Secondary school factors relating to academic success in first year Health Science students

U. Naidoo*
School of Health Sciences
e-mail: naidoo@ukzn.ac.za

P. S. Flack*
School of Health Sciences
e-mail: flackp@ukzn.ac.za

I. Naidoo*
Institutional Intelligence
e-mail: naidooi@ukzn.ac.za

S. Y. Essack*
School of Health Sciences
*University of KwaZulu-Natal
Durban, South Africa,
e-mail: essacks@ukzn.ac.za

Abstract
Universities in South Africa, experience challenges related to throughput rates, especially in the first year of study. Student dropout in the School of Health Sciences (SHS) at the University of KwaZulu-Natal (UKZN) negatively affects the enrolment targets with the concomitant loss of student subsidy and fees. It also reduces the number of prospective healthcare professionals who are required to address the shortage of skilled healthcare workers in the country. Thus, this emphasises the need to determine secondary school factors that relate to success and throughput in the first year of study, namely: area and type of schooling; matriculation point scores (also referred to as admission point scores [APS]); and matriculation subject choices. A retrospective design with a quantitative approach was used to collect data from a total of 713 student records over the period 2009-2011. The quantitative data was analysed using descriptive and inferential statistics while Spearman’s rank correlation coefficient (rho) and the Mann-Whitney U test were used to determine differences between variables related to academic success. A p-value of ≤ 0.05 was considered statistically significant. The data was analysed and presented as annual composite results as well as stratified by disciplines. Overall the area of secondary schooling did not correlate statistically significantly with academic success. In contrast, the type of secondary schooling (p = .012), matriculation points (p = .000) and all matriculation subjects investigated (p < .005) were statistically significant variables that correlated with academic success. At discipline-level, Physiotherapy was shown to have the most consistent correlations among variables, with a moderate correlation with matriculation subjects as well as the APS. The results of this study yielded evidence-based admissions criteria for students into the SHS at UKZN.
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Keywords: academic success, throughput, secondary school, first year students

INTRODUCTION

Student attrition has consequences for universities’ throughput rates and funding and can also have a devastating effect on the students concerned (Eiselen and Geyser 2003; Tinto 1975). Attrition in the first year of study has been the centre of much research for decades as it is often in the first year when the highest rates of failure and dropout occur. This has been found to be largely attributable to poor transition from secondary school to university at a social and, more importantly, academic level. Student dropout in the School of Health Sciences (SHS) at the University of KwaZulu-Natal (UKZN) has a two-fold consequence. Student dropout results in the loss of students, thereby adversely affecting throughput and graduation rates, and the loss of prospective healthcare professionals who are required to address the shortage of skilled healthcare workers in the country. There is an obvious need to explore ways to minimise this loss.

The responsibility of secondary schools in South Africa is to provide the best education to their learners (Jones, Coetsee, Bailey and Wickham 2008). However, the unfortunate South African past of under-resourced schools coupled with under-qualified teachers is still ubiquitous in present-day South Africa. It is especially evident in historically disadvantaged rural communities as well as in public schools.

It has been reported that attending under-resourced schools with under-qualified teachers often compromises the learners’ competence and readiness for university study (Neuschatz and McFarling 1999). The purpose of this study was thus to determine whether school factors, such as area and type of school, matriculation scores (also referred to as admission point scores [APS]) and performance in matriculation subjects relate to first year academic success in the SHS.

Academic success (or achievement) has been defined by Jones et al (2008) as a student’s ability to progress through and adequately complete the intended course of study within the minimum allocated time. However, first year academic success is also considered in terms of a student’s academic performance and retention (Mills, Heyworth, Rosenwax, Carr and Rosenberg 2009). Therefore, academic success has been defined according to the following three parameters: (1) students who have passed all first year modules in the main or supplementary examination sessions, progressing to the second year of study; (2) students who are not at risk of academic failure; and (3) students who may continue with their degree, potentially graduating in the minimum time.

For the research on academic success of first year students, a retrospective quantitative methodology was used. The type and area of secondary schooling; performance in matriculation subjects; as well as APS were part of the focus on the basis of the following pertinent factors.
SECONDARY SCHOOLING CONTEXT

The issues of academic failure and student attrition have been reported by researchers in many countries, including South Africa. However, it is important to understand the uniqueness of these difficulties within the South African higher education and healthcare context. One such issue is the inequitable schooling system in South Africa, with the significant disparities in resources and infrastructure, carried over from a previously fractured and racially segregated education system that still persists nearly two decades after all systems were integrated (Jones et al 2008). The legacy of apartheid has left a differentially resourced educational system that is particularly evident in the division of resources between urban and rural schools, as well as in the differences in resources between private and public schools in the country.

