

## Maths anxiety in midlife

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We know that maths is important. It helps us to learn critical thinking and develops the muscles of problem solving. Great minds describe it as a universal language and there are even those who see beauty and poetry in its order.

“Mathematics is the alphabet with which God has written the universe” said Galileo in the 16th Century. “If I were again beginning my studies, I would follow the advice of Plato and start with mathematics.”

Albert Einstein said “Pure mathematics is, in its way, the poetry of logical ideas.”

But for many adults who experienced any degree of maths anxiety during their school years, there is no beauty or poetry when it comes to maths. There is only the relief that they don't have to suffer through it again.

Many adults have a visceral response at the very thought of being confronted with numbers and figures. It's a memory that is often made worse by a personal history of inadequacy in maths classes.

But what if unfinished business with maths is holding you back in other areas of your life which also require resilience and stamina? And if this is the case is there an age limit to finally getting to grips with it?

It was feminist author Sheila Tobias who said it first: mathematics avoidance is not a failure of intellect, but a failure of nerve. When her book *Overcoming Maths Anxiety* was first published in 1978, Tobias's political and psychological analysis made “maths anxiety” a household expression.

Tobias continues to see maths anxiety as a political issue and now in her 80s, still consults on equity and diversity for academic departments.

Her work examines what it is that makes maths “hard” for otherwise successful people and how women, more than men, become victims of a gendered view of maths. As long as people see themselves as disabled in mathematics and do not rise up and confront the social and pedagogical origins of their disabilities, she believes that they will be denied “math mental health.”

She defines math mental health as “the willingness to learn the math you need when you need it.” In a society which takes STEM subjects and careers increasingly seriously, this willingness can make the difference between high and low self-esteem, failure and success.

It's an all too common malaise. Cognitive Scientist Sian Beilock writes in *Harvard Business Review* that a staggering 93% of Americans report experiencing some level of maths anxiety.

People who have maths anxiety believe that they're incapable of doing anything math-related. This symptom can become what sociologist Robert K. Merton famously described as the “self-fulfilling prophecy” - the phenomenon where a belief or expectation that you hold about a future event manifests simply because you hold it (even when it's not based in fact)

Surprisingly, some of the greatest Scientists experienced struggles with maths. Although Alexander Graham Bell might have enjoyed the intellectual exercise of maths, a biography reveals he was careless about working out final answers. Thomas Edison wasn't especially good at maths and made no attempt to conceal it. Charles Darwin too was candid about the fact that his math was bad and described himself as someone who learned math “very slowly.”

But the modern poster child for overcoming maths anxiety is Barbara Oakley. A Professor of Engineering at Rochester University and author of *A Mind for Numbers: How to Excel at Math and Science (Even If You Flunked Algebra)*, Oakley is also co-instructor of one of the world's largest online courses, *Learning How to Learn* with Coursera.

Unlike most engineering scholars who show some flair for maths in high school, Oakley shares how she “flunked” her way through elementary, middle and high school math and science. She did however have an ease with languages and went from high school straight into the army where she attended the top-ranked Defense Language Institute to become fluent in Russian.

It was only at the age of 26 that she realised that her ability with languages was a skill which offered limited opportunities.

“People weren’t pounding down my door looking for my Russian declension abilities. “

In an attempt to try something new and open up a new world of perspectives, Oakley decided she would have to learn yet another language – the language of calculus - in order to study engineering.

She hoped that there might be aspects to language learning that she might apply to learning in math and science. There were. “What I had done in learning Russian was to emphasize not just understanding of the language, but fluency. Fluency of something whole like a language requires a kind of familiarity that only repeated and varied interaction with the parts can develop.”

It’s for this reason that Oakley believes that understanding a subject conceptually is not sufficient. She explains that the kind of repetition and rote learning advocated by the Japanese Kumon system has to be combined with understanding in order to achieve fluency. The problem with focusing relentlessly on understanding only, is that math and science students can often grasp essentials of an important idea, but this understanding can quickly slip away without consolidation through practice and repetition.

But what of the inevitable performance anxiety? Alison Brooks, a professor at Harvard Business School published a study in the *Journal of Experimental Psychology* exploring the phenomenon of anxiety reappraisal. She ran a few tests: doing karaoke in front of strangers, a hypothetical 30-minute keynote speech scenario, and completing a difficult math task. Before they started, she asked participants to say one of three things before performing completing their tasks:

1. “I am anxious”
2. “I am excited”
3. Nothing

People who reappraised anxiety as excitement sang better, spoke longer and more persuasively, and outperformed others on the maths test. Surprisingly, when participants adopted what Brooks calls an “opportunity mindset” as opposed to a “threat mindset,” neither heart rates nor anxiety levels decreased. Though anxiety levels remained unchanged, it’s interesting that a minor change of attitude resulted in significantly more positive performances.

There’s no doubt that mindset matters. But when it comes to mastering difficult subjects, it’s simply not enough.

The study of mathematics builds on itself, so if you don’t grasp one concept, chances are good that you will fall behind. Math requires repetition, precision and practice.

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Like learning a language, math fluency takes time too. Fortunately the internet is full of resources to make learning it both possible and accessible. If you're ready to tackle your maths anxiety or learned helplessness head on, you can try Brilliant.org and Khan Academy to master foundational concepts and practice them until you've reached fluency.

There is no age limit when it comes to the thrill of solving tough problems and tackling areas which might not come naturally to us at first. Even if you have long passed the stage of life where you need to master algebra and complex equations to get through high school, there's something about taking the time to grapple with tough subject matter which is one of the most satisfying feelings in the world. The good news is that with the right attitude and the right building blocks, maths ability is not an immutable trait but a subject in which we can all learn, improve and succeed. Who knows, one day we too might catch a glimpse of the beauty and poetry within.