

# Mathematics Anxiety

## in the Higher Education (HE) context

### A Focus on Students of Service Mathematics

**Dr Maria Ryan**

Mary Immaculate College  
St. Patrick's Campus, Thurles, Co. Tipperary

Email: [MariaD.Ryan@mic.ul.ie](mailto:MariaD.Ryan@mic.ul.ie)



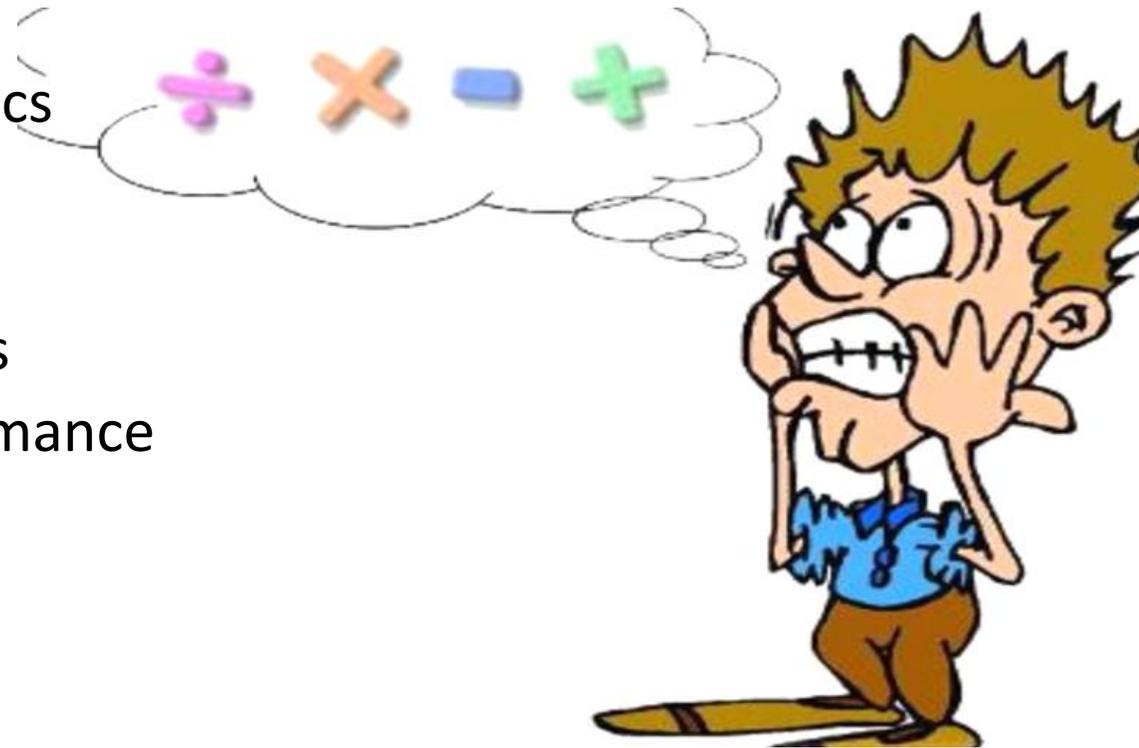
@WhyHateMaths

# Context

- Understanding Mathematics Anxiety (MA)
  - Awareness of MA
  - Impact of MA
  - Detecting MA
- Supporting the Mathematics Anxious student
- Significance of one's Mathematics Story

# Mathematics Anxiety – Prevalent and Problematic

- Prevalent:
  - Among students engaging with mathematics at all levels of education
  - Across disciplines
  - Within (inter)national discourse on mathematics
- Problematic:
  - Affects student engagement with mathematics
  - Negative correlation with mathematics performance
  - Impeded motivation and low self confidence
  - Can lead to mathematics avoidance



