

National Curriculum Statement achievement levels – Can they serve as a measure of science students' preparedness for university study?

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Abstract. The preparedness of matriculants for university studies has been a subject of intense debate and interrogation at various levels of public discourse. In addition, the standardization of assessment outcomes by the Quality Assurance Council in General and Further Education and Training (Umalusi) has of late become a highly contentious issue. It is in recognition of these considerations that we undertook to investigate the extent to which Grade 12 achievement levels in Mathematics, Physical Science and English can serve as a measure of science students' preparedness for university study. Analysis of data collected strongly suggests the existence of the disparity between the National Curriculum Statement achievement levels and the subsequent academic performance of the first-year Electrical Engineering (National Diploma Programme) students at the University of Johannesburg. Some of the underlying critical factors that may have a significant bearing on the aforementioned scenario were also investigated.

Keywords: *Umalusi, National Curriculum Statement, National Qualifications Framework, South African Qualifications Authority, public discourse, assessment outcomes, Education and Training Quality Assurers, throughput rate*

1. Background and contextualization

The implementation of the National Curriculum Statement (NCS) was largely characterised by a complex mix of fanfare and uncertainty. Developments in this regard posed critical challenges for teachers and various stakeholders with varied interest in education. Assessment is an inherent core component of the basic structure of the National Curriculum Statement and the achievement levels are increasingly used as a measure of learner performance and competence. The NCS achievement levels appear to present an unprecedented dilemma for tertiary institutions in South Africa when it comes to admission criteria and the subsequent academic performance of the students. This serves as a unit of analysis which prompted this research endeavour. The critical elements that constitute the disparity between the NCS achievement levels and the subsequent academic performance of the students form the nexus of the analysis in this respect.

At another level, tertiary institutions in South Africa and elsewhere are under severe pressure to produce skilled personnel through appropriate and relevant academic programmes. The relevance of academic programmes has been a highly contested issue over the years as it was felt that some of these programmes are out of sync with the needs of the labour market. To this end, there was a strong push for institutions to undertake far-reaching and strategic programme realignment in order to yield the critical human capital needed by the economy. Consistent with this trend, the throughput rate has largely been used as an essential monitoring tool to signify academic success. Yet, the manner in which it is determined makes for an interesting reading especially if one reflects on the ambiguity in relation to the determination of the throughput rate and the extent to which the National Curriculum Statement achievement levels complicate the situation.

2. Umalusi

Umalusi is a quality assurance council in the general and further education and training bands of the national qualifications framework (NQF) whose broad mandate is to ensure that the provision of education and training is carried out in accordance with expected standards of quality [1]. The council is guided by the General and Further Education Act of 2001 [2]. In terms of the clarification of roles, it is important to point out that the South African Qualifications Authority (SAQA) is entrusted with the responsibility to oversee the development of the NQF and establishment of Education and Training Quality Assurers (ETQAs). More specifically, Umalusi is tasked with ensuring quality in respect of levels of literacy and numeracy, meeting educational targets, raising standards in provision, linking and accessing higher education, preparation for the labour market, and social and economic development.

3. Standardization of assessment outcomes

Umalusi as the Quality Assurance Council in General and Further Education and Training defines standardization as a process used to mitigate the effect of factors other than the learners' knowledge and aptitude on the learners' performance. However, the standardization process has been given a somewhat political interpretation by a considerable number of education commentators in South Africa as recent developments attested. In fact, education commentators in South Africa and indeed members of civil society appear to be extremely pessimistic about the purpose of the standardization process. The report released by Umalusi revealed that marks in some matric papers written during 2010 were adjusted upwards and others downwards. Ironically, upward adjustment affected key subjects such as Mathematics, Physical Science and English. Consistent with this trend, research conducted using the Stellenbosch University Access Test [3] revealed that grade inflation occurred particularly in the results of the lower performance group. Why should the standardization of assessment outcomes be a political terrain despite the reasons advanced by Umalusi for embarking on this exercise? Is it really an exercise in futility or an established law? This matter should be genuinely and honestly debated without compromising both the integrity and the quality of the assessment outcomes. In addition, South Africa cannot afford to replace the wheel while the car is moving.

