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Encouraging Girls into STEM: what can schools do?

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The share of women achieving tertiary education has increased rapidly over time and now exceeds that of men in most OECD countries. Yet women are severely under-represented in maths-intensive STEM fields (Science, Technology, Engineering and Maths), which are considered to be especially important for productivity and economic growth. The lack of female participation is therefore seen as a constraint on economic growth within the European Union.[1] Furthermore, STEM fields are associated with occupations that have higher earnings. As recently noted by Schleicher (2019), despite the huge growth in women's educational attainment over time, women still earn 15% less than men. An important factor here is that men and women pursue different careers and these choices are often made early in life.

PISA 2018. WHAT DO WE LEARN?

A gender gap in maths-intensive STEM subjects might be understandable if boys were typically much better in maths and science at school. But this is not the case. PISA 2018 shows that whereas the gender gap in reading is huge (favouring girls), gender differences are generally small in maths and science. On average across OECD countries, boys outperform girls by a very small margin in maths but the opposite is true in science. As discussed in Schleicher (2019), it seems that even when boys and girls excel in mathematics or science in PISA, they often have very different expectations for their future occupations. The data shows that more than one in four boys report that they expect to work as an engineer or science professional when they are 30 years old, but this is true of only one in six girls. On the other hand, girls are more likely than boys to say they expect to work as a health professional.

EXPLAINING CHOICES OF GIRLS AND BOYS

The choices made by girls and boys for high school courses will affect how prepared they are to study particular fields within tertiary education. Even though boys and girls might be equally good at maths and science, (say at age 15), choices may nonetheless be affected by how they perceive their *relative* strengths. For example, a girl might veer away from maths-intensive subjects if she believes herself to be much better at more literary subjects. In addition to any objective evaluation of relative strengths, the academic literature suggests that girls often have lower self-efficacy in maths and that this helps to explain differential choices made by girls and boys.[2] In addition, girls tend to dislike competitive situations (especially if they are male dominated) and this causes them to be less likely to enter maths-intensive tracks in upper secondary education.

WHAT CAN SCHOOLS DO?

CONFIDENCE-BUILDING IN MATHS

- Given that girls often suffer from lower self-efficacy in maths (independent of any objective measure), it is important to think of ways in which this may be addressed. For example, there is evidence to support a 'growth mindset' in pedagogical practice. In maths, this is the extent to which individuals believe that their maths abilities can be improved over time with effort, as opposed to being unchangeable. This practice has been shown to be particularly efficacious for girls (Boalar, 2013).
- High school students should be made more aware of their own ability in maths and English because they may be comparing their own performance only to that of people within their class; as opposed to having a true sense of how they stand amongst the broader cohort of students (Delaney and Devereux, 2019).

CURRICULUM DESIGN

- Some countries have introduced reforms to encourage the update of STEM-related subjects in upper secondary

[1] See: https://eige.europa.eu/gender-mainstreaming/policy-areas/economic-and-financial-affairs/economic-benefits-gender-equality/stem

[2] In this context, self-efficacy refers to an individual's belief in his or her capacity to perform well in maths. Even among girls and boys who are highly able and perform equally well in maths, girls have been found to have lower self-efficacy.

school. Although this does tend to enable both girls and boys to be better prepared for tertiary education in STEM, it is often not enough to reduce the gender gap.

- Providing more pre-tertiary experience in computer science, engineering and physics may also be beneficial both for girls and boys. But it won't impact on the gender gap unless deeper issues are addressed about why such subjects differ in their appeal to girls and boys.
- A large international project, "The Relevance of Science Education (the ROSE project)" suggests that females might be prepared for STEM education if comprehensive education programmes wisely exploited knowledge about differences in the interests of girls and boys when designing school curricula (Sjøberg and Schreiner, 2010). For example, boys were found to be interested in explosives and engines, whereas girls were more interested in the environment and healthy living. It is also important to diversify the image of subjects like computer science and engineering such that they are not confined to such a narrow profile (Cheryan et al. 2017). Careers information and guidance (discussed in Policy Brief 3/2020: Addressing the STEM Gender Divide: from school to tertiary education) is also important but the attractiveness of STEM subjects to women is a broader curriculum issue than careers lessons alone.

Female-Friendly Environments

- The 'female friendliness' of educational environments has been shown to matter for girls' propensity to enrol in STEM subjects. Proxies for 'female friendliness' range from the share of female peers to having a female teacher or tutor. As interventions to increase female peers (at its most extreme within single sex schooling) do not always work to influence STEM choices – there is no universal prescription here. But the broad principle that girls respond well to female role models, whether among their peers, teachers or parents is relevant when designing interventions to improve female uptake in STEM.
- It is important to challenge teacher bias, whether conscious or unconscious. Teachers' gender stereotypes have been found to affect gender differences in measured performance in maths and science and in STEM-related choices within high school and beyond (Lavy and Sand, 2018; Lavy and Meglokonomou, 2019).

As these factors work cumulatively and in combination, policy needs to consider a strategic approach that addresses several of these areas. It is also important to be sensitive to the educational context of different countries as the effects of similar policies have been shown to differ across settings.

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For more details see: Sandra McNally. *Gender Differences in Tertiary Education: What explains STEM Participation?* EENEE Analytical Report 41, May 2020, http://www.eenee.de/dms/EENEE/Analytical_Reports/EENEE_AR41.pdf.

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