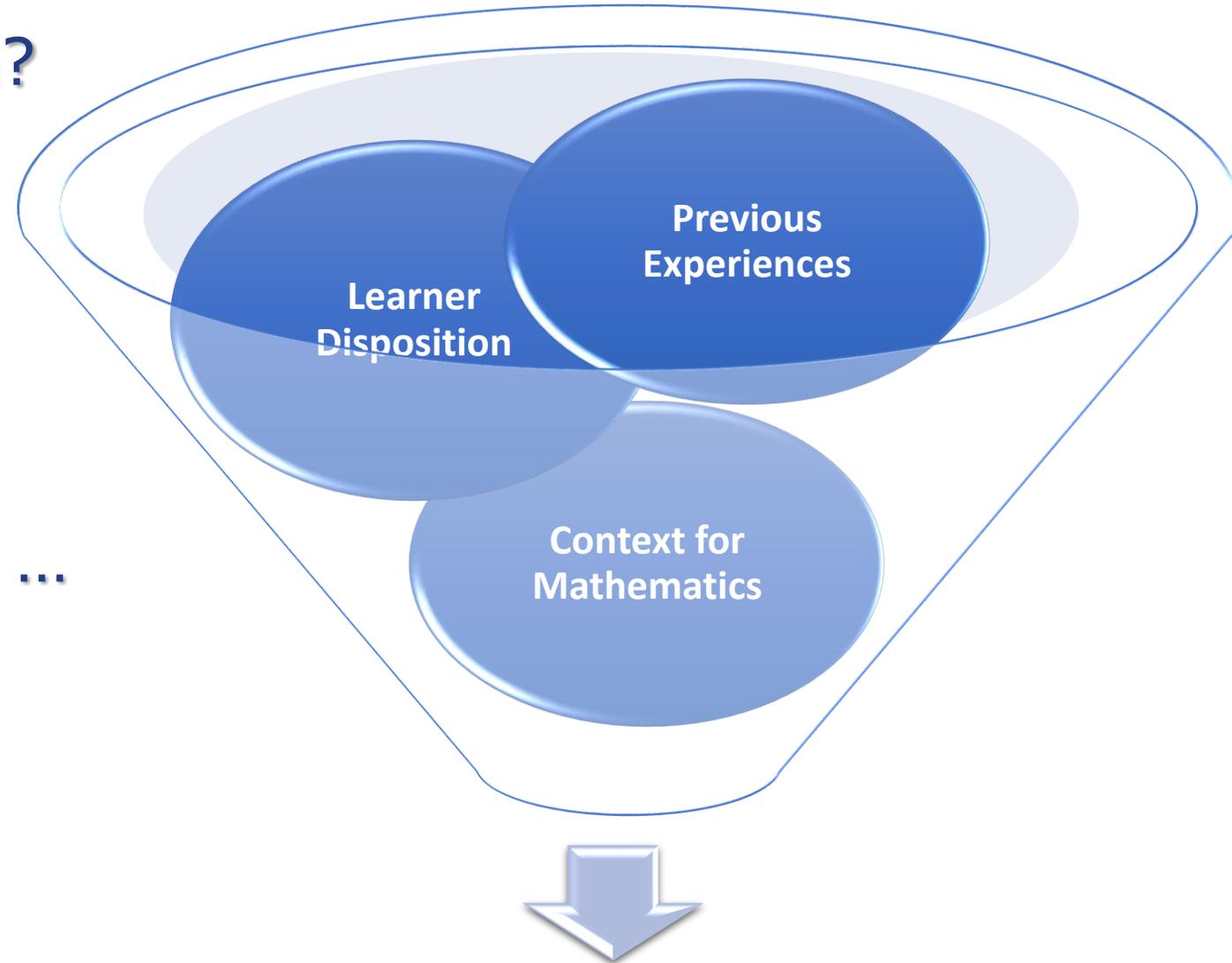
# Service Mathematics

- Mathematics is a component of study, but not the main discipline of study (Gill & O'Donoghue, 2008)
- Mandatory in many undergraduate programmes
- Some students unaware of service mathematics modules



# What leads to a MA reaction?

Combination of factors ...



