

Girls' Participation in A level Mathematics and Further Mathematics

The number of students taking A levels in Mathematics and Further Mathematics in the UK has risen considerably over the last ten years.

Year	AS Mathematics entries	AS Further Mathematics entries	A level Mathematics entries	A level Further Mathematics entries
2004	62 098	3 980	52 788	5 720
2014	162 007	24 402	89 467	14 584

In 2014, Mathematics was the most popular subject at both AS and A level.

Mathematics is now the most popular A level taken by boys and the fourth most popular subject amongst girls, behind English, Psychology and Biology. The participation rates are equally positive at AS level, with Mathematics the most popular subject taken by boys and the third most popular for girls, after English and Psychology. The proportion of students taking Mathematics (AS/A level) who are girls is around 40% and girls also make up around 30% of the AS/A level Further Mathematics cohorts. We believe these proportions should be closer to 50%, as is the case for equivalent qualifications in countries such as the United States of America.

In July 2014, the DfE published **school and college-level data** relating to participation rates of girls in science and mathematics (see Table 1). The three-year **Your Life campaign**, also launched in 2014, aims to increase the number of students taking A levels in mathematics and Physics by 50% within three years (see www.yourlife.org.uk for more information as it becomes available).

Mathematics Hubs are operational from September 2014 with a remit to drive up the quality of teaching and learning in mathematics through the sharing of good practice across local areas and nationally—see www.ncetm.org.uk/resources/44071 for more details. One of the Maths Hubs' priority areas is to focus on strategies for increasing post-16 participation in AS/A level Mathematics and Further Mathematics and the new Core Mathematics qualification. More details about Core Maths can be found at <https://www.ncetm.org.uk/resources/45371>

43% of girls and 65% of boys with an A grade in GCSE Mathematics continue to study Mathematics to at least AS level¹

It is therefore an important time for all stakeholders to consider the role they will play in promoting post-16 mathematics, particularly to girls.

¹ Noyes, A. (2009). Exploring social patterns of participation in university-entrance level mathematics in England. *Research in Mathematics Education*, 11(2), 167–183.



“Science and maths makes you more prepared for life and for business”

*Dr Melanie Windridge
YourLife Campaign*

“Leaders in schools...accepted the stereotypical choices that students made without asking questions”

Girls’ Career Aspirations, Ofsted, 2011



In May 2014, it was announced that future **school performance tables** will include data on the proportion of A level students who take science and mathematics A levels. The data for 2012-13 is available from the www.gov.uk/government/statistics/a-level-and-other-level-3-results-england-2012-to-2013-revised. The data is listed by individual school, institution type, and by region, for boys and girls, in mathematics, further mathematics, physics, chemistry and biological sciences.

The data shows that in 2013, participation in A level Mathematics was highest in the South-East, London, the East of England and the East Midlands. Participation in Further Mathematics was highest in the South -East, South-West, East of England and Outer London.

Region	No. students taking at least one A level	% taking A level	% taking FM A level	No. students taking at least one A level (boys)	% taking A level (boys)	% taking FM A level (boys)	No. students taking at least one A level (girls)	% taking A level (girls)	% taking FM A level (girls)
SE	40 896	27.1	4.5	18 498	36.8	7.5	22 398	19.0	2.0
NW	30 445	23.9	3.4	13 543	32.5	5.6	16 902	17.1	1.6
EE	26 750	25.8	4.1	11 965	36.0	6.9	14 785	17.5	1.9
OL	25 237	33.4	4.8	11 600	42.4	7.5	13 637	25.7	2.6
WM	22 901	24.9	3.2	10 023	34.2	5.1	12 878	17.6	1.7
SW	21 620	24.8	3.9	9 518	34.6	6.8	12 102	17.0	1.7
YH	21 093	22.2	3.2	9 218	31.3	5.5	11 875	15.2	1.4
EM	18 570	25.7	3.6	8 338	35.2	6.0	10 232	18.1	1.6
IL	10 051	27.1	3.1	3 989	38.5	5.6	6 062	19.6	1.4
NE	9 731	21.8	3.3	4 212	31.0	5.9	5 519	14.8	1.4
England*	227 294	26.0	3.8	100 904	35.5	6.4	126 390	18.4	1.8

Table 1 * state funded sector schools only. For all schools and colleges the number of entries was 261,468 and the proportions entered for Mathematics and Further Mathematics were 28.1% and 4.7% respectively.

The regions listed are South East (SE), North West (NW), East of England (EE), Outer London (OL), West Midlands (WM), South West (SW), Yorkshire and the Humber (YH), East Midlands (EM), Inner London (IL), and the North East (NE).

Key findings that can be drawn from these data are:

- Over 25,000 more girls than boys took A levels in 2012-13, meaning the majority (55.6%) of the A level cohort were girls.
- Boys who studied A levels were twice as likely to choose mathematics as girls who studied A levels. Fewer than one in five girls studying A levels in England took mathematics.
- The proportion of boys taking A levels who chose to study further mathematics was around 3.5 times that of girls. Fewer than 2% of girls studying A levels chose further mathematics.
- In the midlands and northern regions, participation in mathematics and further mathematics was below the national average for both boys and girls.

