories of the dependent variable (Maree, 2016:283). Undertaking the discriminant analysis in the study involved three steps. These steps were concerned with first identifying the predictor variables to be included in the discriminant analysis functions (formula) and second, with calculating the coefficients for these discriminant analysis classification functions (the at-risk and the not-at-risk functions). The last step involved testing the accuracy of these functions by using the actual data collected from the R101 sample group of 2015.

In the first step, namely identifying the predictor variables to be included in the discriminant analysis functions (formula), all of the predictor (independent) variables were entered in a forward stepwise manner when calculating the discriminant analysis function. This analysis was done to establish the best combination of predictor variables in discriminating between at-risk and not-at-risk students. As such, the analysis identified the predictor variables that had the least power to discriminate between the two groups and removed variables from the function if a better model fit would result. This process continued until the best model fit was obtained.

The second step of the discriminant analysis involves calculating the coefficients for the discriminant analysis classification functions. These coefficients allow for the practical application of the functions. As with any other multivariate technique the discriminant score for each classification function in the analysis is the summation of the values obtained by multiplying each independent variable by its coefficient (Hair *et al*., 2006:274). Two functions exist: one to predict at-risk and the other to predict not-at-risk students, namely:

At-risk students: $F_A = B_{0A} + B_{1A}(X_1) + B_{2A}(X_2) + \ldots + B_{KA}(X_K)$

Not-at-risk students: $F_B = B_{0B} + B_{1B}(X_1) + B_{2B}(X_2) + \ldots + B_{KB}(X_K)$

Where B_0 is the constant, B_1 is the coefficient associated with X_1, and X_1 is the predictor variable and so forth for K number of predictor variables.

The coefficients for the classification functions used to predict whether a student falls into the at-risk group or the not-at-risk group are then reported. In the case of this study, the predictor variables are measured on different scales. For example, Matric accounting is measured on a scale of 0 to 100 whereas gender is measured on a scale of 0 to 1.

Therefore, comparisons between coefficients cannot be made. However, the larger the classification function coefficient is in absolute terms for a specific predictor variable, the larger the predictor variable's unique contribution to the discrimination specified by the discriminant function (Statsoft, 2009). Furthermore, a positive coefficient indicates that two variables systematically vary in the same direction (Hair *et al*., 1995:131). For example, a positive coefficient adds to the likelihood of an at-risk prediction whereas a negative coefficient reduces the likelihood of an at-risk prediction. The higher the value of the coefficient in predicting at-risk students compared to not-at-risk students, the more weight that predictor variable adds in predicting at-risk students as opposed to not-at-risk students.

The final step in the discriminant analysis involved testing the accuracy of the functions in predicting at-risk and not-at-risk students by using the actual data collected from the R101 sample group of 2015. The actual data collected from the 2015 R101 sample group was input into the discriminant classification functions developed in step 2 and students were classified as falling into either the at-risk or not-at-risk groups.

The extent to which the function (model) demonstrates practical significance was established by calculating Press's Q. Press's Q statistic is a measure of the discriminatory power of the classification matrix when compared with the results expected from a chance model (Hair, Black, Babin & Anderson, 2010:338). The ability of the function (model) is statistically significantly better than would be expected by chance when the Press's Q value is greater than the threshold value (Press's Q critical value) (Hair, Black, Babin & Anderson, 2006:324). The ability to accurately predict is also practically significantly better than chance when the percentage being correctly classified is greater than the practical significance criterion (Cps) value (Hair *et al*., 2006:324). Cps gives the percentage correctly classified if one classifies all the sample into the group with the largest proportion (Hair *et al*., 2006:324).

EMPIRICAL RESULTS

Sample description

From Table 3 it can be seen that the sample group consisted of an equal number of male (50%) and female (50%) students. This sample group was predominantly in the age category of less than 20 years (53%) or between 20 to 24 years of age (41%). Only six per cent were older than 25 years of age. The majority of the students were black (62%), followed by white (25%) students. The remaining students were coloured (12%) and Indian (1%). The majority of the students spoke an African language (55%) as their home language, whereas the remaining students spoke English (32%) or Afrikaans (12%) at home. The vast majority (92%) of the students registered for R101 were South African, while only eight per cent were of another nationality.