**Mathematics Anxiety Reaction**

(Adapted from Cemen, 1987)

# Detecting Mathematics Anxiety

## How do you know a student has Mathematics Anxiety?

- Anecdotally
- Mathematics Anxiety Timeline
- Mathematics Anxiety Questionnaire
- Mathematics Life Story

# Impact of Mathematics Anxiety

## Low Maths Anxious Student

- Proactive about learning maths
- Keen to understand concepts and see relevance
- Well prepared for class and exams
- Will seek support
- Good self-concept in mathematics
- Can move on from past negative experience
- Support from parents and teachers
- Comfortable using calculations or numbers in everyday/work contexts

## High Maths Anxious Student

- Have trouble grasping maths concepts
- Resort to rote learning and following procedures rather than understand concepts
- Focus on just passing an examination
- Less likely to seek support
- Poor self-concept in mathematics
- Have difficulty moving on from past negative experience
- Little or no support from parents or teachers
- Tend to avoid everyday/work contexts involving calculations or numbers
- May have a learning difficulty, or specific maths learning difficulty, i.e. Dyscalculia.

# Mathematics Support for HE Students

- Are students aware of maths support at their HEI?
- How is maths support offered:
  - Preparatory courses for mature students
  - Dedicated mathematics support centres
  - One of a range of academic supports
  - Timetabled tutorials
  - Contact with lecturer/tutor
  - Online resources
  - Peer support
  - Private tuition

Highly maths anxious students often avoid maths support:

- Asking 'irrelevant' questions
- Fear of being perceived as 'stupid'

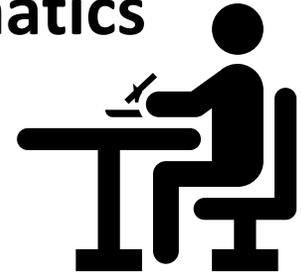
... and even more so among mature students

# Supporting the Maths Anxious Student (1)

## Lecturer/Tutor reflection on own experiences with mathematics

- Reflect on their own mathematics life story

**Find out how maths anxious the students are!**



## Considerations for Teaching Mathematics



- Messages teacher conveys about mathematics
- How teacher starts and ends mathematics class
- Encouraging collaborative mathematics activities in class
- Use of visuals, etc. to suit different learning needs
- Encouraging discussion around mistakes
- Engagement with mathematics classes

# Supporting the Maths Anxious Student (2)

- Understanding and empathy
  - Significance of mathematics to the student
  - Their motivation for learning mathematics
- Support and guidance
  - Start from where the student is at!
- Space to allow students to share their experiences of doing mathematics

## Helpful Strategies:

- **Focus on mistakes!**
- **Stuck Sheet**  
(Chisholm, 2017)
- **Reading** about how others feel about mathematics
- **Writing** about feelings before test
- **Breathing & Exercise**

## e.g. Sharing your Mathematics Story

Simple Approach to  
Mathematics Life Story

1

- Identify a significant mathematics moment in your life

2

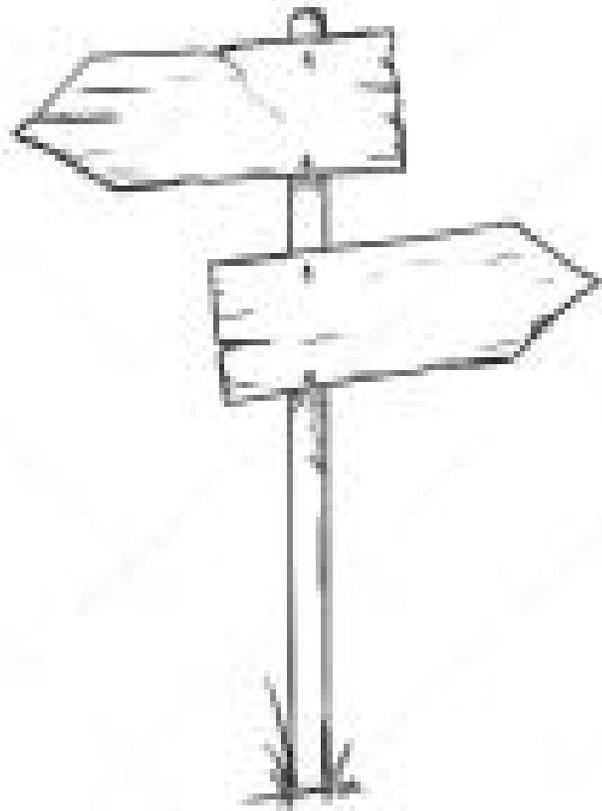
- Write a few lines about it

3

- Share with the person beside you (*optional*)

e.g. Compile a 'Stuck Sheet'

A list of ideas to help the student become 'unstuck'



## Stuck Sheet

Ask the lecturer/tutor

Ask a friend

Read the question carefully

Look at your notes

Read the textbook

Think about similar problems

What information is important?

