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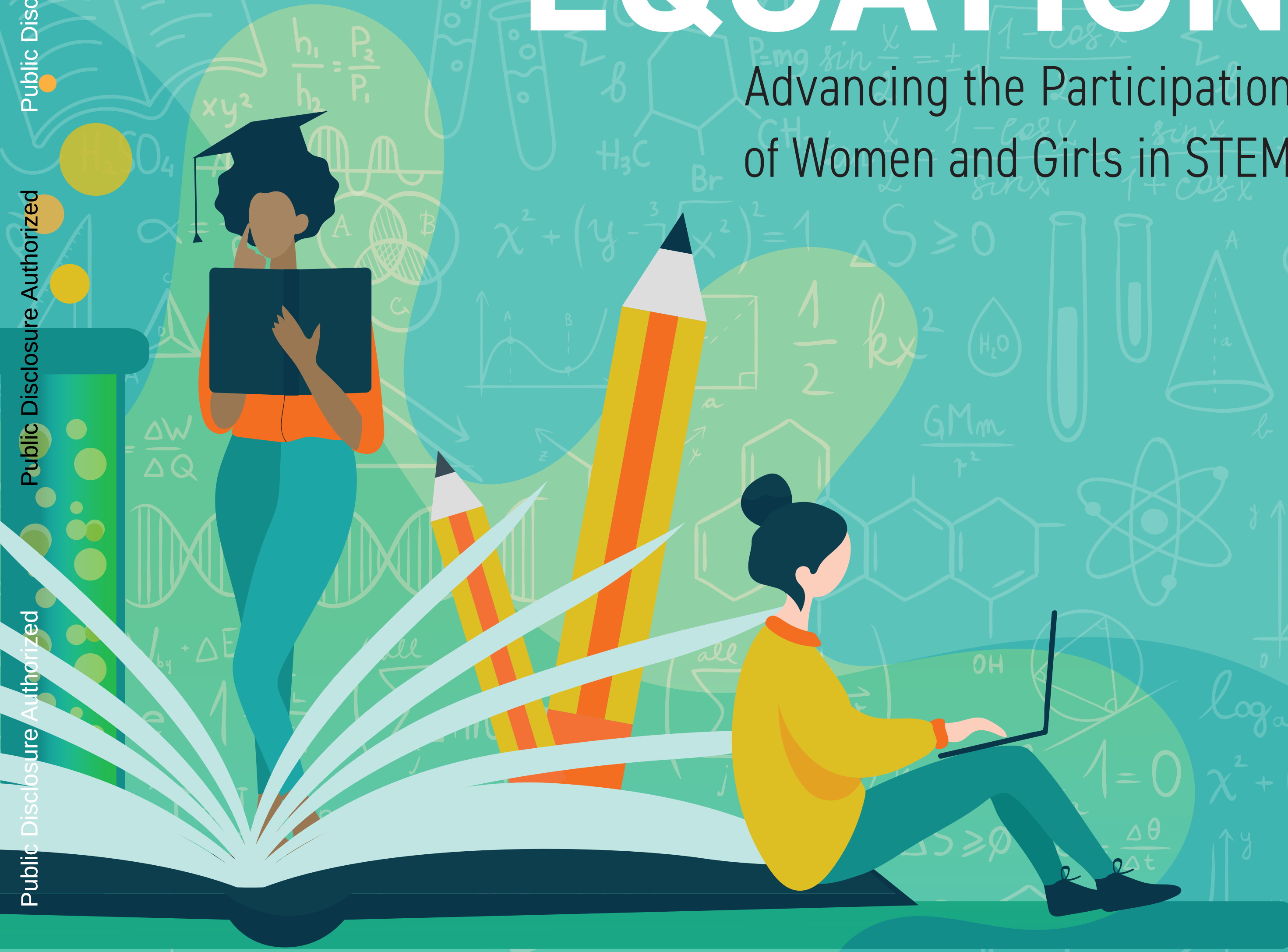
THE EQUALITY EQUATION

Advancing the Participation of Women and Girls in STEM



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Authors & Acknowledgments

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Executive Summary

The economic and social prosperity of countries depends on the state of science, technology, engineering, and mathematics (STEM). Yet, women and girls continue to be underrepresented in STEM studies and careers, although there is wide variation among countries and across STEM fields. Beyond the wage gap that comes with women being underrepresented in STEM jobs, the gender gap in STEM is an inefficient allocation of labor and talent, and a missed opportunity for economies.

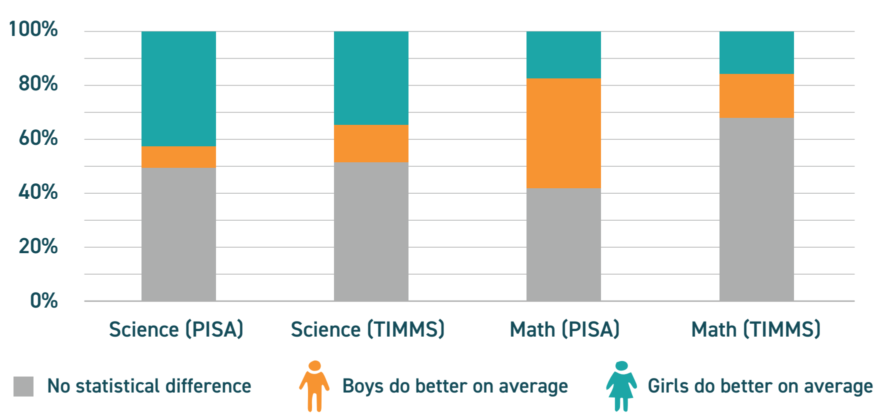
This report explores the participation of women and girls relative to men and boys in STEM-related education and employment through a global, comprehensive review of the evidence. The report focuses on both the drivers and the solutions related to the participation of women and girls in STEM.

