Opportunity index

SIMPLE SUM How do we bring about a sea change in the teaching and experiencing of maths?

Add engagement to subtract failure

Finding X has to be taught differently if we are to change the outcome of our maths education. With a sense-making, problem-centred approach, parents, teachers and pupils can solve the equation together, writes **Christina Kennedy**

Once upon a time, mathematics was a subject that made schoolchildren quake with fear. They would have recurring nightmares about equations, calculus and even long division. But a new approach to teaching maths aims to take the trauma out of trigonometry and the agony out of algebra.

Independent mathematics consultant Aarnout Brombacher says South Africa has to move away from the old-fashioned view of maths as simply a "gateway subject" into a specific career such as engineering, medicine or accounting.

Instead, he argues, doing maths can teach learners important problem-solving skills and attitudes that will give them an advantage in all spheres of 21st-century life.

"We need to change what happens in the classroom and teach maths as a sense-making, problem-solving activity," he says.

Brombacher has been consulting to the Curro group of independent schools to help refine the maths curriculum, develop effective teaching and learning materials, and entrench a culture of teaching excellence.

This is aimed at making numbers interesting, relevant and challenging for children from the foundation phase up to matric.

This lies at the heart of what Alta Greeff, head of the Curro Centre for Educational Excellence, describes as the group's "problem-centred approach to the teaching of mathematics".

She says this radical rethinking was spurred by South Africa's "horrendous" maths statistics: only one out of every 162 learners (or 0.6%) who starts school achieves an A for maths in matric, and only 38 000 out of the 562 000 children (or 6.7%) who write matric will pass maths with more than 60%.

Even more alarmingly, a recent World Economic Forum report - based on business leaders' perceptions of the quality of maths and science education - placed South Africa a dismal 139th out of 143 countries surveyed.

"We certainly need to do things differently," says Greeff. "We will not improve our learners' mathematics ability by doing what we did in the past - no matter how hard we work or how well we monitor the process."

Many parents urge their children to doggedly stick with maths in the higher grades, purely to ensure they obtain a decent university pass. But Brombacher says "we need to think bigger than that".

He says when he was a child, the world's entire body of knowledge was supposedly contained in a single set of Encyclopaedia Britannica, whose publishers would add one new volume every year. With today's pace of technology and innovation, one extra volume of knowledge could be added an hour, if not a minute.

Besides, Brombacher adds, the individual attributes that are most prized in the global economy have shifted over the past century from physical strength to mental agility.

21st-CENTURY LEARNING
A PROJECT IN PARTNERSHIP WITH CURRO SCHOOLS

How parents can get to the square root of the problem

Getting an early start is crucial in shaping children's numeracy skills. The 2011 Trends in International Mathematics and Science Study report showed that in the lower grades, pupils fared better in maths if:

- Parents took part in early numeracy activities with them.
- Children had some level of preprimary education.
- Children had started school already able to do simple addition and subtraction.

Parents can also:

- Ensure their children practise their maths at home. They will develop fluency in maths by doing problems regularly. You don't have to be rich or attend a well-resourced school to do well at maths – but you must practise.
- Help their children by not showing them how to do maths problems. Rather help them by asking questions such as: Have you read the problem carefully? Have you done something similar before? What could we try to solve it? Why did you choose that particular method? What did you learn? Have we answered the question? This is more constructive than telling them what to do.
- Show an interest in what they're doing.
- Read to your children regularly. Internationally, this has been shown to improve maths performance.
- Bring maths into your daily activities. Talk in problems and encourage them to verbalise their thinking. Are there enough potatoes for each of us to have one for supper? Can you divide your sweets equally between you, your brother and your sister?

What does effective problem-solving involve?

A good maths problem should:

- Inspire the pupil to solve it by being engaged.
- Make sense and be relevant to the pupil.
- Allow for different methods to get to the same answer.
- Encourage original, independent thinking.

"So, the world is very different to what it was even 20 years ago. This means that what it means to 'know' today - and how you use and evaluate information - is also different."

He says maths curriculums have traditionally focused on teaching children how to calculate. But they now have calculators and computers at their disposal, on even the most basic of cellphones and electronic devices. So the focus should shift to the real-world applications of mathematics - such as getting to the root of problems, researching and interpreting data.

That's all good and well, but how do we bring about a sea change in the teaching and experiencing of maths?

It's a complex cocktail of factors, Brombacher believes, but much of the damage can be undone having "great teachers" giving effective guidance.

"In the teaching colleges of the past, teaching candidates with the weakest maths marks were placed in the foundation phase - teaching children in their most vulnerable years. So you'd often have the blind leading the blind in their most formative years.

"I want to work with teachers in the early grades to show them how to be more effective in what they do.

"Many of them don't know any better - they also suffered when learning maths, and are bringing their own prejudices into the classroom. Their self-confidence is low. So, we need to be investing our energy in teachers.

"We must develop effective materials that support a problem-driven approach to teaching and learning mathematics, and provide support for teachers on how to use those materials optimally," says Brombacher.

In the case of Curro schools, this includes using technology in the classroom.

The 2011 Trends in International Mathematics and Science Study's detailed results for the world's Grade 4s and Grade 8s (in which South Africa also performed dismally) suggest that the solution is not to "sugar-coat the bitter pill" of maths and "make it fun", adds Brombacher.

But this approach doesn't necessarily translate into improved results.

It is better to emulate top-performing east Asian countries like Japan, he believes, where the classroom culture is one where learners relish the struggle to solve challenging problems, trying out a variety of methods to crack even the toughest of nuts. This makes maths a stimulating and invigorating activity, instead of an intimidating Everest.

Parents also have a vital role to play in improving their children's maths performance, says Greeff, but should be careful not to pass on their own hang-ups.

All too often, parents inadvertently transfer their own past emotional experience of maths - often a negative one - to their children by spoon-feeding them when helping with homework. This is one of the worst things they can do, she maintains - it perpetuates the fear of maths and means the child is not learning how to solve the problem through trial, experimentation and error.

The process of learning from one's mistakes is essential to build the critical thinking skills that will be needed in the 21st-century workplace, she points out.

"Maths poses an opportunity to teach children to think," says Greeff.

"It helps you develop your brain into one of an entrepreneur or an innovator. It's not all about getting an A for maths - the goal is to stimulate the synapses between your brain cells, developing paths and patterns in your brain that enhance the ability to reason."

And it is this very ability to think - and think about your thinking - that will give today's children the competitive edge in the job market of the future.