# The Impact of NSC Mathematics on the Performance of First Year Commerce Students

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## Abstract

The change to the National Senior Certificate (NSC) in 2008 brought with it uncertainty as to what should be the admission requirements into a faculty of Commerce where one of the main filters is the grade obtained for mathematics. The purpose of the study is thus to determine the impact of NSC mathematics on the first year performance of Commerce students at a tertiary institution.

The research methodology involved extracting the mathematics and English or English 2 results from the NSC results for all first year commerce entrants in 2009 and comparing these results to their performance in selected first semester modules. Mathematics and English were chosen as minimum requirements in these two subjects are required in the entrance requirements of the Faculty of Management Studies at the University of KwaZulu-Natal. Furthermore, one extra point in the Mathematics score is the only distinction between the entry requirements for B Com General and B Com Accounting students. Most faculties of commence in South Africa focus on mathematics and English in their entrance requirements.

Performance in each University subject was most strongly correlated with school mathematics performance. Furthermore, the average student with 4 points for Mathematics had 30.77 matric points, but the average student with 5 points for Mathematics has 32.3 matric points. While one of those points is the additional Mathematics point, the other 0.53 points are because s/he is a stronger candidate. This has some implications for admissions in that setting the Mathematics cut-off at 5 points ensures a stronger student with a better chance of passing at university.


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## Introduction

In 2008, learners at secondary schools wrote the National Senior Certificate (NSC) for the first time. All learners writing the NSC at the end of Grade 12 have to offer either Mathematics or Mathematical Literacy. In the past, Grade 12 learners could pass their subjects at three different levels (higher, standard or lower grade) and matriculation exemption was set as a minimum requirement for admission to university. The new curriculum offers 29 subjects at only one level and Grade 10, 11 and 12 learners must take four compulsory subjects, namely two South African languages, Mathematics or Mathematical Literacy and Life Orientation (Nel & Kistner 2009: 954). Furthermore, they must also take an additional three other subjects from the approved list of 29 subjects. To obtain a university exemption, a candidate must obtain at least 50-59% (a score of 4) in four school subjects from the designated list of recognized subjects for admission to university (DoE 2005).

The above changes provided some challenges to tertiary institutions in that the NSC introduced new syllabuses for Mathematics, introduced a new subject known as Mathematical Literacy and scrapped grade levels (i.e. higher and standard). It was also uncertain whether the standard for examination question papers would be of a higher or lower level than the previous years (Nel & Kistner 2009:955). Universities were therefore faced with introducing new entrance requirements to cater for the first cohort of students who would apply to university on the basis of their results in the NSC.

At the University of KwaZulu-Natal (UKZN), considerable thought was put into addressing what should be the new entrance requirements to the Faculty in view of the impending changes. Prior to the introduction of the NSC, the entrance requirements to the B Com Accounting degree and the B Com general degree were identical. Because of the higher failure rates in the B Com Accounting stream, the introduction of the NSC created an opportunity to distinguish between the two streams. The B Com Accounting stream follows the curriculum for students intending to qualify with a Certificate in Theory of Accounting (CTA) pass at the end of four years of

study. The CTA pass is the entrance requirement to write the Part 1 board examination of the South African Institute of Chartered Accountants (SAICA). The B Com general is a 'catch-all' description for all the other B Com curriculums.

While six NSC subjects count towards the score, of which four must be from the designated list, only Mathematics and English are compulsory. It must also be noted that not all the subjects appearing on the designated list are of equal difficulty. While Life Orientation (LO) is also required, its score does not form part of the overall score.

## Problem Statement and Research Question

The NSC was a new examination. The Faculty required feedback as to whether it had set its entrance requirements at the correct level to ensure that learners admitted into the Faculty had a reasonable chance of success, and particularly, whether the Mathematics requirement had been was set at the correct level. The purpose of the study is thus to determine the impact of the NSC, by focusing on the Mathematics and English marks, on the first year performance of commerce students at a tertiary institution.

The research question was formulated as follows: What is the impact of Mathematics and English in the NSC on students' performance in the first semester of their studies?

This research adds further insight into the importance of mathematics and English as a predictor of students' success at university.

The following section of this article discusses the relevant research in this area. The research methodology and the results of the research follow after that. The article then discusses the conclusions, limitations of the study and areas for further research.