TABLE 3: SAMPLE DEMOGRAPHIC DETAILS

Gender	**Frequency**	**Percentage**
Female	239	50%
Male	243	50%
Total	**482**	**100%**
Age	**Frequency**	**Percentage**

<20	247	53%

TABLE 3: SAMPLE DEMOGRAPHIC DETAILS (continued)

20-24	192	41%
25+	28	6%
Total	**467**	**100%**
Ethnicity	**Frequency**	**Percentage**
Black	298	62%
Coloured	58	12%
Indian	4	1%
White	122	25%
Total	**482**	**100%**
Language	**Frequency**	**Percentage**
African	266	55%
Afrikaans	60	12%
English	155	32%
Other	1	0%
Total	**482**	**100%**
Nationality	**Frequency**	**Percentage**
South African (No)	37	8%
South African (Yes)	445	92%
Total	**482**	**100%**

Information relating to the educational background of the sample group is presented in Table 4. Apart from the 31 students (6%), attending overseas schools 94 per cent of the R101 students attended school locally. Most (44%) attended urban model C schools, followed by rural non-model C schools (20%), rural model C schools (18%) and finally urban non-model C schools (11%). Fifty-one per cent of this sample group attended a school where instruction was in English, whereas 49 per cent attended schools where the language of instruction was not English. Fifty-seven per cent of the R101 students of 2015 completed their Matric year in 2014, followed by those having completed their Matric year between 2008 and 2013 (39%), and those completing Matric prior to 2008 (4%).

TABLE 4: SAMPLE EDUCATIONAL BACKGROUND

School category	Frequency	Percentage
Rural Non-Model C	94	20%
Urban Non-Model C	54	11%
Rural Model C	88	18%
Urban Model C	211	44%
Overseas	31	6%

Total	**478**	**100%**
English school	**Frequency**	**Percentage**
No	233	49%
Yes	245	51%
Total	**478**	**100%**
Matric year	**Frequency**	**Percentage**
2014	275	57%
2008-2013	186	39%
<2008	21	4%
Total	**482**	**100%**
Qualification	**Frequency**	**Percentage**
BCom (C3: Chartered Accounting)	197	41%
BComRat (Four-year Chartered Accounting)	36	7%
BCom (C2: General Accounting)	104	22%
Other	145	30%
Total	**482**	**100%**
Matric accounting	**Frequency**	**Percentage**
No	70	17%
Yes	353	83%
Total	**423**	**100%**
Repeating first year accounting	**Frequency**	**Percentage**
No	397	82%
Yes	85	18%
Total	**482**	**100%**

41 per cent of these students were registered for the three-year chartered accounting qualification, and seven per cent were registered for the four-year chartered accounting qualification. 22 per cent were registered for the general accounting programme while 30 per cent were registered for a qualification not majoring in accounting. The vast majority (83%) of students had done accounting as a subject in their Matric year and were attempting the R101 module for the first time in 2015 (82%). Only 18 per cent were repeating first year accounting at university level.

Included in the data gathered from respondents was their *Matric LAMN* and their *APS*. These educational background variables were continuous in nature and thus descriptive statistics instead of frequency distributions were established. From Table 5, it can be seen that the R101 sample group for 2015 reported a mean score of 5.43 for Matric LAMN (7 being the maximum score) with a standard deviation of 0.82 whereas, for the APS, a mean score of 38.89 (49 being the maximum score) and a standard deviation of 5.27 was reported.

TABLE 5: MATRIC LAMN AND APS

	n	Mean	S.D.	Min.	Quart.1	Median	Quart.3	Max.
Matric LAMN	423	**5.43**	**0.82**	3.50	4.83	5.50	6.00	7.67
APS	477	**38.89**	**5.27**	16.00	36.00	39.00	42.00	55.00

Discriminant analysis

As mentioned, the discriminant analysis was undertaken in three steps. Step 1 involved identifying the predictor variables to be included in the discriminant analysis functions. The model (function) derived from the discriminant analysis done on the R101 sample group of 2015 was found to be highly significant ($p < .0005$) and therefore using this function to discriminate between at-risk and not-at-risk students is a significant improvement on the students falling into either group as a result of chance. As such, the model statistics ($F(14.392)$; $p < .005$) show that the differences observed between the at-risk and the not-at-risk R101 students are not by chance but as a result of the combination of predictor variables that make up the discriminatory function. The list of predictor variables found to discriminate between at-risk and not-at-risk R101 students are reported in Table 6. Predictor variables with a p-value of between .05 and .10 are reportable, while those with p-values of less than .05 are both reportable and significant.