4. National Curriculum Statement achievement levels

While the South African curriculum may be regarded to be on par with curricula elsewhere, it is the quality and integrity of the achievement levels that have always been a cause for great concern. Do these achievement levels really serve any purpose if indeed they are inflated? This question lies at the core of this research. It is a known fact that the National Curriculum Statement is characterised by a seven-point rating scale used to rate assessment for Grades 7-12 [4].

Achievement levels falling within 30%-39% band are always questionable in terms of required competence for undertaking tertiary studies. This appears to be a critical band in view of the findings of the research conducted [3] as pointed out elsewhere in this article. Are the achievement levels falling within this percentage band taken into account for purposes of unnecessarily inflating the overall matriculation pass rate so that it looks politically correct and acceptable? This key aspect should be fully and consciously debated as part of a progressive intellectual discourse in order to engender innovative solutions that will benefit the South African education system. However, the appropriateness of the context within which this debate should occur cannot be over-exaggerated.

5. Research design

Data collection involved the administration of a questionnaire to a group of first-year Electrical Engineering (National Diploma Programme) students ($n = 176$) at the University of Johannesburg, South Africa. The design largely employed quantitative analysis techniques.

6. Focus on the analysis of data

Data collected was quantitatively analysed to provide valuable insights into the research question as stipulated. The first phase of the analysis focused on the NCS achievement levels in Mathematics, Physical Science and English in Grade 12. Figures 1 below depicts the students' NCS achievement levels in respect of Grade 12 Mathematics.

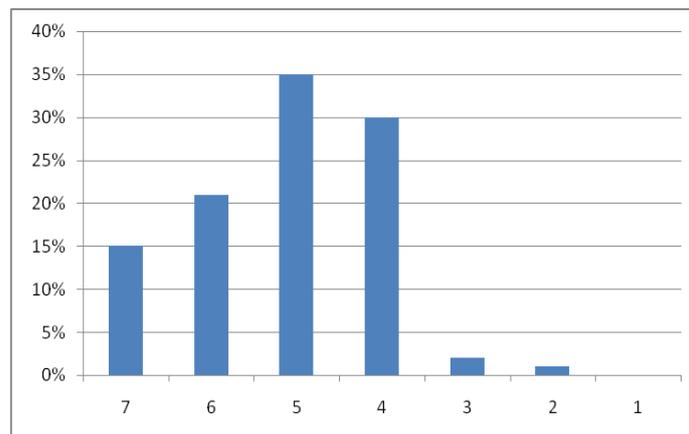


Figure 1: NCS achievement levels - Grade 12 Mathematics.

Of the 176 students in first-year Electrical Engineering (National Diploma Programme) a substantial number appear to have achieved level 4 (30%) and level 5 (35%) in Mathematics during the 2010 National Senior Certificate Examination. The number of students who achieved level 6 (21%) and level 7 (15%) is not pleasing. Schools have been urged to produce excellent results in Mathematics in order to pave the way for the learners to pursue higher education studies and subsequently professional careers in Mathematics, Science and Technology. But as the picture reflected in Figure 1 seems to suggest, a lot of work still needs to be done in this regard ranging from furthering the professional development of teachers and proper mentorship for learners through appropriate and meaningful interventions.

Figure 2 below reflects the students' NCS achievement levels in Grade 12 Physical Science. The picture depicted in Figure 2 is not fundamentally different from the picture in Figure 1 in terms of the NCS achievement levels. The majority of the students appear to have achieved level 4 (38%) and level 5 (31%). This also points to the need for appropriate interventions to be put in place to generate the required excellence as an envisaged policy imperative.