What maths is needed?

Don't give up, keep on going!

(Adapted from Chisholm, 2017)

# Final Thoughts

Mathematics - gatekeeper status

- Service maths – students informed and prepared!
- Significance of maths supports

Address MA to avoid adverse, long-term, cyclical consequences

- Screening for MA and maths learning difficulties
- Significance of previous maths experiences
  - Impact of negative experiences on maths confidence
  - Allowing space to talk about maths experiences

## Selected Resources for Information on Mathematics Anxiety and Related Topics for the HE Context

Dr Maria Ryan

What is math anxiety – and how to help with math anxiety?	Ansari, D. (2017)	<a href="https://www.understood.org/en/articles/what-is-math-anxiety">https://www.understood.org/en/articles/what-is-math-anxiety</a>
Growth Mindset in Mathematics (YouCubed)	Boaler, J. (2023)	<a href="https://www.youcubed.org/resource/growth-mindset/">https://www.youcubed.org/resource/growth-mindset/</a>
A moment to breathe: how reflection can reduce teacher maths anxiety	Cosgrove, F. (2021)	<a href="https://www.bera.ac.uk/blog/a-moment-to-breathe-how-reflection-can-reduce-teacher-maths-anxiety">https://www.bera.ac.uk/blog/a-moment-to-breathe-how-reflection-can-reduce-teacher-maths-anxiety</a>
Love Math Journal	Dillard & Jenner (2021)	<a href="https://www.amazon.com/Love-Math-Journal-Affirmations-Reflections-ebook/dp/B095J36SPN">https://www.amazon.com/Love-Math-Journal-Affirmations-Reflections-ebook/dp/B095J36SPN</a> (Link to eBook on Amazon.com)
Getting into and staying in the Growth Zone	Lee & Johnston-Wilder (2018)	<a href="https://nrich.maths.org/13491">https://nrich.maths.org/13491</a>
Maths Anxiety Research Group (MARG)	MARG Uni. Of Derby (2022)	<a href="https://marg.wp.derby.ac.uk/resources/">https://marg.wp.derby.ac.uk/resources/</a>
Maths Anxiety Trust (UK)	Maths Anxiety Trust (2023)	<a href="http://mathsanxietytrust.com/">http://mathsanxietytrust.com/</a> (General Information)
A guide to tackling Maths Anxiety	Pearson (2019)	<a href="https://www.pearson.com/content/dam/one-dot-com/one-dot-com/international-schools/pdfs/covid-19/guide-to-tackling-maths-anxiety-power-maths-report.pdf">https://www.pearson.com/content/dam/one-dot-com/one-dot-com/international-schools/pdfs/covid-19/guide-to-tackling-maths-anxiety-power-maths-report.pdf</a>
Dyscalculia in Higher Education	Trott, C. (2015)	In S. Chinn (Ed.), <i>The Routledge International Handbook of dyscalculia and mathematical learning difficulties</i> (pp. 406–419). Abingdon, UK: Routledge.
Dyscalculia and Transitions into Higher Education and the Workplace	Trott, C. (2018)	<a href="https://mydigitalpublication.com/publication/?m=13959&amp;i=481642&amp;view=articleBrowser&amp;article_id=3032685&amp;ver=html5">https://mydigitalpublication.com/publication/?m=13959&amp;i=481642&amp;view=articleBrowser&amp;article_id=3032685&amp;ver=html5</a>