HEALTHCARE AND EDUCATION CONTEXT

Statistics South Africa (2011) reports that the South African population has increased in growth by almost 7 million people (15.5%) since the last census conducted in 2001, with the most recent count of the population being 51.77 million. The continuous growth of the South African population poses a major challenge to providing health services and planning for human resources for health, especially considering that South Africa experiences a historical undersupply of healthcare professionals (Mbambo 2008). The National Human Resources for Health Strategy for the Health Sector (Department of Health 2011) quantifies the healthcare professional needs for the country presenting a responsibility on universities to produce competent health professionals. It is imperative that the best students are placed in the limited training vacancies to meet the demand for professionals (Nadasan and Puckree 2003). It is further imperative to minimise student attrition to prevent the loss of prospective healthcare workers and to ensure the maximum output of healthcare workers at the time of graduation.

FACTORS RELATED TO FIRST YEAR ACADEMIC SUCCESS

In Italy, Dante, Valoppi, Saini and Palese (2010) found that the type of secondary school education (i.e., independent/private schooling compared to government/public schooling) did not seem to be a predictor of academic success or failure. Italy’s secondary school context appears to be similar to South Africa’s as schools are stratified according to independent and public schooling sectors. The type of schooling as a variable was investigated, to determine what results are gained from a developing country such as South Africa, where disparities in the allocation of resources were so marked in the past, that the consequences of this inequality are still present.

In 2008, the National Senior Certificate (NSC) examination replaced the old Senior Certificate matriculation system. Pre-2008, the school exit examination, the Senior Certificate, differentiated subjects into Higher Grade, Standard Grade
and Lower Grade, and a matriculation exemption was set as the minimum entry requirement for admission into university (Nel and Kistner 2009). Prospective students were required to have passed two of the following subjects: Mathematics, Physical Science and/or Biology with an ‘E’ symbol on the Higher Grade or a ‘D’ symbol on the Standard Grade. The NSC follows a slightly different structure from the previous system, but still includes prerequisite subjects with new curricula.

The Report on the NSC Results (Department of Basic Education 2009) states that in order for a learner to qualify for entry into university at the level of a Bachelor’s degree, the learner must pass the NSC with one official language at home language level at 40 per cent or more; pass four subjects from the designated list of subjects at 50 per cent or more of which two subjects should be at a minimum of 30 per cent; and meet the language requirement for further study at a South African higher education institution (HEI), namely, one of the two official languages offered by the learner must be either English or Afrikaans.

Nel and Kistner (2009) state that Grade 12 results from an international perspective are considered reasonable predictors of first year academic success. However, in South Africa, there is still a lack of benchmarking in terms of the NSC which was written for the first time in 2008. Table 1 presents the seven levels of competency according to the NSC in terms of aligning marks achieved (in percentage form) to achievement level points, also referred to as APS.

Table 1: Seven levels of competency in the NSC

<table>
<thead>
<tr>
<th>Achievement level (Points)</th>
<th>Achievement description</th>
<th>Marks (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Outstanding achievement</td>
<td>80 – 100</td>
</tr>
<tr>
<td>6</td>
<td>Meritorious achievement</td>
<td>70 – 79</td>
</tr>
<tr>
<td>5</td>
<td>Substantial achievement</td>
<td>60 – 69</td>
</tr>
<tr>
<td>4</td>
<td>Adequate achievement</td>
<td>50 – 59</td>
</tr>
<tr>
<td>3</td>
<td>Moderate achievement</td>
<td>40 – 49</td>
</tr>
<tr>
<td>2</td>
<td>Elementary achievement</td>
<td>30 – 39</td>
</tr>
<tr>
<td>1</td>
<td>Not achieved</td>
<td>0 – 29</td>
</tr>
</tbody>
</table>


Table 2 presents the minimum entry requirement for prospective SHS students who wrote the NSC examination as well as the Senior Certificate examination (prior to 2008).
### Table 2: Minimum entry requirements with APS for programmes offered by the SHS at UKZN