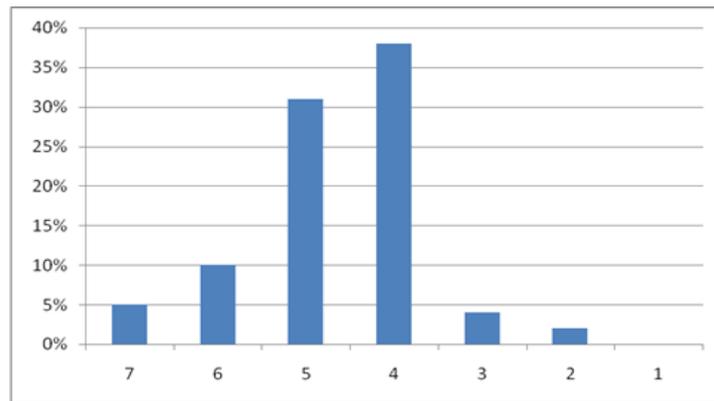


Figure 2: NCS achievement levels - Grade 12 Physical Science.

It is interesting to note that the picture presented in Figure 3 in relation to students' NCS achievement levels for English is not necessarily different from Mathematics and Physical Science. Can this be attributed to the fact that English is not the "mother tongue" for the group of students in this regard? If that is the case, will the performance of the students improve dramatically if they are taught Mathematics and Physical Science in their "mother tongue"? These are some of the critical questions that need to be broadly answered through similar research endeavours.

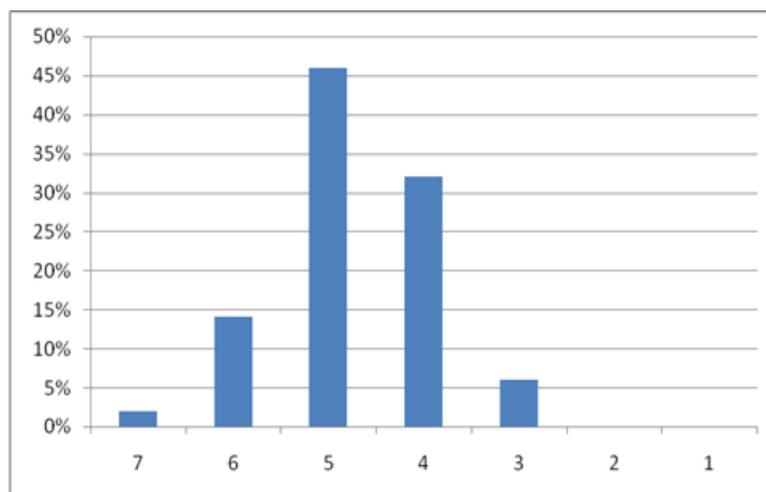


Figure 3: NCS achievement levels - Grade 12 English.

It is important to point out that the second phase of the analysis focused on the Physical Science syllabus coverage for Grade 11. Suffice to say that the syllabus coverage for Mathematics was not particularly investigated as the research undertaking was largely influenced by the authors' field of expertise. Mechanics appeared to have been fairly well covered in Grade 11. However, this fair coverage of Mechanics in Grade 11 does not seem to translate into fair performance in Grade 12. Does this mean that the learners are not well taught in Grade 11 and Grade 12? The analysis also provided a mixed bag in relation to the coverage for Sound, Waves and Light as one of the key knowledge areas. The picture obtained seems to suggest that some themes are covered at the expense of others. For instance, Longitudinal waves and Sound appear to have been covered the most as opposed to Geometrical optics and the Physics of music. The picture obtained in relation to the coverage of Matter and Materials as one of the key knowledge areas was quite disturbing. This may be attributed to the teachers' lack of competence and expertise in teaching this knowledge area. This also seems to suggest the lack of prior training on the part of teachers in new NCS

syllabus content when it comes to the provision of meaningful lessons based on this key knowledge area.

The third phase of the analysis focused on the Physical Science syllabus coverage for Grade 12. The coverage of Mechanics in Grade 12 appeared to be fair although “frames of reference” seems to be a no-go zone for the teachers. While Doppler Effect appeared to be given prominence in terms of the coverage for Sound, Waves and Light in Grade 12, 2D and 3D Wavefronts and Wave nature of matter appeared to be problematic in this regard. The coverage for Electricity and Magnetism in Grade 12 does not compare favourably with the coverage in Grade 11. The Photoelectric effect appeared to have been given adequate attention at the expense of other themes in terms of the coverage of Matter and Materials in Grade 12.