Based on the discriminant analysis (see Table 6), the predictor variables with p-values less than .05 were identified as playing a greater role in the R101 discriminatory function (model) or, stated differently, as playing a greater role in distinguishing between at-risk and not-at-risk R101 students. These variables were *Matric LAMN* (p-value = .022), *Matric accounting* (p-value = .000), *BCom C3* (degree programme) (p-value = .000), *Age* (p-value = .014), *Afrikaans language* (p-value = .000), *English school* (p-value = .001), *Gender female* (p-value = .002), *APS* (p-value = .017) and *English language* (p-value = .034). Even though the other predictor variables reported p-values of greater than .05, they added significantly to the explanatory power of the model as a whole and were thus retained in the discriminatory function. The only predictor variable that was not retained in the model was *Nationality. Nationality* was excluded in the final data set due to the grading system for international students in their final year of secondary school not being comparable to South African students.

Furthermore, the larger the F-remove value, the greater the contribution of the predictor variable to the discriminatory function and, as such, in discriminating between the two groups. Based on the F-remove values (see Table 6) the predictor variables *Matric accounting* (F-remove = 18.78), *BCom C3* (degree programme) (F-remove = 16.05), *Afrikaans language* (F-remove = 15.59), and *English school* (F-remove = 10.47) were the predictor variables contributing the most to the discriminatory function.

TABLE 6: DISCRIMINANT ANALYSIS SUMMARY

	Wilks' Lambda = .593; F (14.392) = 2; p < .0005

Independent predictor variables	Wilks' Lambda	Partial Lambda	F-remove -1 392	p-value	Toler.	1-Toler. (R-Sqr.)
Matr.LAMN	0.601	0.987	5.32	**.022**	0.278	0.722
Matr.Accounting	0.621	0.954	**18.78**	**.000**	0.961	0.039
Race.White	0.594	0.998	0.90	.343	0.148	0.852
BCom C3	0.617	0.961	**16.05**	**.000**	0.534	0.466
Age 20-24	0.602	0.985	6.09	**.014**	0.832	0.168
Lang.Afr	0.617	0.962	**15.59**	**.000**	0.193	0.807
English School	0.609	0.974	**10.47**	**.001**	0.493	0.507
Female	0.608	0.975	9.88	**.002**	0.856	0.144
APS	0.602	0.986	5.72	**.017**	0.269	0.731
Lang.Eng	0.600	0.989	4.51	**.034**	0.150	0.850
Urban Model C	0.597	0.994	2.55	.111	0.601	0.399
BCom C2	0.597	0.993	2.90	.089	0.645	0.355
BComRat	0.596	0.994	2.21	.138	0.723	0.277
Race.Coloured	0.595	0.997	1.36	.244	0.254	0.746

Step 2 involved calculating the coefficients for the discriminant analysis classification functions. These coefficients for the classification functions which are used to predict whether a student falls into the at-risk group or not-at-risk group, are reported in Table 7. As explained earlier, the larger the coefficient, the greater the contribution of the predictor variable to discriminating between the two groups. Although the coefficients vary for the functions predicting at-risk and the not-at-risk R101 students, from Table 7 it can be seen that the same predictor variables carry the most weight in both these functions, namely *Matric accounting, Age 20–24, Afrikaans language, English school* and *BCom C2.*

TABLE 7: COEFFICIENTS FOR DISCRIMINANT ANALYSIS CLASSIFICATION FUNCTIONS

Independent/predictor variables	At-risk (score for R101 < 60)	Not-at-risk (score for R101 > 60)
Matr.LAMN	-2.610	-1.802
Matr.Accounting	**6.389**	**8.028**
Race.White	-2.505	-3.249
BCom C3	0.951	2.441
Age 20-24	**5.742**	**4.999**
Lang.Afr	**3.260**	**6.696**
English School	**7.735**	**8.936**