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Minimum entry requirements: NSC</th>
<th>Minimum entry requirements: Senior Certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audiology</td>
<td>NSC Degree with English and LO 4 and Maths 3 and Life Science or Physical Science 3 APS 30</td>
<td>Matriculation exemption with two of the following: Biology, Maths, Physical Science ‘E’ HG/ ‘D’ SG</td>
</tr>
<tr>
<td>Dental Therapy</td>
<td>NSC Degree with English and LO 4 and Life Science and Maths/Maths Literacy 3 APS 30</td>
<td>Matriculation exemption with Biology ‘D’ HG or ‘C’ SG</td>
</tr>
<tr>
<td>Occupational Therapy</td>
<td>NSC Degree with English and LO 4 and Maths 3 and Life Science or Physical Science 3 APS 30</td>
<td>Matriculation exemption with two of the following: Biology, Maths, Physical Science ‘E’HG/ ‘D’ SG</td>
</tr>
<tr>
<td>Optometry</td>
<td>NSC Degree with English and LO 4 and Maths 4 and Life Science or Physical Science 4 APS 33</td>
<td>Matriculation exemption with Biology ‘D’ HG or ‘C’ SG</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>NSC Degree with English and Life Science and LO and Maths and Physical Science 4 APS 33</td>
<td>Matriculation exemption with passes in Mathematics, Physical Science, Biology or physiology HG, or obtained at least a ‘D’ at SG level, in all of the afore-mentioned subjects</td>
</tr>
<tr>
<td>Physiotherapy</td>
<td>NSC Degree with English and Life Science and LO and Maths and Physical Science 4 APS 30</td>
<td>Matriculation exemption with two of the following: Biology, Maths, Physical Science ‘E’HG/ ‘D’ SG</td>
</tr>
<tr>
<td>Speech-Language Pathology</td>
<td>NSC Degree with English and LO 4 and Maths 3 and Life Science or Physical Science 3 APS 30</td>
<td>Matriculation exemption with two of the following: Biology, Maths, Physical Science ‘E’HG/ ‘D’ SG</td>
</tr>
</tbody>
</table>

Note: APS = admission points score; LO = Life Orientation. Data obtained from Central Applications Office handbook entry, 2013.

Student performance in key matriculation subjects has also been the focus as a predictor of first year university success. Zewotir, North and Murray (2011) found that good academic results in Grade 12 Mathematics and English were found to be useful for identifying successful students in first year cohorts; while Mbambo (2008) found significant associations between English and Biology (Life Sciences) at Grade 12 level and academic success at university for Physiotherapy students.

**METHODOLOGY**

An empirical paradigm was chosen to ascertain which factors contribute to first year academic success in the SHS. Descriptive and correlational analysis of secondary school factors as related to first year academic success was conducted. A quantitative research design was used.
The data collection instrument was a self-developed matrix of variables. The independent variables were area and type of secondary school, matriculation points and subjects and the dependent variable was the successful completion of the first year of study (academic success). The study sample comprised of first year SHS students from the disciplines of Audiology, Dental Therapy, Occupational Therapy, Optometry, Pharmacy, Physiotherapy and Speech-Language Pathology. The first year cohort for three consecutive years (2009 to 2011) subsequent to the commencement of the NSC examinations was chosen because the first year of study is the time when the highest possibility of academic failure and discontinuation occurs (Hillman 2005; McInnis, James and Hartley 2000). A non-probability purposive sampling method was used where the sample was chosen for the specific purpose of determining variables correlating to academic success within a specified population group (Leedy and Ormrod 2010) followed by the saturation sampling method to include all student records that were available. These formed the unit analysis. A total of 713 out of 938 (76%) student records of first-time entering students were retrievable over the 2009–2011 study periods.

The data was collated into the matrix of variables in Microsoft Excel and was analysed with use of the Statistical Package for Social Sciences version 15.0 (SPSS Inc., Chicago, IL). Descriptive statistics were used to describe the data in terms of proportions of the study population. Non-parametric tests were used as the data did not follow normal distribution. The Mann-Whitney U test compared the mean ranks between the type of school and the area of schools attended. The data was also analysed using correlational statistics, using Spearman’s rho, which was used to correlate the performance indicators (dependent variable) with matriculation points and matriculation subjects taken. Table 3 provides a guide to interpretation of the correlational coefficients in terms of the strength of the relationship. A 0.05 level of significance was adopted for all statistical tests.

Table 3: Interpretation of correlational coefficients and strength of relationships

<table>
<thead>
<tr>
<th>Correlation coefficient (r)</th>
<th>Strength of relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 – 0.2</td>
<td>Very weak, negligible</td>
</tr>
<tr>
<td>0.2 – 0.4</td>
<td>Weak, low</td>
</tr>
<tr>
<td>0.4 – 0.7</td>
<td>Moderate</td>
</tr>
<tr>
<td>0.7 – 0.9</td>
<td>Strong, high, marked</td>
</tr>
<tr>
<td>0.9 – 1.0</td>
<td>Very strong, very high</td>
</tr>
</tbody>
</table>


RESULTS AND DISCUSSION

The aim of the study was to determine whether secondary school information obtained from student records prior to students entering university relates to academic success at the end of their first year of study. The results are presented as a composite of the
three years investigated, stratified per year, as well as a composite of all disciplines within the SHS and then stratified according to each discipline, where applicable.