The fourth phase of the analysis focused on the first semester academic performance of the first-year Electrical Engineering (National Diploma Programme) students in Physics I at the University of Johannesburg during 2011. Figure 4 below reflects an unsatisfactory overall performance of the students in the three tests written during the first semester of 2011. The first test was based on the topics: Atomic structure, Wave nature of matter and Photoelectric effect. This is consistent with the picture depicted in Figure 11 which clearly suggests that Matter and Materials as the one of the core knowledge areas was not sufficiently covered. Test 2 was based on Vectors. While the students indicated that the section on Vectors was extensively covered at school level, this does not seem to translate into acceptable performance on this topic at tertiary level. Test 3 was a major test based on all the topics covered in Test 1 and Test 2 and Nuclear Physics as an additional topic. Despite extra exposure to the topics in Test 3, the performance of the students remained fairly stable. This may suggest that teachers rush through the NCS school syllabus and that learners are solely being taught for purposes of passing the examination without meaningful mastery and fundamental understanding of key concepts.

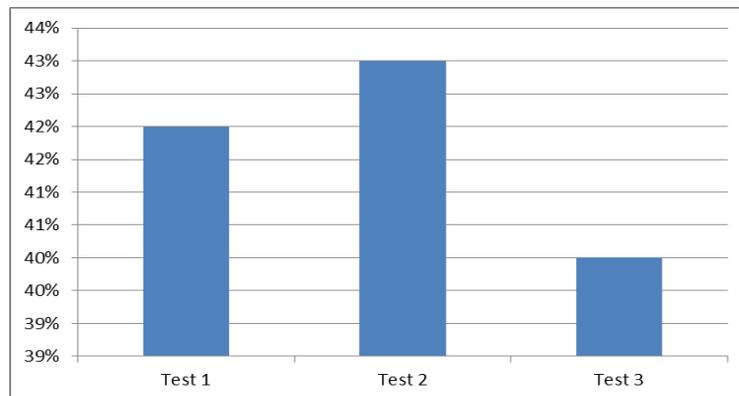


Figure 4: Average pass rates of the three tests written during the first semester of 2011.

The performance analysis for Test 1 in the respective percentage bands revealed that performance marks of a substantial number of students fell within the 0%-29% band. There was a marginal improvement in terms of the performance marks for Test 2 falling within the 30%-39% band in comparison with Test 1. This is still a worrying trend given the fact that this band essentially represents a low performance range. The performance analysis for Test 3 in terms of percentage bands was not drastically different from the analysis for Test 1 and Test 2.

7. Recommendations

Within the context of this research endeavour and the realm of global developments, various education stakeholders in South Africa are urged to make a profound strategic contribution towards the creation of a new social order that is in line with frontiers of human development. Concerted efforts in this regard must admittedly be targeted and directed towards the realisation of the quest for zero-defect in relation to the South African education system. In the light of the aforementioned considerations, we put forward the following suggestions pertaining to NCS assessment outcomes:

- NCS examination papers must assess the acquisition of core skills such as performance of complex procedures and problem-solving to a significant extent.
- NCS assessment opportunities must provide appropriate platforms for intellectual growth and adequate preparation for university studies.
- The quality of the assessment items must be responsive to the critical needs of learners in terms of cognitive demands and level of difficulty particularly in relation to Mathematics and Physical Science.
- NCS assessment opportunities must, by their very nature, serve to bridge the huge gap between school and university in order to facilitate a smooth migration between these educational levels.
- Epoch-making and tangible efforts are required to address the gross educational wastage emanating from a heavy reliance on throughput rates which do not necessarily provide a true reflection of academic success at university.

8. Conclusion

Analysis of data collected in this regard strongly suggests the disparity between the NCS achievement levels and the academic performance of the students in the subsequent higher education sector.

Acknowledgement

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