

Critical Mathematics Education Working Group
Inequalities in mathematics (emotional)
learning outcomes: (how) is gender
relevant?

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Outline

- Evidence from recent research and systematic reviews
- ‘Gender’ conceptualisation and operationalisation in mathematics education research
- Discussion

Evidence on Gender differences in mathematics (emotional outcomes and learning experiences)

- Two systematic reviews
- Various projects with (longitudinal) student (and teacher) surveys:
 - Teleprism (Secondary Education, www.teleprism.com)
 - Transmaths (Post-16 and into HE, www.transmaths.org)




The University of Manchester

Two systematic reviews

Mathematics Education 5-14 and Gender: Review of affect, attitudes and aspirations


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Unsettling Understandings of Maths Anxiety

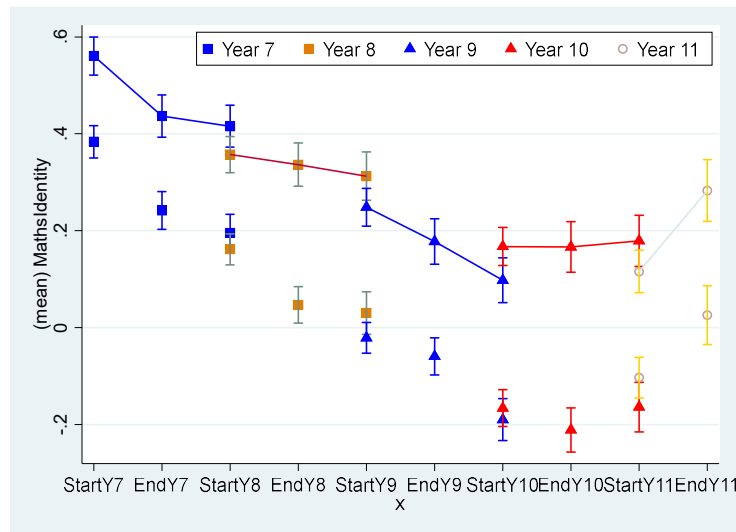
A critical synthesis to inform policy and practice

The British Academy has commissioned a research team to provide an up-to-date systematic review of research into the issue of maths anxiety, analyse its implications for policy and practice, and identify potential interventions and gaps in our knowledge. This Special Research Project is part of the British Academy's initiative to deepen awareness and demonstrate the importance of quantitative skills.



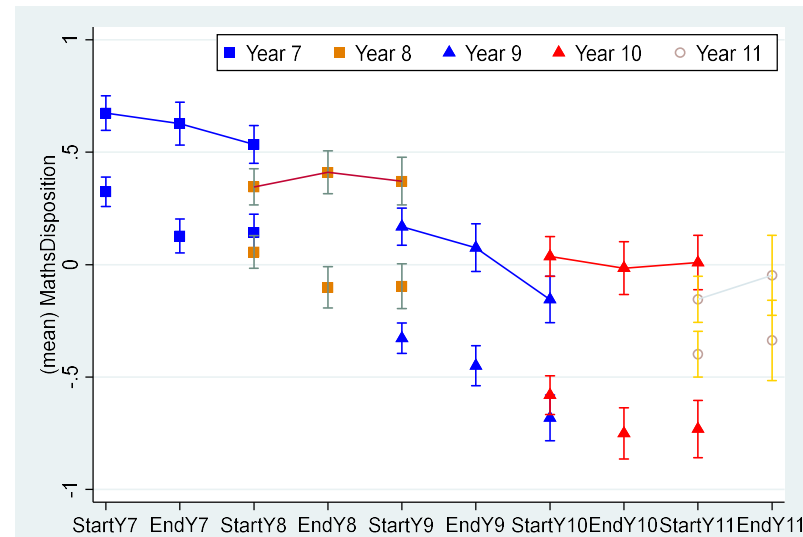
Declining mathematics emotions (Teleprism results)

Mathematics 'Identity'



Mathematics disposition

Boys – line
Girls – no line



Pampaka et al. – UK study (2010-2014) www.teleprism.com
Similar trends reported recently globally