**Rural and urban areas**
The results of the Mann-Whitney U test indicated that there was no significant difference between the progression rates of students from urban and rural schooling backgrounds after the main and supplementary examination sessions, $z = -1.622$, $p = .105$. Further, there was no difference in progression rates between rural and urban students across the three years investigated, 2009–2011.

Dawes, Yeld and Smith (1999) reported that urban, high socio-economic groups out-performed rural groups of students at university-level. While this statement might appear to be logical in the sense that students from urban areas are exposed to better schooling, resources as well as financial and familial support, the results of the current study indicated that rural students are just as likely to achieve academic success as urban students are. This finding is reassuring to note and may be able to speak to the issue of resiliency and motivation of rural students in wanting to achieve academic success, even in the face of adversity which may include inadequate schooling, lack of resources and teaching staff, as well as living away from home when entering university (Jones et al. 2008). The SHS also attempts to actively recruit students who excel academically in secondary school. Although students may hail from educationally disadvantaged backgrounds, having attained previous education achievement in the face of adversity places these students in a similar position when compared to their peers from well-resourced scholastic backgrounds.

**Public and independent schools**
The results indicated that there was a significant difference between the progression rates of students from public and independent schooling backgrounds after the main and supplementary examination sessions, with students from independent schools showing higher progression rates on composite results ($z = -2.514$, $p = .012$) across all three years. A yearly analysis revealed that in 2009, a significant difference between variables was obtained ($z = -2.839$, $p = .005$). This could have been attributed to the 2009 first year cohort having been the first group of matriculants who matriculated under the new NSC examination. This trend, however, did not follow through in 2010 and 2011.

**Grade 12 subjects**
The Spearman’s rho used to correlate performance in Grade 12 subjects and progression rates at the end of the first academic year showed that those students who achieved higher marks for Mathematics, Life Sciences/Biology and Physical Science progressed at a higher rate than those students with lower marks (see Table 4). A yearly analysis revealed that in 2009, students in the SHS who obtained a higher mark for English progressed at a higher rate. Similarly, those students who obtained higher marks in 2009 and 2011 progressed at a higher rate.
Table 4: SHS-wide data of the correlation of Grade 12 subjects to progression to second year after the main examination session

<table>
<thead>
<tr>
<th>Matriculation subjects</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>p</td>
<td>r</td>
</tr>
<tr>
<td>Mathematics</td>
<td>210</td>
<td>.008</td>
<td>.182**</td>
</tr>
<tr>
<td>English</td>
<td>186</td>
<td>.006</td>
<td>.200**</td>
</tr>
<tr>
<td>Life Sciences/Biology</td>
<td>217</td>
<td>.000</td>
<td>.296**</td>
</tr>
<tr>
<td>Physical Science</td>
<td>185</td>
<td>.002</td>
<td>.227**</td>
</tr>
<tr>
<td>Life Orientation</td>
<td>198</td>
<td>.001</td>
<td>.225**</td>
</tr>
</tbody>
</table>

Note. r = Spearman’s rank correlation coefficient

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)
p < 0.05

Performance with regard to matriculation subjects did not always correlate with academic success at discipline-level. Performance in Biology or Life Sciences correlated to first year academic success in the disciplines of Occupational Therapy, Pharmacy and Physiotherapy for two or more years of the three year cohorts investigated. Mathematics correlated to first year academic success mostly in the discipline of Pharmacy. Mathematics marks at matriculation level were investigated by Zewotir et al (2009) who found that students at risk of drop out in the SHS were those with poorer Mathematics marks in Grade 12, and female students with weaker marks in English at school. It must be noted that when interpreting Zewotir et al’s results (2009), the authors investigated the 2005–2009 first year student cohorts. The study sample used by Zewotir et al (2009) included students who matriculated under the Senior Certificate matriculation system, as well as the 2009 cohort who matriculated under the NSC examination, while the student cohort used in the current study matriculated under the NSC only. Interestingly, it can be seen that students who performed better in the matriculation subjects investigated in the current study and in the study by Zewotir et al (2009) had higher progression rates than those with lower marks in these subjects, irrespective of the matriculation bodies under which they matriculated.

Though the results are not strong enough statistically (r < 0.7) to be used as a stand-alone predictor of success, matriculation subject results once again prove to be a valuable tool in the selection and admission of first year SHS students at UKZN.