## Literature Review

The literature review focuses on studies on students' performance in the field of accounting and management studies.

Internationally, the study by Wong and Chia (1996) investigated whether English and mathematics has a positive impact on a student's

performance in a first year accounting course. Their results revealed that a higher proficiency in mathematics was associated with a higher level of performance for students who were also competent in English. However, mathematics competency, if accompanied by poor language skills, negatively affected students' performance in accounting (1996:184).

A study by Drennan and Rohde (2002), who investigated the performance of students in advanced management accounting, found that while English as the first or subsequent language has no differential impact on performance at introductory levels, at advanced levels and in other subjects which required the application of concepts to new situations, students whose first language was English outperformed the students whose first language was not English.

Duff (2004) explored in Scotland the relationship between first-year undergraduate accounting and business economics' students approaches to learning, their age, gender, prior academic achievement and their subsequent academic performance and progression. His analysis identified prior academic performance (i.e. performance in school examinations) as the strongest predictor of first-year academic performance and progression.

Guney (2009) in Hull, United Kingdom, used endogenous factors (age, gender, country of origin, study effort, attendance, numeracy, work experience, academic experience, part-time work, learning disability, personal problems and future career) and exogenous factors (students' perceptions of teachers and teaching environment) to search for possible determinations of performance of non-accounting degree students in undergraduate compulsory accounting modules. Guney's results confirm those of Gist, Goedde and Ward (1996) that students with better numeracy backgrounds perform better in accounting. Interestingly, students with top GCSE grades performed better than those with top A-level grades. Other endogenous factors which show some correlation with performance were age, attendance, work experience, future career and degree course. The study also found that learning disability, part-time work and personal problems (which were combined into one score) may cause students to lose concentration and therefore under perform. With regards to exogenous factors, lecturers and assessment, and teaching material have a positive and significant effect on accounting performance.

Studies in South Africa have examined the impact of school accounting on performance in accounting in University (Rowlands 1988; Van Rensburg, Penn & Haiden 1998). These studies found little correlation between school accounting performance and university accounting performance. However, the latter study found that overall school performance in the matriculation examination a strong predictor of success in first level accounting modules. A comprehensive study by Millar (2006) who tracked the progress of two groups of students from 1st year (1999 and 2000) to 4th year found that at the first and second-year levels, there was a positive relationship between the final marks of the first year students and both the matric points and their matric mathematic results, with matric points a stronger predictor of success in the first and second year accounting module than the matric mathematic results. At third and fourth year, although there was only a modest positive relationship between performance in the two modules and the matric mathematics results, overall matric mathematics became a more important predictor of performance than matric points. Du Plessis, Müller and Prinsloo's 2005 study attempted to determine the profile of the successful first-year accounting student but their study did not take matriculation performance into account. A more recent study by Baard, Steenkamp, Frick and Kidd (2010) examined the factors influencing success in a first-year Accounting module at Stellenbosch University. This study found that the most important predictor of success was whether or not students had studied Accounting at school, the average Grade 12 mark, and attendance. Because the University accounting module covered the content of the school accounting, the strong relationship between school accounting and university accounting was expected. A study by the University of the Witwatersrand (Ballim 2010) indicates that the NSC examination results are a fair predictor of the likelihood of success of students in their first year of study.

The above studies indicate that a combination of mathematical and language proficiency together with overall ability indicated by the matric points are strong predictors of students' ability to perform at university.

## Background

The previous and current requirements for entry into mainstream and four-year undergraduate degrees in the Faculty (as in Faculty Handbook) are presented in Table 1 below:

**Table 1: Requirements for acceptance to degrees in the Faculty of Management Studies prior to and in 2009**

| Degree | Previous requirement | NSC requirement for 2009 |
|---|---|---|
| B Com | 36 points<br>Maths D (HG) or B (SG) | 31 points<br>Maths 4, English & LO 4 |
| B Com (Accounting) | 36 points<br>Maths D (HG) or B (SG) | 32 points<br>Maths 5, English & LO 4 |
| B BusSci (General) | 38 points<br>Maths B (HG) | 33 points<br>Maths 6, English & LO 4 |
| B BusSci (Actuarial Science) | 38 points<br>Maths A (HG) | 34 points<br>Maths 7, English & LO 4 |
| B Admin | 30 points<br>Maths E (HG) or D (SG) | 28 points<br>Maths 3, English & LO 4 |
| B Bus Admin | 30 points<br>Maths E (HG) or D (SG) | 28 points<br>Maths 3, English & LO 4 |
| B Com4 | 32-35 points<br>Maths E (HG) or D (SG) | 28 points<br>Maths 4, English & LO 4 |

