

Accessibility of Maths Education in South Africa

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Introduction

Good afternoon fellow educators, ladies and gentlemen, I'm Aslam Mukadam and in my capacity as co-ordinator for the Concerned Maths Educators' forum I would like to thank Equilibrium International for inviting me to speak on the "Accessibility of Maths Education in South Africa".

We are a network of concerned and dedicated Maths educators teaching in schools and institutions throughout South Africa. Our stance as educators is one of proactive and progressive participation. We are all dedicated and committed to improving Maths education in our country.

Objectives

To improve the standard of Maths education and make Maths more accessible to ALL South African learners.

We have established a network where we as professionals, can debate issues that affect us and the learners we teach; exchange ideas and resources; and become an effective pressure group for change.

How accessible is Maths education?

Although Maths or Maths Literacy has been made compulsory the current assessment structure of the new Maths curriculum has made maths inaccessible to the majority of learners.

Precisely *what* are we referring to when we speak of ACCESSIBILITY?

The key question is, are we preparing our learners sufficiently so that they can access Maths at the required level of proficiency when they enter universities?

And, are we doing enough to attract the below- average learner to do Maths instead of losing them to Maths Literacy ? Remember, learners having passed Maths Literacy won't have access to Maths related courses at tertiary level.

There are many challenges in Maths education but one of the major challenges of the new curriculum is the structure of the assessment system.

The assessment structure presently caters well for the middle-ground learner, but does not adequately accommodate the top learner and the below-average learner.

Although the top learners scored the highest number of 'A' symbols ever achieved in Maths, this does not reflect accurately on the mathematical abilities of these learners; they are not necessarily equipped to cope at tertiary level in Maths related courses.

On the other end of the spectrum more than 50% of all learners who wrote Maths in 2008, failed the exams. Therefore many learners are going for the easier option and doing Maths Literacy instead. This defeats the intended outcome of producing more potential in South African learners to follow careers in Maths based disciplines.

Looking at the 2008 Maths results, we need to take cognizance of the state of euphoria among learners and education officials; a euphoria which needed a reality check in order to give a true reflection of the situation regarding the Maths results.

Stipulations of 2008 Subject Assessment Guidelines

According to the 2008 Subject Assessment Guidelines the weightings for Paper 1 and Paper 2 in terms of the levels of cognitive demand, should be approximately 55/45 i.e. approximately 55% of questions requiring basic knowledge and simple routine procedures and 45% requiring complex procedures and non-routine procedures including problem solving. In this scenario the higher level learner starts off with a great advantage because effectively 55% of the paper can be done without much cognitive application and challenge. On the other hand the below average learner only has access to about 55% of the paper and therefore already starts the paper off with a handicap, as about 45% of the examination is outside this learner's cognitive range.

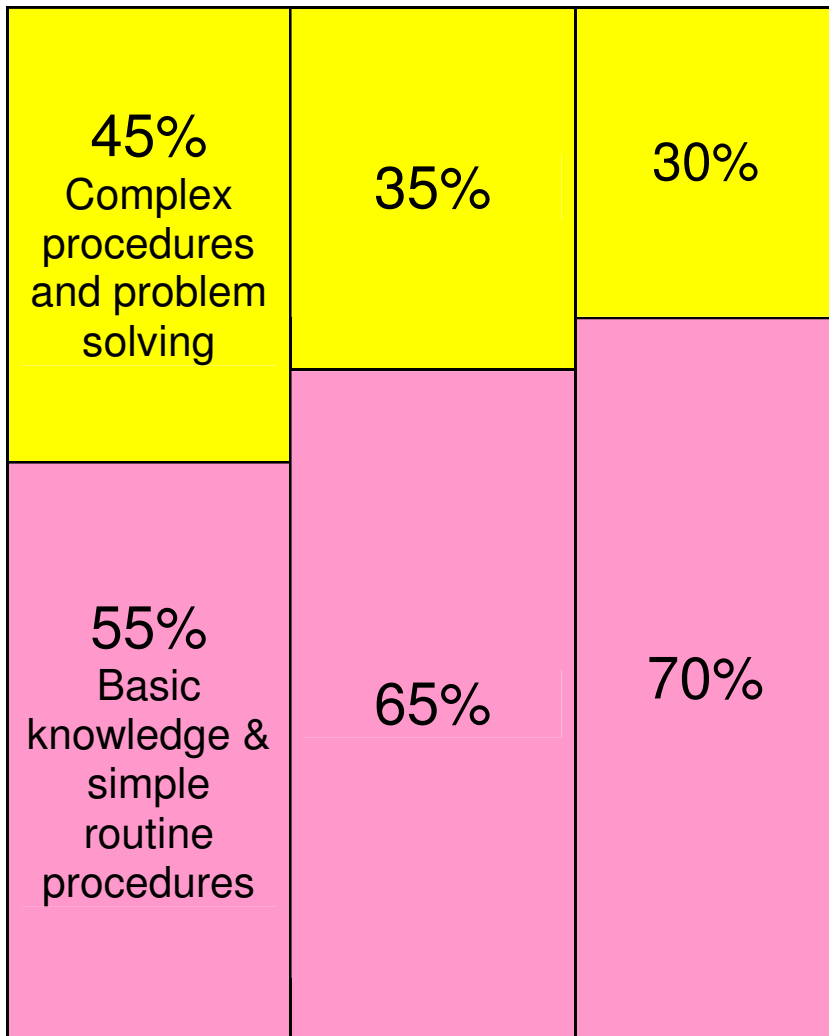
In the 2008 final examination the actual weighting for Papers 1 and 2 combined was closer to 65/35 instead of the stipulated 55/45 i.e. the standard was approximately 10% lower than that stipulated in the Subject Assessment Guidelines. In Paper 2, the actual weighting was closer to 70/30 i.e. the standard was approximately 15% lower than the stipulated weighting.

