Article refuting South African Institute of Race Relations claim that mathematics outputs are declining in Grade 12

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The South African Institute of Race Relations (IRR), in its February 2016 *Fast Facts* publication, concludes that 'schools drag South Africa down' and that learner performance is declining substantially. The latter conclusion is based almost entirely on two numbers: the number of Grade 12 learners obtaining a score of 70% or more in mathematics in 2008, which was 25 027, and the corresponding figure for 2015, 17 452. The two figures point to a decline of around 30%. At first glance, this appears to be a national disaster.

However, analysis done by myself and others in the Department of Basic Education, to be published shortly, paints a completely different picture, of large and encouraging improvements in mathematics in Grade 12. Many of the challenges facing the schooling system are accurately described by the IRR's report, but I disagree completely that the numbers should be pointing to a deterioration.

The problem is firstly that the IRR looked selectively at the numbers, and ignored important figures, including a few appearing in their own report. This seems irresponsible. Secondly, analysing learner performance trends is exceedingly complex, not just in South Africa. The British education analyst John Jerrim has written extensively about how the data on mathematics trends have been spectacularly misinterpreted in his country. In South Africa, the complexities are particularly daunting in the case of Grade 12 mathematics.

So what did the IRR get wrong? They failed to point out that all of the 30% decline they refer to happened between 2008 and 2009. From 2009 to 2015, the trend, using values from all years (as one should), is a weakly positive 2% overall. The number of passes at the 70% level in 2008 was exceptionally high relative to all other years, something which should make any analyst suspicious.

The IRR also fails to point out that the overall increase in the number of physical science passes at the 70% level, over the entire 2008 to 2015 period, was a whopping 85%. In contrast to mathematics, what appears suspicious here is at least one exceptionally *low* value at the start of the period, in 2009. The question is why two such closely related subjects would move in completely opposing directions.

A further suspicious trend discussed in the analysis to be released by the DBE is that the percentage of white and Indian learners achieving high marks in mathematics has declined markedly over the 2008 to 2015 period. There appears to be no plausible explanation for this trend amongst these two relatively advantaged groups.

We zoomed into a sample of particularly stable and well-performing schools, with around 4 000 mathematics candidates each year, to find explanations to the apparent anomalies. What emerged clearly is that variations across years in the difficulty of obtaining certain marks, for instance 70% in mathematics, explain most of the anomalies. Mostly these variations are small, but for certain years they are large. Learners who obtained 69% in the years 2012 to 2015, when levels of difficulty appeared particularly stable, would have obtained 68% in 2011, a marginally more difficult year, and at least 72% in the years 2008 to 2010. 2008 was a particularly easy year for obtaining high marks. Changing the criteria for our sample did not

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change the picture substantially. Over the years, the mathematics examination became more difficult, whilst for physical science the opposite was true.

So is the problem then poor standardisation in the examinations system? Yes and no. There appears to be scope for improving the comparability of marks across years and this is receiving the attention of the DBE and Umalusi. At the same time, it is technically impossible to achieve anything approaching perfectly comparable marks, at all mark levels, in an examination system such as ours, or in similar systems in other countries. We need to learn to live with some variation over the years and rely on other systems, such as the international testing programmes, for more rigorous assessment of trends.

When we recalibrated results for all learners over the 2008 to 2015 period, using what we found to be equivalent scores, we found that the number of learners achieving a 70% level of performance in mathematics increased by 27% overall. For black African learners the increase was 61%. Physical science improvements, on the other hand, were found to be smaller than what published statistics would suggest, but were still encouraging. By far the largest improvements were in historically disadvantaged schools and top mathematics performers are spread across more schools in 2015 than they were in 2008.

We do not dispute that the under-performance of schools is a key factor holding the country's development back. This is made clear in the National Development Plan. However, where we do disagree strongly with the IRR is the direction the schooling system has been taking in recent years. If the movement has been in the right direction and improvements as large as one might realistically expect, then one could hardly hope for more. The evidence suggests the quality of school education is improving, that the improvements have been substantial and encouraging, and that they are helping to overcome historical race-based inequalities. But trends seen in a few other countries, such as Brazil, suggest we should be aiming for an even steeper improvement. This is what ongoing changes to our interventions, of which there are many, should aim to achieve. We also need a more rigorous national debate, involving a wider range of stakeholders, about the actual performance trends of schools.