Table 1 also shows the entrance requirements for other degrees within the Faculty. A survey of entry requirements for similar degrees at other universities indicates that the requirements of the Faculty of Management Studies are more or less in the middle when compared with

those of these institutions, some of whom indicate that they plan to raise their existing requirements (Spaull 2010). Students who do not meet the entrance requirements for the B Com degree enrol for the B Admin or B Bus Admin degree with the sole purpose of transferring to the B Com degree. This study thus includes all students registered for any of the five core modules for the B Com degree, regardless of whether or not a student was indeed registered for that degree.

The Faculty met its enrolment target as set out in the enrolment plan for 2009. There was thus no impact on our enrolments by the NSC in 2009 although a number of students applied to enter the Faculty with Mathematical Literacy and were not accepted.

## Research Methodology

All first time entrants into the Faculty formed the population regardless of the degree for which they were registered. The study extracted the NSC score for all students, including their Mathematics and English marks, using EXCEL. The study then used the statistical package, STATA, to match the NSC marks (overall points, Mathematics, English and English 2) of each individual student to the marks the student received in the five core subjects or modules taken in the first semester. (This detailed data is not shown in the paper.)

The correlation coefficients between five core degree subjects (Accounting - ACC101, Economics - ECON101, Information Systems and Technology - ISTN101, Management - MGNT101 and Mathematics - MATH134) and three relevant school subjects (Math, Eng1, Eng2) were then calculated using the actual mark that the student received for the university subject (64% for Econ101 for example) and the points (or level) they received for Maths or English (5 for Maths (60-69%) for example). In addition a cross-tabulation was performed to identify the marks obtained by students in each category of NSC Mathematics.

## Results And Discussion

The profile of the new intake of first year students in 2009 who were admitted with the NSC is provided in Table 2 below:

**Table 2: Profile of 2009 first year entry mainstream cohort**

| Overall point score according to the NSC | Number of students | Gender | |
|---|---|---|---|
| | | Male | Female |
| 45 and above | 31 | 13 | 18 |
| 43 - 44 | 44 | - | 31 |
| 41 - 42 | 76 | 22 | 54 |
| 39 - 40 | 110 | 42 | 68 |
| 37 - 38 | 142 | 60 | 82 |
| 35 - 36 | 170 | 68 | 102 |
| 33 – 34 | 185 | 85 | 100 |
| Less than 33 | 382 | 180 | 202 |
| **Total** | **1 140** | **483** | **657** |

Table 2 shows that approximately half of the students (567 or 49,7%) have 34 points on entry into the faculty and more than half of the students are female (657 or 57.6%). As gender was not investigated in this study, no further analysis of the results is made in respect of gender. A summary of the pass rates in each module and the corresponding number of students are shown in Table 3.

**Table 3: Performance of students in the five core modules**

| | ACC 101 | ECON 101 | ISTN 101 | MNGT 101 | MATHS 134 |
|---|---|---|---|---|---|
| 39% and below | 91 | 272 | 64 | 3 | 137 |
| 40 – 49% | 74 | 258 | 168 | 20 | 141 |
| 50 – 59% | 430 | 359 | 553 | 263 | 266 |
| 60 – 69% | 227 | 181 | 183 | 334 | 170 |
| 70 – 79% | 86 | 101 | 59 | 125 | 95 |
| 80 – 89% | 8 | 34 | 5 | 10 | 59 |
| 90 – 100% | - | 7 | - | - | 39 |
| **Total number of students** | **916**[1] | **1 212** | **1 032**[2] | **755**[3] | **907**[4] |

Notes:
[1] Only the B Com degree requires ACC 101
[2] Students can choose between ISTN 100 and 101
[3] MNGT 101 is not offered on the Pietermaritzburg campus, thus the number of students represents Westville only.
[4] This discrepancy could be due to the fact that some students achieved points (for English or Mathematics) below 4, i.e. they achieved 1, 2, or 3. These students are not shown in the tables. It should also be noted however that the total number of these students makes up only a small proportion of the total (ranging from 1- 8%). If these were to be included, it would make the tables unnecessarily detailed or extensively footnoted.