# References

- Ashcraft, M.H. (2002). Math anxiety: Personal, educational, and cognitive consequences, *Directions in Psychological Science* Vol. 11 pps. 181-185
- Boaler, J. (2016). *Mathematical Mindsets: Unleashing Students' Potential Through Creative Math, Inspiring Messages and Innovative Teaching*, San Francisco: Jossey Bass
- Cemen, P.B. (1987). *The Nature of Mathematics Anxiety*. Stillwater, OK: Oklahoma State University
- Chisholm, C. (2017). *The Development of Mathematical Resilience in KS4 Learners*. Unpublished Ph.D. Thesis, University of Warwick
- Dowker, A., Sarkar, A., & Looi, C.Y. (2016). Mathematics anxiety: what have we learned in 60 years? *Frontiers in Psychology* 7, 1-16
- Drake, C. (2006). Turning Points: Using Teachers' Mathematics Life Stories to Understand the Implementation of Mathematics Education Reform, *Journal of Mathematics Teacher Education* 9, pp. 579-608
- Faulkner, F., Fitzmaurice, O. & Hannigan, A. (2016). A Comparison of the Mathematical Performance of Mature Students and Traditional Students over a 10-year Period. *Irish Educational Studies* 35(4), 337-359
- Fitzmaurice, O., Mac an Bhaird, C., Ní Fhloinn, E., O'Sullivan, C. (2014) Adult learners v traditional learners - insights from a large scale survey of Mathematics Learning Support in Irish HEIs
- Gill, O. & O'Donoghue, J. (2008) A Theoretical Characterisation of Service Mathematics, 11<sup>th</sup> International Congress on Mathematics Education Mexico
- Goodall, J., Johnston-Wilder, S. & Russell, R. (2017). The Emotions experienced while Learning Mathematics at Home. In U. X. Eligio (ed.) *Understanding Emotions in Mathematical Thinking and Learning*, London: Academic Press, pp. 295-313.
- Hembree, R. (1990) The Nature, Effects, and Relief of Mathematics Anxiety, *Journal for Research in Mathematics Education* Vol. 21(1), pps. 33-46
- Hunt, T. E., Clark-Carter, D. & Sheffield, D. (2011) The Development and Part Validation of a U.K. Scale for Mathematics Anxiety, *Journal of Psychoeducational Assessment* Vol. 29, pps. 455-466
- Lawson, D., Croft, T., Halpin, M. (2003) *Good Practice in the Provision of Mathematics Support Centres*, 2nd Ed., University of Birmingham
- Mac an Bhaird, C., Fitzmaurice, O., Ní Fhloinn, E. & O'Sullivan, C. (2013). Student Non-Engagement with Mathematics learning Supports. *Teaching Mathematics and Its Applications* 32, pp. 191-205
- McAdams, D. (1993) *The stories we live by: Personal myths and the making of the self*. New York: William Morrow
- McCulloch, A. W., DeCuir-Gunby, J. T., Marshall, P. L., and Caldwell, T. S. (2013) Math Autobiographies: A Window into Teachers' Identities as Mathematics Learners, *School Science and Mathematics* Vol. 113 (8), pps. 380-389
- Plummer, K. (2001). *Documents of Life 2: An Invitation to a Critical Humanism*. London: Sage
- Richardson, F. C. & Suinn, R. M. (1972) The Mathematics Anxiety Rating Scale: Psychometric Data, *Journal of Counseling Psychology* Vol. 19(6) pps. 551-554
- Russek, B. (1998) Writing to learn mathematics, *Writing across the Curriculum* (9), pps. 36-45
- Ryan, M. (2019) *An Investigation into the Extent and Derivation of Mathematics Anxiety among Mature Students in Ireland*. Unpublished Ph.D. Thesis, University of Limerick
- Ryan, M. & Fitzmaurice, O. (2017). Behind the numbers. The preliminary findings of a mixed methods study investigating the existence of mathematics anxiety among mature students. *Adults Learning Mathematics: An International Journal* 12(1), 49-58
- Ryan, M., Fitzmaurice, O., & Johnson, P. (2023) Investigating Mathematics Anxiety among Mature Students of Service Mathematics using the Mathematics Anxiety Scale U.K. *International Journal of Mathematical Education in Science and Technology (TMES)* (forthcoming)
- Sheffield, D. & Hunt, T. (2007) How Does Anxiety Influence Maths Performance and What Can We do About It? *MSOR Connections* Vol .6 (4) pps. 19-23
- Thumpston, G. & Coben, D. (1994). *Getting Personal: Research into Adults' Maths Life Histories*, *Adults Learning Mathematics-1 Proceedings*, London
- Tobias, S. (1978/1993) *Overcoming Math Anxiety*, New York: W.W. Norton

**Thank you!**

**Email: [MariaD.Ryan@mic.ul.ie](mailto:MariaD.Ryan@mic.ul.ie)**



**@WhyHateMaths**