

Barriers for women in UK mathematics academia: their voices

R Dhanda and L E Wadkin. School of Mathematics, Statistics and Physics, Newcastle University, UK.

The problem

Women are still under-represented in mathematics in UK Higher Education, with 42% women at undergraduate level, 19% at PhD level and dropping to only 6% at professorship level [1]. This is often referred to as the ‘leaky pipeline’ (Fig 1). While previous research has quantified and identified some of the structural barriers in place [2, 3], here we seek investigate what work has been done to deepen our understanding of this problem through the exploration of the beliefs, feelings, and experiences of women in mathematics academia.

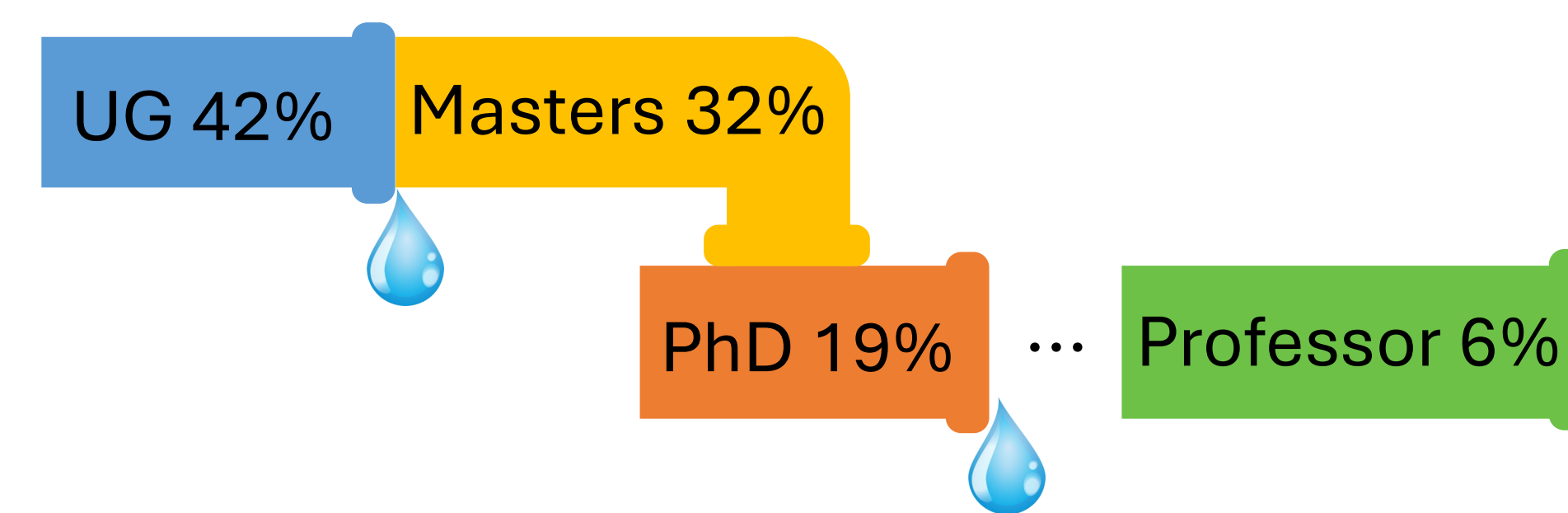


Fig 1: Illustration of the “leaky pipeline”[1].