“...the unequal participation of women in STEM identifies a potential source for recruiting more mathematicians”

FMSP/loE Gender Literature Review

Research evidence

As part of the new FMSP contract, the **Institute of Education (IoE)** have researched and produced a literature review of recent national and international findings on gender participation and performance in post-compulsory mathematics.

Prior attainment was found to be the most significant factor in progressing to A level, but boys with the same grade as girls were much more likely to continue to A level than girls, with this disparity becoming more pronounced for students with lower GCSE grades B or C rather than an A or A* grade. Students were more likely to choose mathematics if it was their highest grade at GCSE. With girls attaining more of the A/A* grades across the full range of GCSE subjects, their positioning as ‘all-rounders’ may affect their uptake of A level Mathematics.

Enjoyment was more likely to be cited by girls than boys as a reason for STEM related choices.

Girls have been found to have a lower **self-concept** than boys of the same ability; this is of concern because research shows the degree of match between task performance and self-concept is linked to intention to continue with mathematics.

Students were found to be aware of the **stereotypical images** of mathematicians, but still used them. Female students were also sometimes distanced by presentation of images of successful, attractive female mathematicians, meaning the images had the reverse effect to that intended.

A lack of awareness of the **utility of mathematics** affected students of both genders. Advice and encouragement to continue with mathematics from a teacher or family member was found to be important, and this could mediate the effect of lower self-concept in girls in particular.

Research evidence acknowledges the importance of **socio-economic factors** and the impact of ‘science capital’. Students who had formed an opinion against pursuing maths and science in the future by age 10 were highly unlikely to change their minds by the age of 14, for both genders.

Successful strategies for girls and mathematics: Case Studies

From the Autumn term 2014, IoE are working with FMSP to identify five **case studies** of schools and colleges that are making an impact on improving girls’ participation in mathematics.

We will use teacher and student focus groups to examine strategies and factors that have contributed to effective change in take-up of A level Mathematics and Further Mathematics.

This project will result in recommendations in a case study report for teachers of key stage 4 and sixth-form students.



Recommendations from the literature review include:

- Avoid presenting A level mathematics as a ‘specialist’ subject—emphasise the general benefits of studying the subject.
- Present images of a range of male and female users of mathematics, importantly including those of average ability in addition to high achievers.
- Support female students in developing a more accurate match between task performance and self-concept.
- Teachers should provide students, especially female students, with an incremental view of their ability, where success is seen to follow from effort and failure is both expected at times and redeemable.
- Teachers should embed advice about how mathematics is used in ‘real life’ contexts into lessons to make students aware of the utility of the subject.

Girls taking A-levels in Business Studies, Economics, Geography, Psychology and Sociology would all benefit from studying mathematics as a supporting subject because of the mathematical content of these courses.

FMSP IoE Gender Literature Review

Strategies that senior leaders could implement to promote greater gender balance in the uptake of A level Mathematics and Further Mathematics:

- Use the Department for Education tables to identify the relative participation rate of girls in mathematics post-16 in relation to similar local schools and against the national picture.
- Support the head of mathematics department in identifying and supporting girls in Years 10 and 11 who show the potential and interest in mathematics to progress to post-16 study.
- Present a clear message to staff interviewing and enrolling students to A level courses about the possible barriers that may need to be broken down when recruiting girls to post-16 mathematics courses and provide clear information about the importance of A level Mathematics and Further Mathematics qualifications.
- Provide clear messages to students, and girls in particular, about the wide range of careers and degree courses for which post-16 study of mathematics would be beneficial.
- Engage with parents/carers about the importance of promoting a positive message to girls about progressing to study mathematics post-16.

Heads of Mathematics Departments could increase the focus on gender balance by:

- Considering the gender balance in previous A level cohorts and identifying trends in progression from Year 11 classes (for 11-18 schools) or feeder schools (for sixth form colleges).
- Identifying and supporting Year 10 and 11 girls who show ability and interest in mathematics in progressing to post-16 study.
- Inviting current or previous female A level Mathematics students to speak to younger students about the importance of mathematics in their degree course or future employment, both in STEM and non-STEM fields.
- Joining local networks of teachers to share and develop good practice in promoting high levels of progression to post-16 mathematics.
- Analysing the proportion of girls and boys with an A or A* in GCSE Mathematics who progress to study Mathematics to at least AS level and which factors affect students' decisions.



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The **Further Mathematics Support Programme (FMSP)** is a government-funded initiative supported by the Department for Education and managed by MEI. The FMSP supports schools and colleges at Key Stage 4 and post-16 level to increase teacher expertise and student participation in AS/A level Mathematics and Further Mathematics.

FMSP produce dedicated website content encouraging and supporting girls in participating in Mathematics and Further Mathematics A levels and organise *Celebrating Women in Mathematics* events with female speakers from industry and Higher Education and a range of exciting and engaging activities and workshops.

If you have any comments or queries relating to this publication, please contact Claire Baldwin via email: clairebaldwin@furthermaths.org.uk