

What is maths anxiety?

Maths anxiety is a situation-specific anxiety which can be described as “*an emotion that blocks a person’s reasoning ability when confronted with a mathematical situation*” (Spicer, 2004). It is thought to affect up to 85% of students (Perry, 2004) with 26% having moderate to high levels (Jones, 2001). The fear is thought to primarily stem from negative learning experiences with maths in the past and whilst someone is in a state of anxiety, effective learning cannot occur. Statistics anxiety has been shown to be the biggest predictor of poor performance (Onwuegbuzie, 2000) in research methods courses and whilst it is often related to maths anxiety, can also affect a person’s ability to use statistical computer packages and interpret research articles.

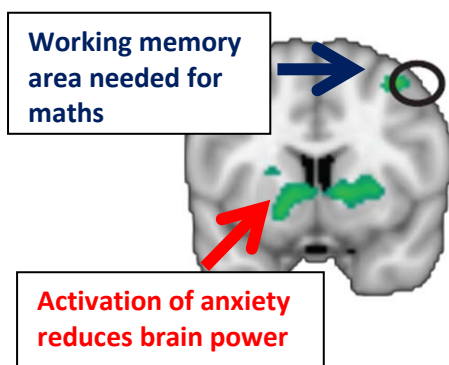
Whilst it is natural to feel a little bit anxious when studying, particularly during exam time, these are some of the feelings you may experience when studying maths or statistics if you have either type of anxiety:

1. **Anxiety:** Generally anxious and unable to take anything in especially near exams
2. **Panic:** Feeling of helplessness that will not go away
3. **Paranoia:** Believing that you are the only person not capable of doing maths/statistics
4. **Passive Behaviour:** Feeling there’s no point in trying/ wanting to quit and go home
5. **Lack of Confidence:** Don’t know where to start/ expect to never know the answer to questions
6. **Physical symptoms:** heart racing, irregular breathing, sweatiness, shakiness, biting nails, feeling of hollowness in stomach, nausea, not being able to think clearly.

One student with high levels of maths anxiety describes her first maths lesson at the University of Sheffield: “*Well what can I say, after losing sleep, worrying about maths my fear was true. I arrived this morning with complete brain block and anxiety. Nervous, scared and petrified of the maths lesson, even though I had read the class notes. Once the teacher started talking my mind went blank as if she was talking a different language, everything she said went in one ear and out the other...*” “*As she asked us to practise questions my mind went on shut down, I started sweating thinking oh my god what if she asks me?*”

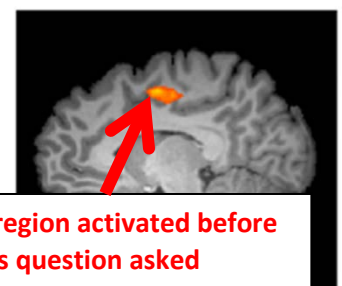
Effects on the brain

Whilst maths anxiety itself is difficult to measure, recent research using brain scanners (fMRI) has shown that maths anxiety has measurable effects on the parts of the brain used to understand maths.



Working memory is important for solving mathematical problems. Anxiety causes activation of a different part of the brain which interferes with working memory making maths seem harder than it really is. Maths anxiety eats away at working memory because the brain is too busy worrying about maths instead of doing it (Young, 2012). This means that whilst someone is in a state of anxiety, they will struggle to understand the maths being taught or attempt questions. Those with maths anxiety often believe that they are not clever enough to understand but it is the fear rather than stupidity that is interfering with learning.

Bad experiences with maths in the past mean that the brain sometimes associates maths with pain, so the regions of the brain associated with pain processing can be activated when thinking about maths (Lyons and Beilock, 2012). This only occurs when *thinking* about the maths, but doesn’t occur when the brain is actually *doing* maths. The brain can also see maths as a threat, so the natural response is to ‘run’ away from maths in a similar way as one would run from a tiger.