**Matriculation points/APS**

Composite data across the three years revealed that there was a statistically significant but very weak correlation between matriculation points/APS and progression to the
second year of study ($r = .167, p = .000$) with similar results obtained on yearly-
analyses, that is, in 2009 ($r = .362, n = 20, p = .000$), 2010 ($r = .215, n = 221, p = .001$) and 2011 ($r = .342, n = 242, p = .000$). A similar pattern of results emerged when supplementary examinations were considered; however, only in 2009 ($r = .302, n = 220, p = .000$) and 2011 ($r = .138, n = 242, p = .032$).

Internationally, learners’ Grade 12 school results have been found to be reasonable predictors of first year success at university (Nel and Kistner 2009). However, Nel and Kistner (2009) attest to the uncertainty surrounding the standard of the new NSC and have stated that there is a need for additional measures/instruments to be used in conjunction with the final matriculation to select and place applicants more appropriately in order to achieve academic success at university.

When the results were analysed at discipline-level, Audiology showed that there was a significant but moderate correlation between matriculation scores/APS and progression to the second year of study after the main examination session in 2009 ($r = .567, n = 18, p = .014$) and 2010 ($r = .582, n = 18, p = .011$) as well as after the supplementary examination sessions in 2009 ($r = .633, n = 18, p = .005$) and 2010 ($r = .581, n = 18, p = .012$). There was no significant correlation noted in 2011. Similarly, the discipline of Pharmacy indicated that the results in 2009 ($r = .385, n = 65, p = .002$) and 2010 ($r = .306, n = 80, p = .006$) were statistically significant, however, with a low correlation after the main examination session. In terms of the results after the supplementary examination session, 2009 was the only year in which there was a significant but low correlation between matriculation scores and first year academic success ($r = .251, n = 65, p = .043$).

The discipline of Occupational Therapy showed a significant but moderate correlation between the variables investigated in 2011 only after the main examination session ($r = .619, n = 22, p = .002$) and the supplementary examination session ($r = .619, n = 22, p = .002$). In 2009 and 2010, no correlations between variables were noted.

The results for the discipline of Speech-Language Pathology indicated that in 2009 ($r = .602, n = 17, p = .004$) and 2011 ($r = .499, n = 16, p = .049$), significant and moderate correlations between variables were obtained after the main examination session. Whereas in 2009, a significant and moderate correlation between variables was noted after the supplementary examination session ($r = .693, n = 17, p = .000$).

The results for the discipline of Physiotherapy revealed consistent significant and moderate correlations between the two variables investigated across 2009 ($r = .640, n = 40, p = .000$), 2010 ($r = .455, n = 36, p = .005$) and 2011 ($r = .619, n = 42, p = .000$) in the main examination sessions as well as in the 2009 ($r = .475, n = 40, p = .002$), 2010 ($r = .518, n = 36, p = .001$) and 2011 ($r = .627, n = 42, p = .000$) supplementary examination sessions.

The results for the disciplines of Dental Therapy and Optometry showed no statistical significance between matriculation scores (APS) and academic success across all three years. This indicates that the APS is not likely to be a variable that predicts academic success for first year students in these disciplines.
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It was evident that APS provide valuable information on previous academic achievement and may serve as a predictor of future academic success of the prospective university student. However, it is clear that a single answer does not exist across all SHS disciplines in this regard. Although statistical significance was found to exist between APS and first year academic success for most disciplines, it must be advised that these scores not be used as a stand-alone predictor of academic success due to many other academic and non-academic factors that could impact on an individual student’s performance. This information should inform future selection procedures for the specific disciplines.

CONCLUSION

The composite results across the three years showed that students who attended independent schools achieved statistically significantly better progression rates into the second year of study as compared to those students who attended public schools. However, it was interesting to note that there was no significant difference in progression rates to second year between those students from rural and urban school settings. In terms of performance in matriculation subjects (Mathematics, Life Sciences, Physical Science, English and Life Orientation) and APS, a statistical significance with weak to moderate correlations was obtained with regard to individual subjects and the APS when correlated with progression across the three years. It is important for these variables (ie, performance with regard to matriculation subjects and APS) to be considered in the selection process. However, none of the variables should be used in isolation, but rather collectively in order to enable successful selection as is existing practice. The research therefore contributes to the field of knowledge of first year academic success in selected Health Science disciplines at UKZN. Admission and selection panels should take cognisance of the findings as there are implications for future admission and selection planning procedures. Understanding factors that relate to academic success in first year students in the SHS will assist in achieving better progression, throughput and graduation rates of prospective healthcare professionals. Further research into determining academic success and performance of previously disadvantaged students and students from rural areas is required in order to understand the university experiences of these students and factors that contribute to their academic success. This may ensure that recruitment and retention strategies are evidence-based.

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