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Don't let maths muddle you

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Dr Jo Boaler, professor of mathematics and author, examines the way that maths has become the most dreaded subject for many school children, plus how we can help them begin to enjoy and even excel at it

Do your children tell you how exciting maths is or how objects that you count stay the same number even when you move them around? How patterns can be seen in flowers and pine cones? If they haven't started school yet they might talk about maths with curiosity and wonder, but if they have begun they are more likely to tell you that maths is confusing and scary.

This is because schools in England have been moving down a damaging track over recent years, where the purpose of maths has become simply to rank children and their schools. Maths has become a performance subject and kids of all ages are more likely to tell you that it is all about what level you are and whether you can do it or not, than they are to tell you about the beauty of the subject or the way it piques their interest.

Huge numbers of children in England leave schools innumerate, lacking the ability to perform even basic calculations. Millions of adults in the general population, including those who are successful in all other fields, hate and fear maths. This is particularly true of women. When I was interviewed on several BBC radio stations recently, every single one of the articulate and educated interviewers (who were all women) told me they were terrified of maths.

Despite decades of research on good maths teaching and the development of scientific knowledge about ways to teach maths well, things have been going backwards instead of forwards. One of the main reasons for the problems in our country comes from the fact that children are taught too much, too early. Children in countries



such as Finland don't learn any formal methods until they are seven, but in the UK we start teaching formal methods at four, and by six they have been taught all of addition subtraction, multiplication, and division. Instead of introducing young children to the joy and wonder of numbers through puzzles and problem solving, they start their maths experiences perplexed and confused and quickly come to think that maths means lots of nonsensical rules to be followed.

Given the performance and test-driven culture of schools, with an over-packed curriculum and stressed-out students, what can parents do to transform maths for their children? Here are some useful tips.

Helping with maths at home

- 1.** Encourage children to play maths puzzles and games. Award-winning mathematician Sarah Flannery reported that her maths ability and enthusiasm came, not from school, but from the puzzles she was given to solve at home (Flannery, 2002). Puzzles and games or anything with a dice will help kids enjoy maths and develop numeracy and logic skills.
- 2.** Always be encouraging and never tell kids they are wrong when they are working on maths problems. Instead, find the logic in their thinking because there is always some logic to what they say. For example, if your child multiplies three by four and gets seven, say 'Oh I see what you're thinking; you're using what you know about addition to add three and four. When we multiply we have four groups of three.'
- 3.** Never associate maths with speed. It is not important to work quickly, particularly in the younger years, and we now know that forcing kids to work fast on maths is the best way to start maths anxiety for children, especially girls (Boaler, 2012).
- 4.** Never share with your children the idea that you were bad at maths at school or you dislike it, especially if you are a mother. Researchers found that as soon as mothers shared that idea with their daughters, their daughter's achievement went down (Eccles & Jacobs, 1986).
- 5.** Encourage number sense. What separates high and low achievers in primary school is number sense, ie having an idea of the size of numbers and being able to separate and put numbers together flexibly (Gray & Tall, 1994). For example, when working out $29 + 56$, if you take one from the 56 and make it $30 + 55$, it is much easier to work out. The flexibility to work with numbers in this way is what is called number sense and it is very important. My book [The Elephant In The Classroom: Helping Children Learn And Love Maths](#) shares ideas of ways to develop number sense in younger and older children.
- 6.** Perhaps most important of all, encourage a growth mindset, ie the idea that ability and smartness change as you work more and learn more. The opposite to this is a fixed mindset, where the idea is that ability is fixed and you can either do maths or you can't. When children have a growth mindset, they do well with challenges and do better in school overall (Dweck, 2006). When children have a fixed mindset and they encounter difficult work, they often conclude that they haven't got what it takes to do maths. One way in which parents encourage a fixed mindset is by telling their children they are clever or smart when they do something well. That seems like a nice

thing to do, but it sets children up for difficulties later, as when kids fail at something they will inevitably conclude that they aren't smart after all. There is a pervasive cultural view in England that some kids can do well in maths and some can't. Parents believe this and some teachers believe it too. This is completely wrong and one of the biggest reasons that maths is a traumatic experience for many children in England.

The good news is that parents can be very powerful in bringing about change. They are the voices that politicians listen to and also that schools and teachers listen to. In the coming months I will include advice about ways to talk with teachers and schools to help ensure that your child experiences real mathematics. That's mathematics that they will enjoy and learn well and that will help them in their future.

References: Boaler, J (2012). *The Role Played By Timed Math Tests in the Development of Math Anxiety: Evidence from Neuroscience and a US School District*; Dweck, CS (2006). *Mindset: The New Psychology of Success*. New York: Ballantine Books; Eccles, J & Jacobs, JE (1986). *Social Forces Shape Math Attitudes and Performance*. *Signs: Journal of Women in Culture and Society*, 11(21) pp 367-380; Flannery, S (2002). *In Code: A Mathematical Journey*. Chapel Hill, NC: Algonquin Books, p38; Gray, E, & Tall, D (1994). *Duality, Ambiguity, and Flexibility: A "Proceptual" View of Simple Arithmetic*. *Journal for Research in Mathematics Education*, 25(2), 116-140

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About the author: *Professor Jo Boaler*

Jo Boaler started her career as a secondary maths teacher in inner city London. Since then she has been a researcher, lecturer and professor of maths education in England and a professor of maths education at Stanford University in California. Jo's award winning research focuses upon different teaching approaches, considering the impact they have on students' enjoyment and learning. Her research has appeared in newspapers across the world including The Times, The Guardian and The Independent in the UK, and The Wall Street Journal in the US and she regularly appears on radio in England and the US. Jo has spent the last few years working as the Marie Curie Chair of Mathematics Education at the University of Sussex, and now as a Professor of Mathematics Education at Stanford University, California. Her latest book, *The Elephant in the Classroom. Helping Children Learn and Love Maths* (2009) published by Souvenir Press, is written for parents. It sets out the nature of good teaching approaches and explains the ways that children can be encouraged to

enjoy and be successful with maths. Jo lives in Palo Alto, California with her two daughters aged five and nine, and she is an avid West Bromwich Albion supporter! For more information on Jo's work visit <http://ed.stanford.edu/faculty/joboaler> or www.joboaler.com

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