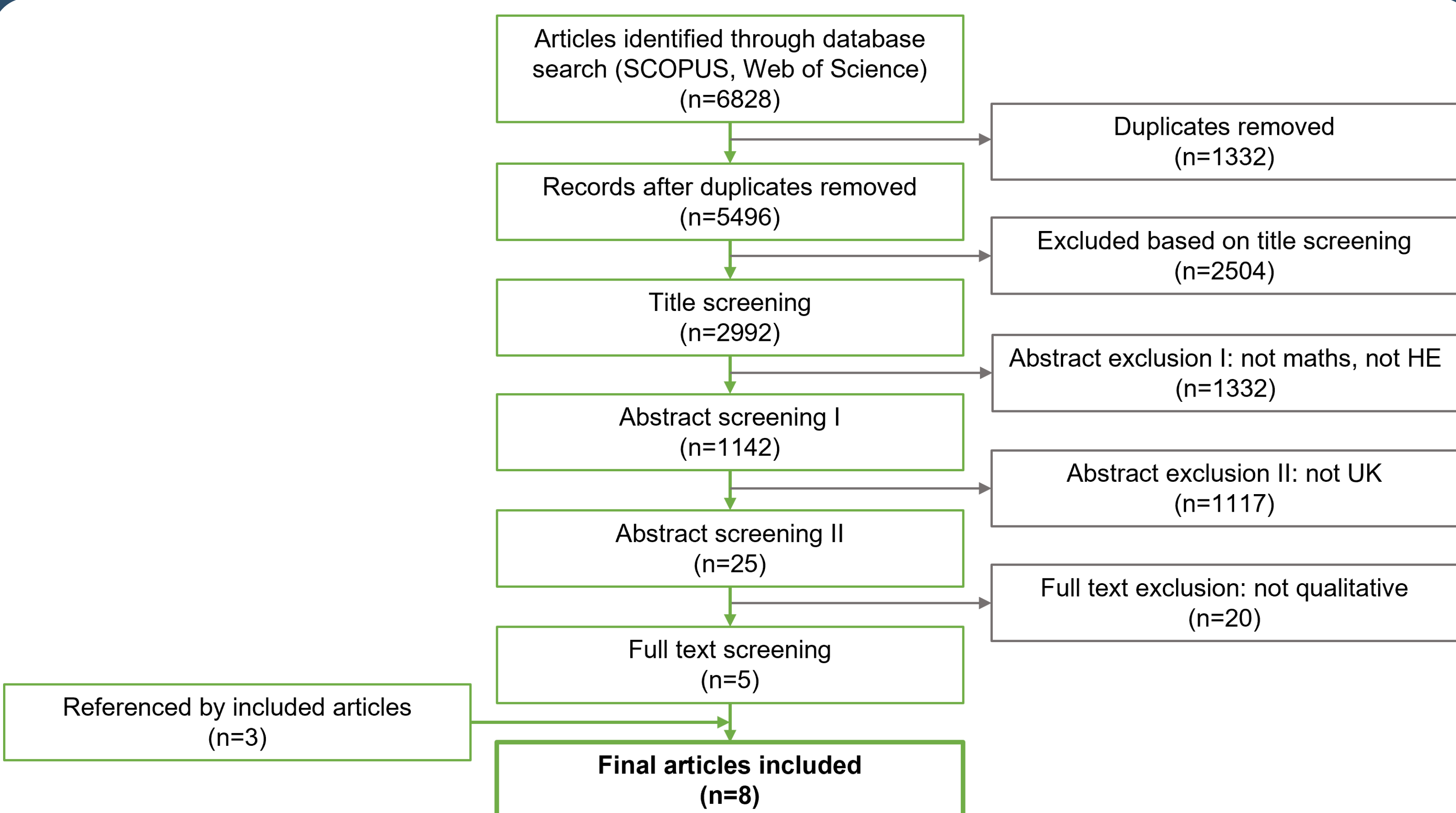


Fig 2: Flow diagram illustrating the search strategy.

Aims

To identify and analyse the relevant literature that explores the ‘leaky pipeline’ of women in mathematics academia at UK universities through qualitative techniques. The objectives are to:

- Identify relevant literature intended to explore the perceived barriers to entry for women in mathematics academia.
- Analyse any common themes in the results of the included studies.
- Identify any gaps in the literature and the priorities for future work.

Methodology

Articles were identified through a database search of both SCOPUS and Web of Science up to 13/07/2021 using the search syntax: (gender OR wom?n OR female) AND (math*) AND (higher education OR universit* OR college OR phd OR masters OR postgrad* OR PGR). The search strategy is shown in Fig 2 resulting in the eight included studies [4-11].

feeling “different”

Women surveyed in the studies [4-8] all cited some feeling of “being different” to their peers for liking and/or being good at maths. Lucy (UG) [4] says “everyone’s called me strange ever since I was a little kid I’ve always liked doing maths”. There were no analogous statements from the males interviewed in the study [4].

gendered roles in learning environments

In studies [4,5,9,10] the authors identified that participants’ roles in learning environments were often along traditional gender lines. For example, female students reported they were less likely to speak up in class than their male counterparts: Rachel (UG) [5] “I don’t like to ask public questions myself... I don’t want to look stupid in front of the rest of the group”.