The impact on learning

Marshall, E., Mann, V., Wilson, D., & Staddon, R. (2017). Learning and teaching toolkit: Maths anxiety

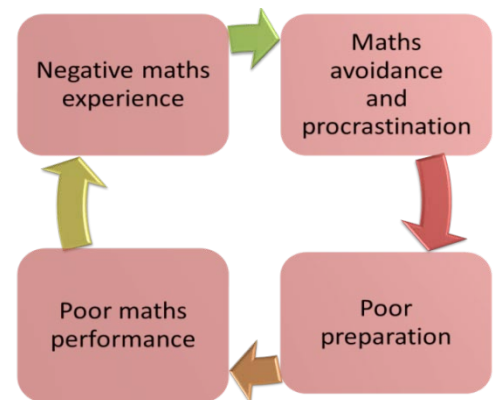


The growth zone model (Johnston-Wilder et al, 2016) can be helpful in explaining the different stages of learning. In the 'Comfort zone', students are working independently on material they are familiar with. However, in order to progress, students must enter the 'Growth zone' which can be challenging but rewarding in terms of the increase in knowledge and understanding. In the growth zone, taking risks with appropriate support and making mistakes is part of learning. In the growth zone, it is important to persevere with questions and ask for help if needed but many students with maths anxiety expect failure, lack motivation and move straight to the 'Anxiety zone' where very little learning can occur. At this stage, stress levels increase rapidly, mathematical helplessness takes over and the brain activates the 'fight or flight' defence mechanism. In the anxiety zone, students may feel tearful or

angry and want to remove themselves from the situation as soon as possible. It is important to recognise when you are in this zone and develop strategies for coming out of it e.g. breathing out for 7 and in for 5, listening to a favourite piece of music or writing about your anxiety.

Maths avoidance cycle

Most people have had negative maths learning experiences and encountering maths or statistics triggers negative thoughts and memories so an understandable learned behaviour is to avoid maths wherever possible. This could mean avoiding subjects or modules they think contain maths (including statistics) or in situations where they have to study maths, avoid studying until the last minute. Poor preparation leads to poor performance which is another negative maths experience, making the student more anxious as it reinforces their view that they are bad at maths. Avoiding maths or statistics is becoming increasingly hard given that most degrees now require students to study at least one of them. However, maths anxiety can be overcome within a nurturing environment, by recognising when anxiety is affecting your work, developing strategies for thriving in the growth zone and by accepting that maths requires practice rather than inbuilt ability.



by recognising when anxiety is affecting your work, developing strategies for thriving in the growth zone and by accepting that maths requires practice rather than inbuilt ability.

References

- Johnston-Wilder, S., Pardoe, S., Almehrzi, B., Marsh, J. Richards, S. (2016). Developing teaching for mathematical resilience in further education. *9th International Conference of Education, Research and Innovation, ICERI2016, Seville (SPAIN), 14th - 16th of November, 2016.*
- Jones, W. G. (2001). Applying Psychology to the Teaching of Basic Math: A Case Study. *Inquiry, 6(2)*, 60-65.
- Lyons IM, Beilock SL (2012) When Math Hurts: Math Anxiety Predicts Pain Network Activation in Anticipation of Doing Math. *PLoS ONE 7(10)*: e48076.doi:10.1371/journal.pone.0048076
- Onwuegbuzie, A.J. (2000) Statistics anxiety and the role of self-perceptions, *Journal of Educational Research, 93*, pp. 323–335.
- Perry, A. B. (2004). Decreasing math anxiety in college students. *College Student Journal, 38(2)*, 321-324.
- Spicer, J. (2004). Resources to combat math anxiety. *Eisenhower National Clearinghouse Focus 12(12)*.
- Young, C. B., Wu, S. S., & Menon, V. (2012). The neurodevelopmental basis of math anxiety. *Psychological Science, 0956797611429134*.

Websites: <http://www.sheffield.ac.uk/mash/anxiety> <http://mathematicalresilience.org/>