Hence our press statement at the beginning of the year that the 2008 Maths papers were indeed watered-down and we further said that if this standard were to be used as the benchmark for future exams, it will not adequately prepare young learners to study maths related courses such as engineering, architecture, and business science at tertiary level.

Analysis of 2008 Maths papers in terms of cognitive demand compared to the stipulated weightings in the 2008 Subject Assessment Guidelines.

2008 SUBJECT ASSESSMENT GUIDELINES	2008 P1 & P2 Combined	2008 P2 only
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STIPULATED WEIGHTINGS	APPROXIMATE WEIGHTINGS	APPROXIMATE WEIGHTINGS
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The Department of Education in its media release dated 09 February 2009 posted on their website stated that “ A panel of maths experts has found that the maths papers in the 2008 national senior certificate exam *were up to standard*. However, they found that there was a lack of differentiation at the level of A and B in the exam.”

We absolutely disagree with the panel of Maths experts and wish to make it very clear that the 2008 Maths papers were indeed not up to standard and due to this we had the highest number of Maths distinctions ever. Most Maths educators agree that there should have been more higher order questions and the papers did lack challenge at the top of the range.

Despite the lowering of standards, Maths was the only subject which more than half of those writing failed. Remember, the pass mark was only 30% !

So there clearly is a problem !

Dr Mamphela Ramphela, former Managing Director of the World Bank and Vice-Chancellor of UCT in her article ‘Another generation betrayed’ cited in ‘The Sunday Times’ of 18 January 2009 says: “The jump in the proportion of pupils who wrote and passed mathematics, which is a source of pride for education officials, requires closer scrutiny.”

So let us now scrutinize the statistics and see what it says about the standard of last year’s Maths papers.

WESTERFORD 2008 RESULTS		
SUBJECT	% A's	Class Ave
MATHEMATICS	66%	83,9%
PHYSICAL SCIENCE	33%	73,6%
LIFE SCIENCES	45%	74,5%

BISHOPS 2008 RESULTS		
SUBJECT	% A's	Class Ave
MATHEMATICS	60.5%	80.5%
PHYSICAL SCIENCE	30.7%	72,8%
LIFE SCIENCES		

SOUTH PENINSULA 2008		
SUBJECT	% A's	Class Ave
MATHEMATICS	26%	64,7%
PHYSICAL SCIENCE	7%	47,7%
LIFE SCIENCES	14%	64,9%

ALL WESTERN CAPE SCHOOLS		
SUBJECT	% A's	
MATHEMATICS	12.0%	
PHYSICAL SCIENCE	4.0%	
LIFE SCIENCES	5,6%	

Clearly the Maths results are totally out of sync !

What then is the solution to this problem?

The CME Model

It is imperative that we address the Maths issue more holistically by taking cognizance of the fact that not all learners have the same capabilities, and more importantly, creating an assessment system which considers the diversity of our learner populace. It is clear that this “one-size-fits all” assessment system does not deliver the desired outcome.