The results in Table 3 suggest that some students are not coping, especially with modules involving quantitative analysis. For ECON 101, 530 students failed (i.e. 43,7%). For MATHS 134, 278 students failed (i.e. 30,7%). This sentiment was expressed at the Faculty Examination Board meeting after the first semester examinations where lecturers pointed out that students were not coping with the problem solving aspect within some modules and the introduction of a numeracy test for potential students was suggested. In addition even where students performed well, their writing skills were extremely poor.

Table 4 shows the correlation coefficients between five core degree subjects (ACC101, ECON101, ISTN101, MGNT101 and MATH134) and three relevant school subjects (Mathematics (Math), English first language (Eng1) and English second language (Eng2).

**Table 4: Correlation[1] between performance on four 1st year modules and NSC point scores for related school subjects**

| | | |
|---|---|---|
| Correlation between Math and: | ACC101 | 0.5560 |
| | ECON101 | 0.5569 |
| | ISTN101 | 0.5125 |
| | MGNT101 | 0.4160 |
| | MATH134 | 0.6479 |

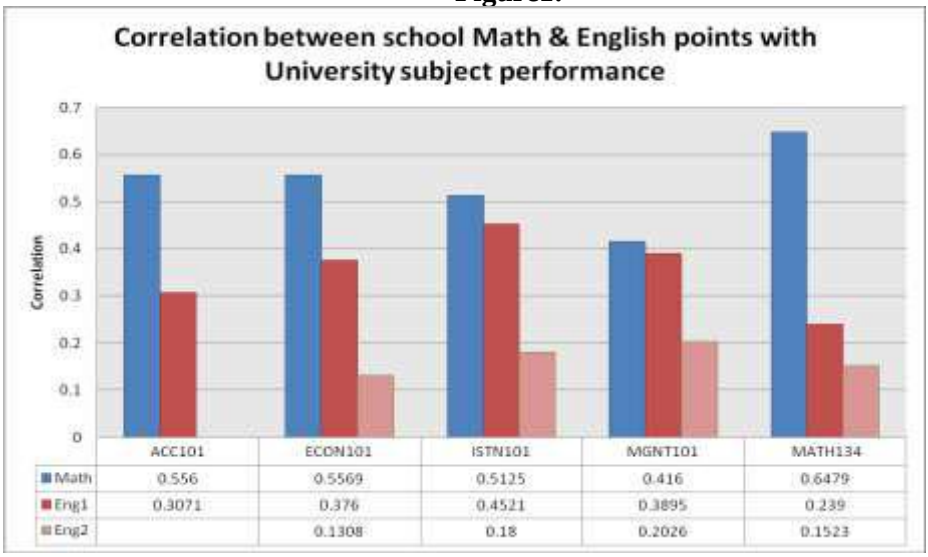
| | | |
|---|---|---|
| | | |
| Correlation between Eng1 and: | ACC101 | 0.3071 |
| | ECON101 | 0.3760 |
| | ISTN101 | 0.4521 |
| | MGNT101 | 0.3895 |
| | MATH134 | 0.2390 |
| Correlation between Eng2 and: | | |
| | ACC101 | Not statistically significant |
| | ECON101 | 0.1308 [3] |
| | ISTN101 | 0.1800 [2] |
| | MGNT101 | 0.2026 [2] |
| | MATH134 | 0.1523 [3] |
| Correlation between NSC points and: | | |
| | ACC101 | 0.5811 |
| | ECON101 | 0.6250 |
| | ISTN101 | 0.6013 |
| | MGNT101 | 0.5591 |
| | MATH134 | 0.5543 |

[1] Technically this is Spearman's rho that is calculated since one variable (NSC points) was ordinal while the other (first year module performance) was interval. However, this measure of correlation can be interpreted in the same way as a normal correlation coefficient.
[2] 5% significance
[3] 10% significance

Figure 1 shows that performance in each University subject is most strongly correlated with school mathematics performance. All of the correlation coefficients are positive indicating that if students performed well in school subjects they were more likely to perform well in University subjects, which is to be expected. Similarly, school Mathematics and MATH134 have the strongest correlation (0.6479). Again, this is to be

expected. It is interesting to note the relatively weak positive correlation between the University subjects and Eng2. Thus, although there is a positive relationship between Eng2 performance and University performance, this relationship is weak, especially in comparison to the relationship between Eng1 and University performance and Math and University performance (see figure 1).

