

Encouraging Girls' Engagement With And Uptake Of Maths And Physics At A-Level

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The Future of Women in STEM 30 October 2019



Proportion of pupils taking A-level in some science subjects



Source: Department for Education, <u>Statistics: 16 to 19 attainment for England</u>



Proportion of pupils taking A-level, conditional on A/A* at GCSE



Source: Authors' calculations based on a census of pupils in England taking GCSES in 2010.

Why is there a gender gap in maths and physics A-levels? What can we do about it?



We conducted a study aimed at understanding the barriers and facilitators to girls taking maths and physics at A-level

The study focused on high-achieving girls

- Girls predicted to achieve at least grade 7 in maths, physics or combined science GCSE
- These girls have an interest in maths and physics and have the grades necessary to continue studying these subjects
- They might be more likely to be "nudged" into pursuing these subjects

This is not to say that other groups and other routes are not important to consider

We collected novel data



School and pupil online surveys

- School survey administered to Headmaster or Head of Science
- Pupil survey sent in Fall term of Year 11
- Covered many possible factors: teaching, perception of subjects and likelihood of doing well, university and career choices, role models, etc.

Focus groups

- 4 focus groups with 6-8 girls in Bolton, Hull, Birmingham and Portsmouth
- "Things that make you want/not want to study maths or physics at Alevel" to start off the discussions

Sample





What did we learn?



- 1. Teaching
- 2. Confidence
- 3. Male-dominance

Teaching is of high-quality...



Teaching of maths and physics A-level appeared to be well-resourced

- Only one (two) school(s) did not offer maths (physics) at A-level
- A large majority reports all maths and physics teaching is done by specialist teachers
- 73% of schools report assigning their best teachers to A-level

Girls are more satisfied with maths teaching than physics teaching

 76% girls said teaching was very good or outstanding in maths; 38% in physics

But girls are put off by the style of teaching



But they are discontent with the style of teaching and course content

- Too focused on exam preparation
- A lot of difficult material to cover
- Subjects cover breadth rather than depth

"I like the concepts in maths and physics but hate the way they are taught."

Girls also find it intimidating that maths and physics are assessed entirely by an exam at the end of the course

Girls lack confidence in their ability



Girls report concerns about their ability to perform at A-level, particularly in physics

- 50% of girls agree or strongly agree that *"I often worry that it will be difficult for me in physics classes",* compared to 25% for maths
- 80% of teachers agree or strongly agree that "these girls are just as able, but not as confident in their ability to learn STEM subjects as boys"

And they perceive these subjects as very hard



Girls believe ones needs to be "excellent" at physics to take it and that maths and physics are very difficult subjects

"I chose it[maths] but at first I wasn't going to because people kept telling me that it was too hard."

"A-level maths and science are know as the `hardest' A-levels"

Some girls believed that boys are better at maths and physics than girls

"...it's like traditional that boys are really good at maths and physics so I feel quite not as good as the boys because in my class the best people are the boys"

These stereotypes may be reinforced by teaching practices (e.g. boys against girls competitions)

"Male dominance" in the classroom deters some girls



Girls feel intimidated and concerned that they would be in a class of mostly boys both at A-level and university

• Perceptions formed through taster days or speaking to older students

"When I went to computer science at a taster day and I was one of the two girls in the entire classroom and it put me off taking the A-level... I don't want to be in a class again of just mainly boys"

Teachers also cite concerns that the lack of girls taking STEM subjects at A-level is self-reinforcing

 68% of teachers agree or strongly agree that "these girls don't want to/feel discouraged from pursuing STEM subjects at A-level because many of their female peers do not".

Maths and physics are seen as opening doors ________, at university



Girls perceive that maths and subjects were valued more highly on university applications and that they can be used for many careers and university choices

Nevertheless, most girls had decided on course that do not require physics



Which subject would you like to study at university?

Girls are aware of the benefits of STEM careers, but fear they are male-dominated



Girls view STEM careers favourably

- 87% agree or strongly agree that "working in a STEM job would enable me to make a positive contribution to society"
- 92% agree or strongly agree that "working in STEM job would enable me to make a good living"

But girls believe that STEM jobs are difficult to obtain and maledominated

- 49% agree or strongly agree that *"STEM jobs are hard to get, especially for women"*
- 67% agree or strongly agree that *"STEM jobs are male dominated"*

Most teachers agree that girls don't aspire to work in STEM, mostly because *"STEM occupations tend to be male-dominated"*

Lack of STEM role models seems important



Teachers believe that girls do not aspire to work in STEM occupations because they lack female role models working in STEM

- 31% of girls agree or strongly agree with *"I know someone who works in STEM, so I know what to expect from a STEM job"*
- Girls lack informal information about day-to-day aspects and potential downsides
- Insofar as female STEM teachers may serve as important role models, there is some evidence of lower exposure to female physics teachers than to female maths teachers
- 90% of girls have been taught by a female teacher; only 64% in physics
- 34% of schools have no female physics teachers at A-level

Policy implications I



Changing the way maths and physics are taught and assessed could make maths and physics A-levels more appealing to girls

- There may be a need to scrutinise the curriculum and ponder on the need to cover so much and such advanced material at A-level
- There may be a need to move towards more coursework-based assessment
- Engagement activities, such as STEM clubs and work experience in STEM, may be able to shift the perception that it is all about exams
- 98% of teachers think that work experience would be effective or very effective but only 43% of schools have links to businesses in STEM



Interventions to boost girls' confidence, especially in physics, could also play an important role

- Providing girls with tailored statistics on the proportion of girls like them who do go on to achieve an A/A* at A-level
- When should these interventions take place?

Female role models could help break stereotypes and provide much needed information about the day-to-day aspects of STEM jobs

- 98% of teachers think that helping girls to access female role models working in STEM would be very effective or very effective
- 33% of girls who are not going to study STEM at A-level say that meeting women could make them more interested



IFS is starting a large project to better understand these issues

- 1. Collection of data on girls, boys and their parents to understand the role that beliefs, lack of confidence, and stereotypes play in driving the gender gap in subject choices at A-level
- 2. Randomised Controlled Trial to evaluate the "Girls Like Me" programme in 2020-21
- Information sessions for girls and their mothers and delivered by STEM professionals recruited through STEM Learning

THANK YOU!

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