Primary maths isn't child's play but it should be

There are many active, fun and hands-on ways to teach the essential concepts to young learners. You can even make numbers beautiful.

By **Joseph Grotowski** and **Marty Ross**

Charles Darwin once supposedly described a mathematician as "a blind man in a dark room looking for a black cat which isn't there".

Well, it probably wasn't Darwin, but whoever wrote it was spot on. As research mathematicians, we can attest to the fact that trying to create and understand new mathematics involves at least as much chasing conceptual shadows as it does hard calculation.

But if that's what mathematics is like for professional mathematicians, what hope is there for primary schoolchildren? Plenty! But, we must be realistic.

The annoying truth is that the concepts underlying primary school mathematics are very, very difficult: zero, fractions, negative numbers, positional notation and decimals – all of it took thousands of years to figure out.

Even "natural" numbers (positive whole numbers) are anything but natural; we may be able to count to 7, and we may know what a pile of seven oranges looks like, but it is no easy matter to then abstract, to capture the essential notion, of 7-ness.

Nonetheless, primary schoolchildren can be taught important, interesting and engaging mathematics.

YOU GOTTA HAVE RHYTHM

We may not be able to teach young children what numbers are, but we most definitely can teach them what numbers do. That is, we can teach arithmetic.

The critical point is that primary students can do arithmetic without an abstract understanding of the strange mathematical creatures they are manipulating. Indeed, it is only when they master the arithmetic that they can start to understand and appreciate the mathematics that lies beneath.

Note that we said "master". For this to work, the arithmetic must be second nature. That means the students must know their times tables by heart, and they must learn the traditional arithmetical algorithms, to the level where they can be employed intuitively, easily and automatically. That means practice, practice and more practice.

GOODBYE TO THE BLACK BOX

How do calculators help with this? They don't.

ALL THE REASONS NOT TO BOTHER

Let's look at some possible counter arguments, together with our responses.

It's too hard. No it's not. Yes, it requires practice, chants or drills or a combination of these. It requires a time commitment and a sense of purpose. But it simply isn't that hard.

Students hate it. No they don't. Students like rules, as long as the rules are clear and have a purpose. They like rhythm and pattern, and they like the sense of achievement attained by mastering and applying skills.

There's no point. Yes there is. These skills provide the foundation upon which the students are able to begin to understand and appreciate deeper mathematical concepts.

But they can "do" maths without having these basic skills at their fingertips: the understanding is what counts. No, they can't, since actual understanding has a chance of developing only when students have the basic skills at their fingertips.

We all accept the necessity of basic skills in other aspects of life. We would never say: "You can't actually play a musical scale by heart but you'd like to try your hand at Chopin? Sure, go to it!" We don't expect our cricket coach to allow us to open the bowling on

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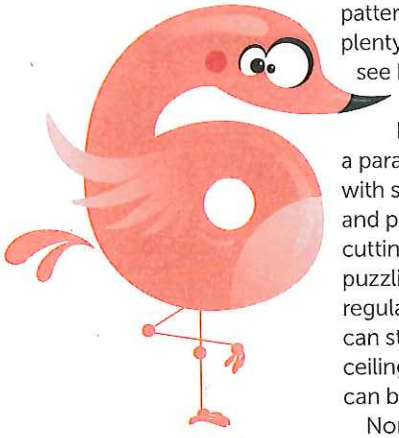

the basis that we've watched a few games on TV; we're not surprised that we first need to bowl over after over in the nets. Maths is no different.

TIME TO PLAY

Of course there is more to mathematics and more to being a child than mastering skills.

Play is central to children's development, indeed to their lives. Mathematics offers wonderful opportunities for play, at times for beautiful play.

This can be done in a primary school classroom, with no need for expensive props or glitzy software. Keep it physical! An ordinary deck of playing cards offers tremendous scope for sharpening arithmetic skills, recognising patterns, learning the elements of probability and plenty more. Grab a set of Cuisenaire rods and see how playful and insightful students can be whilst learning their tables. The difference between reading about the area formula for a parallelogram and demonstrating it for yourself with scissors and paper is astounding. Scissors and paper also lead naturally to constructing (and cutting) Möbius strips, and hours of wonderful puzzling. Construction kits can be used to create regular solids and more exotic shapes; and they can stay there, hanging from the classroom ceiling, a constant reminder that mathematics can be beautiful.

None of this mathematical play has to be undertaken with a clear plan or a premeditated take-home message. The students don't have to get the deep details to enjoy it, or to learn from it.

Perhaps this appears daunting, but it shouldn't. There are plenty of wonderful resources out there and plenty of people keen to help: try any of Martin Gardner's wonderful books; go to your local university and grab a friendly mathematician or two; consider CSIRO's Mathematicians in Schools program; or, simply Google "fun mathematics" and see what pops up.

There's a purpose to primary mathematics. Students need the skills. And they need to learn to appreciate mathematics, to see that it is not only incredibly powerful, but that it can be beautiful and fun.

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