**Figure1:**




In order to further probe the implications of the NSC Mathematics mark, a cross-tabulation of the performance in each of the five core modules by each NSC Mathematics level is shown in Table 5.

**Table 5: Cross-tabulation: NSC Mathematics by performance in the core modules**

| NSC Maths | ECON 101 | ACCT 101 | ISTN 101 | MNGT 101 | MATHS 134 |
|---|---|---|---|---|---|
| 1 | 30 | . | 63.5 | . | . |
| 2 | 36.83333 | 50 | 59.2 | 63 | . |
| 3 | 41.2973 | 48.54545 | 54.04545 | 59.85714 | 29 |

| | | | | | |
|---|---|---|---|---|---|
| 4 | 45.64255 | 56.29268 | 54.33155 | 60.74757 | 43.37681 |
| 5 | 51.17466 | 56.50112 | 58.33745 | 60.80365 | 58.57216 |
| 6 | 56.44521 | 63.74829 | 59.11994 | 63.24199 | 64.155534 |
| 7 | 63.29833 | 65.99 | 61.04151 | 66.33913 | 69.34231 |
| 8 | 71.16204 | 68.97945 | 65.04571 | 71.13333 | 81.47143 |
| Total | 56.39277 | 62.39459 | 59.45454 | 63.56663 | 64.08729 |

Table 5 shows that students with an NSC Mathematics level 4 on average failed both ECON 101 and MATHS 134. Thus entry requirements should be pitched at Mathematics level 5 rather than Mathematics level 4.

Table 6 shows the mean matric points for each Math NSC category. Those students who do better in Mathematics do better in other subjects. This has some implications for admissions. The average student with 4 points for Mathematics has 30.77 matric points, but the average student with 5 points for Mathematics has 32.3 matric points (one of those points is the additional Mathematics point, but the other 0.53 points are just because s/he is a stronger candidate (i.e. s/he got 0.53 points higher on average for the other subjects which comprised the matric score than the student with four points for NSC Mathematics).

**Table 6: Mean matric points for each Math NSC category**

| **Maths NSC** | **Matric points** |
|---|---|
| 1 | 25.8 |
| 2 | 27.86813 |
| 3 | 28.7713 |
| 4 | 30.77284 |
| 5 | 32.32245 |
| 6 | 34.40893 |
| 7 | 37.88707 |
| 8 | 41.94163 |
| **Total** | **34.21431** |

These results must also be contrasted against research that has established that there are large differences between the previous Mathematics Higher Grade and NSC Mathematics (Simkins 2010:3). Simkins comments that while the general policy 'was to make an old standard grade pass at the 33% level equivalent to 30% in the corresponding National Senior Certificate subject and to make an old higher grade pass at the 40% level equivalent to 50% in the new NSC subject', what actually occurred was quite different. Correspondences established between marks in Mathematics Higher Grade 2007 and Mathematics in 2008 'place a 40% pass in mathematics higher grade in 2007 as equivalent to 54% in mathematics in 2008' (2010:18). This would further support that the admissions requirements into a B Com degree should be raised to the next bracket (i.e. at least at a level 5) for Mathematics.

## Conclusion, Limitations And Further Research

The study was undertaken with the objective of confirming whether the entrance requirements in respect of Mathematics had been correctly set in view of the unknown quality of the NSC and the changes in the NSC as compared to the former matriculation examination. The study has shown that a student needs to enter the university in a commerce faculty with at least a pass at the Mathematics level 5 to succeed in the five core first semester modules (see table 5). This suggests that the entrance requirement needs to be increased to Mathematics level 5 for all Commerce students. If the Mathematics level remains at level 4, then the University will need to provide support for those students who do not enter with Mathematics level 5. This is further confirmed by Simkins (2010).

A limitation of this study is that it only considers one cohort of students in the area of commercial studies. Further research could examine new cohorts of students and also consider gender and race in the analysis.

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