Common themes

confidence

In all the studies [4-11] participants described a lack of confidence in their abilities. Diane (UG) [5] “I got those questions right but I still didn’t understand what I was doing really”. Roz (PG) [9] “I always feel like I’m struggling”. Anonymous (Lecturer) [10] “I am so inclined not to believe myself” and “at 23 I felt like the thickest PhD student ever, all these men talked, I couldn’t talk”.

relationships with tutors and role models

In studies [4,5,10,11] women reflect less positively on their relationships with tutors: Megan (UG) [5] “they pick on you”, Jess (UG) [5] “he (tutor) doesn’t particularly help you” and Anon (Lecturer) [11] “I never got beyond being intimidated by my supervisor”. A lack of female role models is also reported: Roz (PG) [9] “the only time we ever had a lady lecturer...”.

Other notable themes include the **pre-university experience** [4-6,9-11], **workplace sexism** [11], more **family responsibilities** [11], **competition culture** [9-11] and the relationship between mathematics and **femininity** [6, 8, 9].

Positives?

Many of the participants report a feeling of pride and empowerment by their choice to pursue a male-dominated field [4,5,8,9,11] Sarah (UG) [5] “I used to think that was more a guys’ subject but recently I think that... there are a lot of girls that are good at it as well and they have this natural thing where they are brilliant”. Roz (PG) [9] “I just feel really strongly that I want to do this—feel the fear and do it anyway”.

What next?

This study has highlighted the lack of research focused on documenting and analysing the experiences, thoughts and feelings of female-identifying mathematicians within UK Higher Education. Our literature review found only eight such papers between the years of 1999-2021. We found that literature in this area tended to focus on US universities, different subjects (general STEM or engineering), or pre-university students. Some similar studies have been undertaken for general STEM academics [12] which could inspire similar research focusing particularly on mathematics.

References

- [1] The London Mathematics Society National Benchmarking Study, 2017.
- [2] N. Dasgupta & J. G. Stout, Girls and Women in Science, Technology, Engineering, and Mathematics: STEMing the Tide and Broadening Participation in STEM Careers, *Policy Insights from the Behavioral and Brain Sciences*, 2014.
- [3] L. Howe-Walsh & S. Turnbull, Barriers to women leaders in academia: tales from science and technology, *Studies in Higher Education*, 2014.
- [4] M. Rodd & H. Bartholomew, Invisible and special: young women’s experiences as undergraduate mathematics students. *Gender and Education*, 2006.
- [5] Y. Solomon, D. Lawson & T. Croft, Dealing with ‘fragile identities’: resistance and refiguring in women mathematics students, *Gender and Education*, 2010.
- [6] H. Mendick, M. Moreau & S. Hollingworth, Mathematical Images and Gender Identities, *Research Report Series for UKRC no. 6*, 2008.
- [7] M. Brown & M. Rodd, Successful undergraduate mathematicians: a study of students in two universities. *Proc. of the 28th Conference of the International Group for the Psychology of Mathematics Education*, 2004.
- [8] Y. Solomon, D. Radovic & L. Black, “I can actually be very feminine here”: contradiction and hybridity in becoming a female mathematician. *Educational Studies in Mathematics*, 2015.
- [9] Y. Solomon, Finding a voice? Narrating the female self in mathematics. *Educational studies in Mathematics*, 2012.
- [10] Y. Solomon, Not belonging? What makes a functional learner identity in undergraduate mathematics? *Students in Higher Education*, 2007.
- [11] L. Burton, Fables: The Tortoise? The Hare? The Mathematically underachieving Male? *Gender and Education*, 1999.
- [12] C. Westoby, J. Dyson, F. Cowdell & T. Buescher, What are the barriers and facilitators to success for female academics in UK HEIs? A narrative review. *Gender and Education*, 2020.