Female	-2.664	-3.546
APS	3.185	3.334
Lang.Eng	-0.787	0.811
Urban Model C	3.509	2.969
BCom C2	**6.692**	**7.383**
BComRat	-6.567	-5.751
Race.Coloured	2.054	1.113
Constant	-60.603	-73.778

Step 3, the final step in the discriminant analysis, involved testing the accuracy of the functions in predicting at-risk and not-at-risk students by using the actual data collected from the R101 sample group. In Table 8, the results of the discriminant analysis classification matrix are presented. From Table 8 it can be seen that the at-risk function accurately predicted 83.4 per cent of at-risk students as falling into the at-risk group, whereas only 16.4 per cent of the R101 students were not accurately predicted. The not-at-risk function accurately predicted 77.2 per cent of not-at-risk students as falling into the not-at-risk group. In this case, 22.8 per cent of the not-at-risk students were not accurately predicted as being not-at-risk students. The prediction value of the functions as a whole is high with 80.6 per cent of students being accurately classified into either the at-risk or the not-at-risk group. The R101 model can be seen as good (effective) in that it is a better predictor of R101 at-risk students than not-at-risk students.

TABLE 8: DISCRIMINANT ANALYSIS CLASSIFICATION MATRIX

Observed group	Correctly classified	Predicted group		Actual number
		At-risk	Not-at-risk	
At-risk	83.4%	**186**	37	223
Not at-risk	77.2%	42	**142**	184
Total	**80.6%**	**228**	**179**	**407**

The findings based on the R101 sample group for 2015 show that by using the prediction functions resulting from the discriminant analysis, the ability to predict students as being either at-risk or not-at-risk, is statistically significantly better than chance because the Press's Q value of 152.34 is much greater than the threshold value (Press's Q critical value) of 6.63 (Chi^2 d.f. = 1 and p = .01). The ability to accurately predict is also practically significantly better than chance, because 80.6 per cent being correctly classified is greater than a Cps value of 88.5 per cent. Cps provides the percentage correctly classified if one classifies the whole sample into the group with the largest proportion (Hair *et al*., 2006:324).

Against this background, support is found for the following hypothesis:

H^1: A selected subset of the demographic and educational variables investigated in this study (*Gender, Age, Ethnicity, Home language, School category, School language,*

Nationality, Degree programme, Repeat student, APS, Matric LAMN, Matric Accounting, Matric year) acts as predictor of at-risk R101 students (first year first semester course for students majoring in accounting).

DISCUSSION, IMPLICATIONS AND RECOMMENDATIONS

The primary objective of this study was to develop a predictive model capable of identifying students at risk of failure in first year accounting that can serve as an early warning system for identifying at-risk first year accounting students at NMMU. The results of the study show that the correlation between the predictor variables, namely *Matric LAMN, APS, Matric accounting* and *Degree programme,* and the dependent variable (*R101 actual score*) are both statistically and practically significant. The predictor variables *Ethnicity* and *Gender* reported no significant correlations with the dependent variable. The correlations between the remaining predictor variables and the dependent variable were statistically but not practically significant.

In the process of identifying the predictor variables to be included in the discriminant analysis functions, the model (function) derived from the R101 sample group of 2015 was found to be highly significant. All the predictor variables originally included in the model added significantly to the explanatory power of the model as a whole, except for *Nationality*. Based on the discriminant analysis the predictor variables, *Matric accounting*, *Degree programme (BCom C3*), *Afrikaans language*, and *English school,* were identified as contributing the most to the discriminatory function.

When calculating the coefficients for the discriminant analysis classification function the predictor variables, namely *Matric accounting, Age 20–24, Afrikaans language, English school* and *BCom C2,* were found to carry the most weight in both these functions. When testing the accuracy of the functions in predicting at-risk and not-at-risk students, the results of the discriminant analysis classification matrix showed that the at-risk function accurately predicted 83.4 per cent of at-risk students as falling into the at-risk group, and the not-at-risk function accurately predicted 77.2 per cent of not-at-risk students as falling into the not-at-risk group. As such, the model can be seen as effective in that it is a better predictor of R101 at-risk than not-at-risk students. The prediction value of the functions as a whole is high, with 80.6 per cent of students being accurately classified into either the at-risk or the not-at-risk group. The ability to accurately predict was also practically significant.