Differences in students perceptions of teaching practices

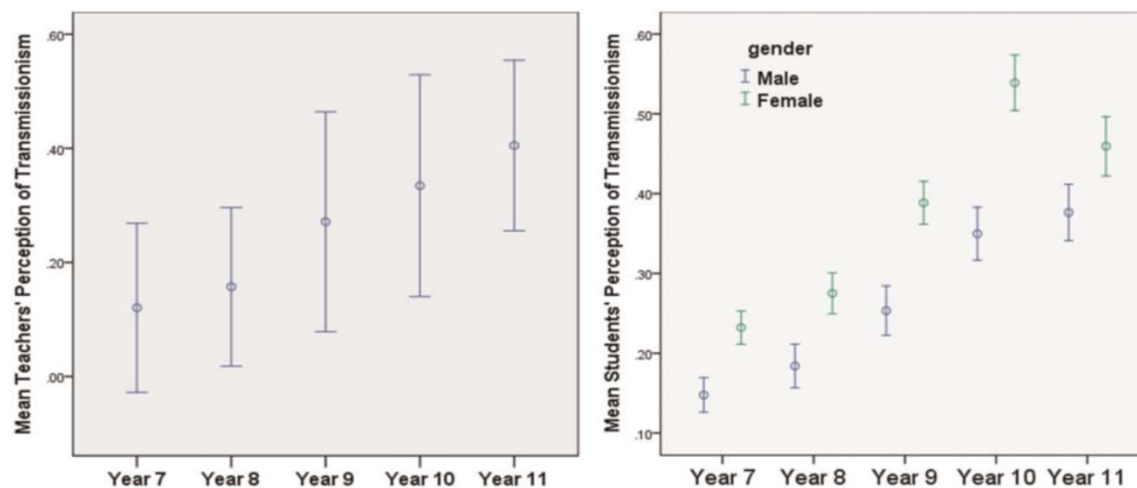


FIG. 3. Plot of means (with confidence intervals) of teachers (left) and students' (right) perception of transmissionism by Year group and gender (only for students).

(Pampaka & Williams, 2016)

- Perceptions of teaching: more transmissionist as students progress in secondary schools
- Girls perceive teaching as more transmissionist than boys do

Teaching is related to declining dispositions

- Increasing perception of transmissionist teaching is related to declining mathematics disposition

Table 17.8 Fixed and random effects for a 3-level growth curve model of Mathematics disposition.

Fixed effects	Model 1 Coefficient (se)	p > z	Model 2 Coefficient (se)	p > z
Age	-0.13 (0.01)	<0.001	-0.05 (0.03)	0.066
Gender (Ref: Male)	-0.39 (0.02)	<0.001	-0.39 (0.02)	<0.001
Transmissionist teaching	-0.61 (0.01)	<0.001	-0.60 (0.01)	<0.001
Parental support	0.19 (0.01)	<0.001	-0.19 (0.01)	<0.001
Constant	2.21 (0.11)	<0.001	1.37 (0.33)	<0.001
Year_cohort (ref: Year 7)				
Year 8			-0.17 (0.53)	0.746
Year 9			1.96 (0.57)	0.001
Year 10			-0.35 (0.63)	0.571
Year 11			-1.05 (1.24)	0.401
Year_cohort X age				
Year 8			0.005 (0.04)	0.916
Year 9			-0.17 (0.05)	<0.001
Year 10			0.003 (0.05)	0.943
Year 11			0.051 (0.08)	0.547
Sample size: Schools	40		40	
Students' level variance	16, 811		16, 811	

(Pampaka, 2021)

Evidence from our reviews

Key findings (with Policy and Practice Implications)

It is crucial to observe children's developing relationships with mathematics early enough to understand trajectories of disengagement from learning

Gender inequalities and stereotypes shape children's developing mathematics relationships and aspirations for future participation at different levels beyond the individual (i.e family, community, classroom and school, regionally and nationally).

There are clear links between gender differences in outcomes and a culture of performativity and associated pressures (e.g. transmissionist pedagogies with an emphasis on attainment which could lead to negative emotions for many students).

Problematizing gender in mathematics education

- Predominant use of male/female biological sex as a proxy for gender – critiqued by Elizabeth Fennema in the 1970s yet in measurement studies at least, biological sex is still dominant. 2.
- A substantial body of work drawing on feminist theories has highlighted gender as a socio-cultural construct that is produced, enacted and performed in classrooms. This rejects binaries of male/female, plus the conflation of (body) sex with masculinity/femininity (gendered construct)
- More recent work highlights importance of intersectionalities - Allows us to think about exclusion or 'being othered' as multidimensional.

Our Methodological Project....

Aims:

- To (possibly) conceptualise and operationalise a better measurement of gender for mathematics education research
 - Non-binary
 - Intersectionality
 - Avoids essentialising

Current focus:

- working out what/how constructs are associated with unequal access and participation in mathematics in classroom (e.g. aspects of pedagogic practice/beliefs about mathematics) & build a measurement instrument from there.
- Such constructs may be different in different classrooms depending on context – e.g. see Cascella et al for work that highlights relevance of place
- Crucially such constructs are theorised as structural as well as subjectively experienced & are likely to operate power hierarchies
- This must involve both survey (measurement) and interviews with young people – one without the other is meaningless!

Questions for Discussion:

- Should we measure gender and why?
- What might a better construct of gender look like?
- How might we conceptualise intersectionalities?
- How might we move away from linear thinking about gender (i.e. as an input variable that influences outcomes) and recognise gender as a dynamic variable that is producing and produced by other outcomes in the mathematics classroom?
 - E.g. Is maths anxiety a gendered position? Or does your gender produce your maths anxiety? Or is it both? Or neither?

References [for the evidence]

- Pampaka, M., & Williams, J. (2016). Mathematics teachers' and students' perceptions of transmissionist teaching and its association with students' dispositions. *Teaching Mathematics and its Applications*, 35 (3), 118-130.
- Pampaka, M. (2021). Establishing Measurement Invariance across Time within an Accelerated Longitudinal Design, in A. Cernat & J. W. Sakshaug (Eds). *Measurement of Error in Longitudinal Data Measurement Invariance* (pp. 405 – 445), Oxford, UK: Oxford University Press.

<https://www.jmc.org.uk/2022/09/26/mathematics-education-5-14-and-gender-summary-report/>