So, the question is.....

How do we test the basic understanding of mathematical principles without the rigorous conceptual demands for the average learner? And at the same time how do we ensure that we do not disadvantage those learners who wish to further their studies at tertiary level in Maths related courses?

To solve this problem, we propose the following:

1. Papers 1 and 2 to only test basic knowledge & routine procedures and a small percentage of complex procedures.
2. Paper 3 becomes compulsory for students wishing to attend university.
3. Paper 3 should contain the higher level questions from topics covered in both Papers 1 and 2.
4. In reporting we propose to continue to reflect the results from Papers 1 and 2 separately from that of Paper 3.

Let me elaborate on the above four proposals:

1. Papers 1 and 2 to only test basic knowledge & routine procedures and a small percentage of complex procedures.

This will test basic understanding of mathematical principles for the average learner who will no longer be disadvantaged for not being able to answer the higher level questions currently in Paper 1 and 2. The standard set in these papers will still enable them to register and cope at Universities of Technology to further their studies in careers requiring basic mathematical knowledge.

2. Paper 3 becomes compulsory for students wishing to attend university.

Learners with higher mathematical ability would also write Papers 1 and 2 however, their real assessment will be in the optional Paper 3 which we propose should be compulsory for entrance to university. This Paper 3 will test conceptual ability through application of cognitive skills to higher level questions in topics covered in both Papers 1 and 2. For these learners, standards need to be raised and kept optimally high to facilitate excellence in Maths based modules. To this end we need to rapidly close the gap between Maths at Grader 12 level and the level of Maths which our students suddenly encounter at tertiary level – this in itself would go a long way to increasing the output of maths and science graduates from our universities.

3. Paper 3 should contain the higher level questions from topics covered in both Papers 1 and 2.

Presently Paper 3 covers geometry, probability & statistics. In order to include topics from Papers 1 and 2 the mark allocation should be increased from 100 marks to 150 marks and the duration of the paper from 2hrs to 3hrs.

This assessment structure will also motivate the average and above-average learner to migrate to Paper 3 without the fear of diluting the results in Papers 1 and 2 if they do not perform well in Paper 3.

4. In reporting we propose to continue to show the results from Papers 1 and 2 separately from that of Paper 3.

This will naturally cater for the need to distinguish between those learners wishing to enter university and those wishing to enter universities of technology.

Shortage of qualified and trained Maths educators

The 2008 final exam results clearly illustrate that the more affluent schools performed much better than those in lower income areas. It has also been reported that many Maths educators are not up to par with the new syllabus; so how can our learners gain access to the new Maths when our educators are not adequately equipped to provide that access.

How many generations of learners are we still going to allow to suffer before we bring about any meaningful change. Therefore, in order not to further disadvantage the poorer communities which are already adversely affected by the lack of qualified educators and adequate resources, modification of the assessment system, as a first step, will surely help to vastly improve the situation.

CME contribution

We agree with the minister of education that technology must play a very important role in bringing Maths education to the masses.

From our side, to help improve the standard of Maths education and make Maths more accessible the CME has set up a dedicated Maths website,

www.mathsexcellence.co.za

to help both the educator and the learner.

This website contains:

- **The Maths curriculum policy documents**
- **Exemplar papers and solutions**
- **Examination Papers and solutions**
- **Free online Maths & Science textbooks from Grade 1 to Grade 12**
- **And a blog for exchanging ideas**

Our long term goal for this website is to convert the textbooks that we already have into video format. Then educators as well as learners can easily access the sections of work they are having difficulty with or work that they need brushing up on. This is a major project and I am sure there are many big businesses out there who would be happy to provide the necessary funding.

This will obviously provide some relief to one of the major challenges we are currently facing and that is the shortage of qualified and trained Maths and Science educators. Schools without Maths and Science educators can then have access to Maths and Science lessons via their computer labs. Also, educators who have not taught Maths or Science before can use these video lessons to upskill themselves.

Conclusion

We, the CME, acknowledge the efforts of the DOE for the work which they have done up to this point, especially for making Maths or Maths Literacy compulsory. Also the new Maths curriculum as it presently stands is designed for the modern society, and with our proposed modification in the assessment system, it would indeed provide a solution for preparing our learners adequately for tertiary studies as well as attract more learners into the Maths stream instead of losing them to Maths Literacy.