This study has developed a predictive model that can be used to identify individual first year at-risk students in accounting at NMMU when they first enter the first year accounting module. Based on the results of this study an Excel spreadsheet will be designed using the discriminant classification formula. First year accounting lecturers will be able to use this Excel spreadsheet to input the nine statistically significant predictor variables of all students registered for R101 and upon calculation the formula will identify those that are at-risk or those that are not-at-risk. Upon identification, additional interventions can be undertaken by lecturers or university support services among students identified as high-risk students. Identifying at-risk students when they first enter the first year accounting course is vitally important as it will allow sufficient time for the early delivery of targeted interventions and support services, while success is still possible (Jia, 2014:3; Lewis & Lewis, 2007:32). Such

interventions and support may provide these students with a means of overcoming their challenges**.**

The findings relating to language and having done Matric accounting are of particular interest in this study. Having attended a school where the instruction language is English carried the most weight in predicting both at-risk and not-at-risk students. This finding highlights the importance of the language of instruction at school level. Many students attend schools where the language of instruction is different from the language of instruction that they encounter at university. As a result, the student is not only entering a new, unfamiliar learning environment, but is also expected to deal with this environment in a language of instruction that was not encountered at school level. Students from non-English schools should be encouraged to make use of all the support offered by universities in terms of reading, writing and comprehending English. Lecturers of accounting should recommend accounting dictionaries, and provide opportunities for students to identify and summarise unfamiliar terminology during contact sessions, as well as by means of online self-assessments. The possibility of making online language programmes available to assist students should also be investigated. Universities as a whole should continuously strive to improve their language policy, their entrance requirements and language support, so that students from non-English speaking schools are not at a disadvantage while undertaking tertiary studies.

The findings of this study also highlight the importance of having done Matric accounting at school. Having done accounting at Matric level also carried a substantial weight in predicting both at-risk and not-at-risk students. Students with the intention to follow a career in accounting should be counselled appropriately at school level to ensure correct subject choices are made. Those who specify entrance requirements for universities should take cognisance of this finding, and consider including Matric accounting as a prerequisite for entrance into programmes with accounting majors. Lecturers at universities could also offer support in the form of an introductory accounting course prior to the commencement of the academic year, or an academic support programme that runs concurrently with the lecturing programme. In this way, students with poor Matric accounting results, or students without Matric accounting, could be offered the support they need.

Accounting is referred to as the language of business and has many terms and concepts specific to the field. Students who have never been exposed to accounting as a school subject and who have attended non-English schools, face the additional challenge of not only mastering a new subject but also a new language.

The results of this study also indicate that the age of the student, being Afrikaans-speaking and following a certain degree programme carry significant weight in predicting both at-risk and not-at-risk students. These findings could be attributed to the motivation levels associated with life-stage, career choice and cultural background. However, explanations and recommendations for these findings fell outside the ambit of this study.

LIMITATIONS AND FUTURE RESEARCH

The study has several limitations that need to be highlighted. The literature study revealed that many factors influence the academic success or failure of students at first year level in

general, and in first year accounting in particular. However, for the purpose of this study, only certain factors were considered. The factors selected were based on literature support and the ability to access the necessary information. Factors relating to motivation and personality, for example, were not included and these could play a significant role in predicting academic success.

The data collected to develop the model was from one group of first year accounting students, and from NMMU only. As such, the findings cannot be generalised to the entire first year accounting student population. Future studies should include other accounting modules at both NMMU and other universities throughout South Africa to establish whether predictor variables vary across student groups. Future studies should also strive to improve the model by taking the next cohort of accounting first year students' results and testing the accuracy of the model developed based on 2015 data. In this way, the model can continuously be refined and improved. The model that has been developed in this study could also possibly be used in future research attempting to predict at-risk students in other subjects such as management and law. The development of a comprehensive, institution-wide, early warning intervention system for at-risk students would be invaluable, not only to NMMU but also to universities countrywide.

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