Students' obstacles to “belonging” to the mathematics community

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I loved mathematics and I was good at mathematics; I was also certain I did not have what it took to be a mathematician.

Sara N. Hottinger
Author, *Inventing the Mathematician: Gender, Race, and Our Cultural Understanding of Mathematics*
State University of New York, 2016
We need more mathematicians (especially maths teachers)

We want a diverse mathematical community

We want promising mathematicians to feel they “belong” to the community
What word did successful first year students use to describe how they felt on their first day at university?

TERRIFIED!
Diversity
Need to Diversify

• Mathematics pipeline is important for UK economy
• We have a lot of leaks!
• Many students who were good at maths become disillusioned with A-level or are not considered good enough to do A-level.
A near miss

- I found A-Level maths difficult and interpreted my struggle as a sign that I was not smart enough to succeed. I gave up on a mathematical career and decided to pursue other interests. It was not until two years after I left school that I realised how much I missed it. I worried that I had given up too early and, by counting myself out, had missed the opportunity to do something I loved.

  Robyn Goldsmith (BSc Mathematics graduate and current PhD student at Lancaster University)
Barriers to belonging

- Lack of diverse and relatable role models
- It is not clear what a mathematician does
- No one talks about the state/benefits of being stuck
- It’s assumed that you understand the language used
- The transition from school to university still needs improving
Being stuck

When I first started my degree, I had little confidence in my ability. Believing I did not have what it took to finish, I set a goal to just make it through to the end of the first term. My lecturers at Greenwich were the ones who really changed my outlook. They taught me that being stuck is an essential part of being a mathematician.

I remember one particular conversation where my lecturers spoke about how the most successful mathematicians are stuck for years, if not decades, on just one problem. I learnt then not to be discouraged by finding things difficult and realised that maybe the only person that was holding me back from being the mathematician I wanted to be, was me.

Robyn Goldsmith
How to diversify?

• Whilst many universities will still stick to A-level maths others will need to be aware of other entry requirements that could feed into maths degrees:
  • Core maths
  • T-levels
  • Access courses
• These may need changes to first year modules or a foundation year.
Belonging
Tony’s story

• White, male, straight, middle class, ... every privilege going
• No doubts about my right to belong as a mathematics student

• School sent many to study maths at university
• Teacher recent Cambridge maths graduate
• Well versed in maths notation and culture
• Well trained in exam technique
Contrasts

Tony:
• Financially secure with student grant
• Supportive family all with university experience
• No caring responsibilities
• No health problems
• Lived 2 minutes from lecture rooms

Many of today’s students:
• Must earn money as they study
• First generation at university
• Have children or other caring responsibilities
• May have health problems
• May have long journey to university
Obstacles to belonging

• Lack of role models
• Lack of confidence
• Microaggressions

• See Francis Su’s two short articles on “Mathematical Microaggressions”

• Microaggression: a small but commonplace verbal or behavioral slight that can be insulting in light of one’s identity in a stereotyped group.
Possible microaggressions

(i) Language like “obvious”, “trivial”, “easy”
(ii) Symbols like $\alpha$, $\beta$, $\phi$, $\psi$, ...
(iii) Examples referring to Peter, John, Bill, ...
(iv) Apparent assumptions that “mathematicians” are male, white, ...
(v) Use of gender as example of a binary variable

Other ways to accidentally exclude people:
• Jokes they don’t get
• Cultural references they don’t get
• References to sports they don’t understand

These all lead people to feel they don’t belong!
History and names

• Mathematical history is diverse but most of the mathematicians students hear about in the curriculum are white men

• Names of results can be problematic
  • (“Marriage Theorem”)
  • Some results are named after people with unpleasant views – how do we deal with that?
Assessment

• People are good at different kinds of assessment
• (Sir Roger Penrose needed extra time in exams!)
• Assessment is stressful
• Damaging for health of students and staff
• Do we sufficiently consider how assessment affects diversity?
• 2020 (with no traditional exams) saw the biggest recorded drop in the BAME attainment gap
Belonging to the community

- Communities create their identity through their language, conventions, jokes, etc.
- On the one hand, sharing with students the community’s conventions helps them to acclimatise.
- On the other hand, feeling that they don’t understand may lead them to feel they don’t belong.
- How can we help students feel that they belong to this community?
Conclusion
Conclusion

- We haven’t given answers
- There is tension between helping students getting used to unfamiliar mathematical practices and helping them to feel that they belong
- We should think about microaggressions
- And how to avoid unnecessary barriers
- The world has changed and today’s students don’t have the background some of us had in the past
- To meet the national need for tomorrow’s industries we need to diversify talent
References


• QAA, 2023. Subject Benchmark Statement for Mathematics, Statistics and Operational Research

• Tony Mann, 2023. Assessment as a barrier to inclusion. MSOR Connections 21(1), pp. 4-8.
Thank you.

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