Improving mathematics performance at schools

The education system consists of two parts, namely the socioeconomic haves and the have-nots. VIJAY REDDY and DEAN JANSE van RENSBURG analyse the mathematical performance of the South African schooling population and come to the conclusion that differentiated targets need to be set for both these socioeconomic groups, since neither is performing at the requisite levels.

In a nutshell, the South African schooling system shows the following characteristics: the national mean mathematics scores are low and need to improve. There is a high differentiation of the educational performance of students from different socioeconomic conditions and we can say that we have two systems of education. This means that an estimated 30% of schools perform reasonably well, while 70% of schools are underperforming.

Another feature of our educational system is that the national average mathematics achievement score for different grade levels across the schooling system is similar and stable; around 30% to 40% at different grades.

This raises the question of whether improved schooling makes any difference in performance.

In discussing mathematics performance, I am not dismissing the other areas of a school curriculum, but mathematics is a proxy for analytical thinking.

As we evaluate the high skill capacity in the country and active participation in the knowledge economy, mathematical skills are very important.

The Trends in International Mathematics and Science Study (TIMSS) is an international assessment of the mathematics and science knowledge of fourth and eighth grade students around the world. South Africa participated in TIMSS in 1995, 1999 and 2003. South Africa is participating in the 2011 study.

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Let us focus on mathematics performance in both the 'performing' and 'underperforming' parts of the educational system.

Underperforming schools

For the underperforming schools, mathematics performance continues to be low. Even with many interventions we seem unable to effect changes, using the indicator of matriculation mathematics performance.

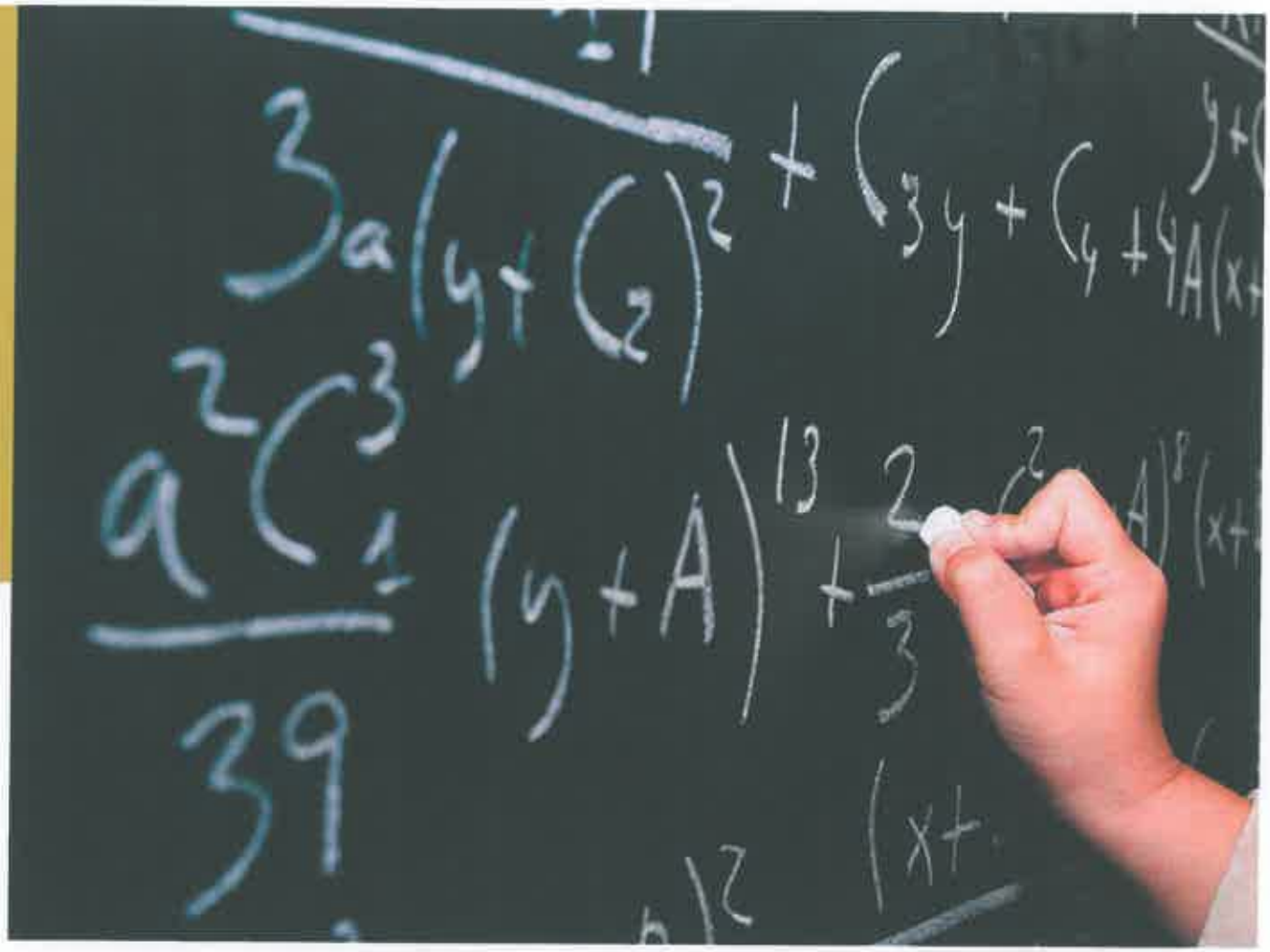
Findings from a paper[1] where we used a panel-like data-set to examine the extent of association between grade 8 mathematics performance and grade 12 performance shows a strong correlation between grade 8 mathematics performance and matric mathematics achievement. The strong relationship between grade 8 and grade 12 mathematics scores corroborates the findings from the literature that earlier performance and strong foundational knowledge form the base for subsequent learning.

