

Solving the maths problem - a brain development approach

Since the World Economic Forum (WEF) released its Global Information Technology Report, which placed South Africa last out of 148 countries for the quality of its mathematics and science education, there's been much debate on the state of mathematics in the country's schools.



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Two South African mathematics and teaching experts agree that the situation is dire. There is nothing wrong with the mathematics curriculum and our learners are perfectly capable of being successful in mathematics. The quality of educators and educator training, and the manner in which our learners are taught mathematics, are the culprits, they say.

Learners lack understanding, instead they are learning formulas by heart

Aarnout Brombacher, Founder and Head of Brombacher and Associates, a consultancy in the field of mathematics education, says the focus of our school training is very much around computing or calculating.

"Of course our learners should know their basic addition and subtraction facts, learners should know their multiplication tables. However, the problem is *how* they learn these. Learners don't understand what they are learning, instead they are learning formulas by heart. The outcome is that for many of our learners, mathematics is over by the time they reach Grade 4 because they lack understanding, they lack the ability to decode what they have learned - much like graduates singing *Gaudeamus Igitur* by heart without knowing what the words mean," explains Brombacher.

"If you look at, for example, the Western Cape Education Department's systemic assessments they show that in Grade 3, 52% of the learners pass the examination. However, by Grade 6, only 26% of those learners pass the examination. By Grade 9 it's down to 14%."

The Grade 3s do not fare better because they are doing mathematics with understanding, reasoning and application, but because at that early stage they can still get away with idiosyncratic methods and memory, he says.

"As they progress through the years their ability to get away with memorised formulas and facts and procedures begins to diminish and they can't keep up any longer."

According to Brombacher, the challenge is to refocus our teaching efforts in those early years towards developing the learners' understanding, reasoning and application of the basic facts of mathematics.

Alta Greeff, Head of the Curro Centre for Education Excellence at Curro Holdings, parent company of affordable independent schools, says a shocking number of mathematics educators in primary schools are not comfortable with their own experience of mathematics.

"They feel inadequate and that they 'could not do' mathematics at school. This is no surprise, as many foundation phase mathematics educators themselves have a very poor history with the subject. They often revert to the same kind of teaching that they were subjected to; it's like a vicious circle in our country. Yet it is in the foundation phase that learners need the most attention and support to ensure that they develop a strong number concept," says Greeff.

Learners continue through their schooling career, learning mathematics as a set of recipes or algorithms, with very little concept development underpinning their thinking and reasoning.

This is often the reason one hears of learners having achieved seven distinctions in matric, including in mathematics, but not being admitted to, for instance, a medical degree, because they fare so badly in the national benchmark tests that are written as part of the process to get access to certain universities. In the national benchmark tests the same concepts that are being assessed in mathematics are now testing a learner's understanding of the concept.

A problem-driven approach

"Mathematics should be about developing problem-solving habits of mind, about understanding the world around you, which learners would do much better if they learned to reason and solve problems," says Greeff.

Brombacher agrees, saying a problem-driven approach is needed. "We need to create a situation with which learners can engage, a situation created in such a way that it provokes a particular kind of response. That response it provokes is the mathematics that we want to develop."

Both Brombacher and Greeff agree that parents play a fundamental role. Parents get frustrated with mathematics homework and then want to show their children how they themselves would solve the problem. That is not the solution, says Brombacher.

"Parents need to ask their children questions: What are we being asked? What do we know? How can we use that information? Have we done a problem like this before? How did we solve that problem? How is this problem different? How is this problem similar?

"To grow the economy we have to invest in our children, and one way to do this is by making mathematics a national priority. We can do amazing things in this country, we can host a world cup, we can deliver examination papers around the country for the senior certificate examinations to be held successfully, and we can run elections without a problem. I believe it is possible to solve our mathematics issue," says Brombacher.

Greeff believes the solution lies in a good, strategic approach between our academic institutions in the country. Their voice must be the one to which the government listens in solving this problem.

"Government's role is to make the mathematics crisis in our country a national priority for four or five years, retrain our educators, and teach them an approach that will foster reasoning.

"We need to give every learner in South Africa a fighting chance to reach their full potential, and the ability to survive in the 21st century," Greeff says.

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