# Hannah Fry: Teach children to fall in love with maths and they can count on it for life

Social media stars are helping British pupils discover the joy of numbers — and work out the world around them.

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Hannah Fry says mathematicians are always employable

Much to my delight, maths is popular now. Cool, even. Everything has exploded. Maths-based YouTube channels such as Numberphile and 3Blue1Brown boast millions of followers. The mathematical stars of social media, such as James Grime and Matt Parker, entertain legions of fans with glorious videos demonstrating how powerful and playful maths can be.

We live in an age where everybody is talking of data and algorithms. And the Royal Institution has even invited me, a mathematician, to give its Christmas lectures this month.

Maybe this explains, in part, why British schoolchildren are getting better at maths. According to the Programme for International Student Assessment (Pisa), whose findings were published last week, our 15-year-olds are the 18th best at maths in the developed world, up from 27th in 2015.

**We're still a way behind Estonia, though. Europe's best performing nation is in eighth place. I couldn't call myself a mathematician if I didn't take some of the explanations for our new ranking with a pinch of salt. Over the past three years, our schools have increasingly been borrowing elements from how they teach maths in places such as Singapore — second in the Pisa table behind China. [Oh dear! I gather from Dr Yeap Ban Har, Singapore creator, that there is no such thing as "Singapore Mathematics" as it is based on the UK's Cockcroft Report[1] and a report from the USA.]**

There's a greater emphasis on making sure pupils understand the foundational principles behind the work they are doing before moving on to the next skill — not just blindly learning formulas and rules by rote. [But what are these foundational principles? Do ST readers know?? AND what is rote??? Counting by rote; Tables by rote; Definitions by rote i.e. area of rectangle, def of a square avoid thick squares. ]

This is a good thing. But it's too early to tell whether changes to the way maths is being taught are responsible for our rise up the table.

It's in primary schools where the changes are being most eagerly adopted — and our improving 15-year-olds are clearly not the beneficiaries of that. A-levels and GCSEs are tougher but grade boundaries have dived to reflect that.

Perhaps children, and their parents, have realised that if you are a mathematician, you'll always be employable. The skills that universities and employers want are critical thinking, finding patterns, drawing connections and a deep understanding of a system — all of which

[1] **The Cockcroft Report, Mathematics Counts, was translated into Chinese in 1994.**

mathematics [can/should] gives you. [What is a "deep understanding"???? How does that show itself in a lesson/book/wall-display/lecture/exam/(newspaper article)???]

After all, it's almost impossible to find a single aspect of modern life that hasn't at some level been influenced by mathematics. [It is the reason we teach mathematics. The Cockcroft Report, our Cockcroft Report, said "There are other reasons for teaching mathematics besides those which we have put forward in this chapter. However, we believe that the reasons which we have given make a more than sufficient case for teaching mathematics to all boys and girls and that foremost among them is the fact that mathematics can be used as a powerful means of communication - to represent, to explain and to predict." **Page 3 para 8**

"Mathematics helps us a lot to explore the regularities of the objective world, as well as make appropriate choices and decisions in a modern society overwhelmed by a flood of intricate information. Simultaneously, mathematics provides us means of communication effectively and quickly. As mathematics is a technology widely applied everywhere, it helps us collect, organize, and describe information, establish mathematical models, as well as solve problems, resulting in direct generation of wealth for the society." **Prepared by Ministry of Education of People's Republic of China (2004)** [**Why Teach Mathematics at all]. [Note China translated and published The Cockcroft Report.]**

It's there in cars, bridges and mobile phones. [ what mathematics are we talking about here? **Binary System**/logic circuits/??] And maths can give us a new way of looking at who we are and what's important to us. [Taught well] It gets us noticing life's bigger patterns.

Knowing how to unlock and decipher that invisible world of numbers carries with it a set of enviable skills that apply well beyond the classroom.

Yet it's worth noting that exams still largely reward an ability to memorise things, stuff that has been drilled into you over and over again.

Teachers, then, have a difficult job. They get caught in the middle. They try to build students who have a deep understanding of their subject and a critical mind; but, come exam time, these students also need to be able to reel off formulas and definitions.

If you speak to the professional mathematicians, the ones who truly went on to succeed at their subject, almost all have a story about one teacher who really understood their talents and nurtured and stretched them.

Teachers have an incredible power to shape an individual's whole life trajectory; you can't really overstate that. Mine was Mrs Andrews. [Mine was that group of children I taught in my first teaching post.] She taught me throughout my years at an all-girls' comprehensive school in Hertfordshire. She was kind and sympathetic; she celebrated your successes and didn't make you feel bad about your failures. [but learn from them.] It was precisely what I needed at that age.

Everyone likes to feel they are good at something and the better you feel about something the more you want to do it. It's a self-perpetuating cycle. [Developing that spirit of enquiry is vital. Doc Searls[2], one of America's most respected technology writers, reminds us 'Work matters but curiosity matters more. Nobody works harder at learning than a curious kid.'[3]]

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[2] Doc Searls, senior editor of the Linux Journal. In The Flat World – a brief history of the 21st century. Thomas Friedman page 304

[3] ("It is a miracle that curiosity survives formal education." Albert Einstein.)

Parents, of course, can also play a huge part. [But they/we do need help. It is far from helpful when certain celebrities would have us believe that one can multiply two cupcakes by two cupcakes and get four cupcakes; or a major shopping chain will sell me a book which explains that an ice-cream cone is a triangle; or more …but don't mention multiplication again…] Both my parents left education at a young age. We weren't particularly well-off, but Mum understood the value of education [GREAT], and she would bring maths into my and my two sisters' lives as often as possible.

"How many roads do we need to cross to get to school?" she might ask, or: "What's the quickest way to get to school, crossing as few roads as possible?"

During one summer holiday, when I was still at primary school, my mother made me sit and work through a page a day of a maths textbook.

She even used to play a singalong times-tables tape in the car — the worst, most boring tape ever. I hated it. But it worked. I had a head start [to do what?].

Mind you, I can't remember my times tables at all now, which is embarrassing when you're trying to work out the bill in a restaurant. [Same for me but once a month I lunch with three of the finest teachers I have met. ☺]

*Hannah Fry presents the Royal Institution Christmas lectures, to be shown on BBC4 from 8pm on Boxing Day. She spoke to Katherine Forster*

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