Analytic skills in mathematics need to be built up from early years. Mathematical knowledge is hierarchical in nature and therefore strong prior knowledge is critical for conceptual development. The acquisition of these capabilities is shaped in the early years by the nature and quality of interactions in the home and community and the quality of input from school.

The policy implication from this finding is that raising the mathematics scores at grade 12 level requires raising grade 8 mathematics scores. Extrapolating from this – and linking to the literature on cognitive development – we need to raise the mathematics scores from the foundation phase of schooling.

High levels of attention paid to the early years of learning (reception year and foundation phase) for children from environments of lower household and parental resources would contribute to breaking the cycle of poor academic performance. If we do not do this, both their backgrounds and schooling will let the children down and the reproduction of inequality will continue.

Students must know and understand earlier concepts and only when they do can they progress. Our findings show that it is too late to try to improve matric mathematics performance by the time students reach the secondary level. But this learning does involve a school and a teacher – a teacher that especially understands how learning occurs. Thus, one of the priorities is that foundation phase teachers must have appropriate qualifications and expertise to teach these classes.



This means government targets should not only be the assessment scores, but should also include the number of new foundation phase teachers. Interventions made at the secondary level do not raise exit level mathematical performances. It might raise general performance, which is fine, but we need to recognise what interventions at the secondary level will provide and what they will not. Therefore, as we talk about 'second chance' programmes, we need to recognise what the outcome will be, and it may not be raised mathematics scores at grade 12 level.

Performing schools

There are also challenges for students from what are described as well-performing schools. Scores on international tests show that we are not globally competitive.

The Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) results show that students from South African top-performing schools are outperformed by other African countries – with lower GDPs.

In the 2002 TIMSS study, involving 50 countries, schools categorised as well resourced and better performing (i.e. from the House of Assembly and House of Delegates) schools performed at the international mean level.

The way forward

The country's mathematic performance must be located within the global trends. TIMSS surveyed a number of countries for grade 12 physics performance. It had undertaken these studies about 10 years ago. The results showed that globally (with the exception of Russia), performance levels in physics had decreased.

Internationally, there is a concern that students entering tertiary institutions are coming in with less maths and science knowledge.

Given the knowledge growth and the vastly technological and information-oriented world we live in and the strides that need to take place for the economy to grow and meet the social and environmental challenges, it would seem that we are not nurturing or growing the mathematics knowledge at the top end.

The hypothesis for the drop in science and maths competencies and capabilities is that we have focused on the Education for All agenda – and it was necessary to do so – and have neglected the agenda of maths for excellence and access to science, engineering and technology qualifications.

Given South Africa's agenda for economic competitiveness, this is an investment we need to make. The mistake we made is to assume that it would happen on its own. But results have shown that it does not and for this reason we should include achievement targets for better-resourced schools as well.

In conclusion, we need to set differentiated targets for the two parts of our educational system. Neither part is performing at the requisite levels, and specific strategies need to be designed for each part of the system. ◂◂

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[1] Reddy V, Van der Berg S, Janse van Rensburg D and Taylor S (2011) Educational Quality in an Unequal Society: Student pathways and performance in South African schools. Submitted to *South African Journal of Science*.

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