IDENTIFYING GENDER GAPS IN STEM EDUCATION AND CAREERS

Globally, girls and boys enroll and complete primary school at about the same rates. Gender gaps in attendance and completion, to the disadvantage of girls, are concentrated mainly in some low-income countries, mostly in Sub-Saharan Africa. In secondary education, in Sub-Saharan Africa, the lower-secondary completion rate is 46 percent among boys compared with 41 percent among girls. On the other hand, in Latin America, girls are 5 percentage points more likely than boys to complete lower-secondary school.

In STEM learning, girls often score equal to or higher than boys in science and mathematics (figure ES. 1). Gaps between boys and girls in the last four decades have closed as a result of both improvements in mean scores of girls and a decline in the scores of boys, especially at the upper end of the distribution. The evidence on Sub-Saharan Africa, though, differs from global averages: boys score significantly higher in mathematics in 14 of the 19 economies.

FIGURE ES.1. Girls do as well or better than boys on science and math tests



Note: See details in Table 1 of report.

At the tertiary level, more women are enrolled in universities and have higher graduation rates than men around the world. Yet, women are significantly less likely to enroll in many (but not all) of the STEM fields. Women are well-represented in the life sciences but not in computer science, engineering, and physics. As country income rises, the gender gap between the likelihood of studying in a STEM field widens. Likewise, this gap increases with measures of greater country gender equality, described as a gender-equality paradox. Scholars disagree on the underlying drivers of this paradox.

The skewed pattern of differences by sex in fields of study translates into occupational sex segregation in the workforce. Even when women study in STEM fields, they are less likely to pursue careers in STEM. Eastern European countries are an exception: STEM educated women and men have similar rates of employment.

To compensate for inadequate STEM labor market data, research careers have been used as a proxy indicator. Relative to the share of women who have attained tertiary education, women's participation in research shows a precipitous drop—although women account for 54 percent of university graduates globally, they represent only 34 percent of researchers. Further, the share of women working in specific areas—data and artificial intelligence, engineering, and computing—is especially low, consistent with the field of study data from universities.

FACTORS THAT DRIVE STEM GENDER GAPS

If the level of enrollment and test scores are not lower for girls and women, what drives the STEM gender gap? A growing body of literature examines the drivers of why women do not pursue STEM studies or jobs, though with the caveat that most studies are from high-income countries, have small samples, and do not use experimental or quasi-experiment approaches.

One strand of evidence points to how stereotypes and biases influence gender gaps in STEM, especially in classrooms and educational materials in many countries. For example, men are more likely to be depicted as professionals in science (whether by name or as an illustration), while women are more likely to be depicted as teachers. Between 8 percent and 20 percent of mathematics teachers in Latin America reported that they believed mathematics is easier for boys. Such biases have been shown to result in lower self-confidence in STEM among girls and women.

These stereotypes and biases extend to tertiary education. Male and female professors in the United States both assigned lower ratings for competence to women compared to that of men among equivalent applications among science students; they considered the women applicants less competent and suitable for the job and offered a lower salary and less mentoring.

Bias and stereotyping also emerge in the home. Surveys show that parents show a greater preference for sons to work in STEM. Additionally, male students disproportionately identified their male peers as more knowledgeable about biology compared to female students who perform better.

Finally, women face more discrimination in the workplace than their male colleagues, especially in more male-dominated STEM fields. This can discourage women from applying for STEM jobs and can drive greater attrition from these occupations.

OPTIONS TO CLOSE GENDER GAPS IN STEM

The leaky STEM pipeline is path dependent, starting early and continuing throughout the life cycle. One starting point is correcting gender biases in learning materials. Additionally, extracurricular activities, such as museum visits, competitions, clubs, and robotics and coding camps, offer promise in building interest, fostering positive attitudes, inspiring greater confidence, and developing relevant skills in STEM studies and careers among both boys and girls. Interest in STEM can be fostered before tertiary enrollment through collaborations between primary and secondary schools and STEM departments at universities.

Few interventions target parents, although parents influence children's achievements and aspirations. Even a one-day event that engages parents of girls in STEM can contribute to reshaping parental attitudes toward the participation of girls in engineering.

Role models provide examples of the kind of success that one may achieve ("I can be like her") and often supply a template of the behaviors necessary for success. At the tertiary level, mentorship from faculty predicts the development of a science identity as well as deeper interest in science and promotes persistence in science fields among female undergraduates. Financial incentives may be another important option for bringing more women into STEM studies in universities.

Female peers also matter. The presence of more female peers in classrooms might help reduce women's implicit bias that engineering is a man's field and help women feel more confident about their own STEM abilities.

Finally, the private sector can play a role by bringing financial support to initiatives, facilitating exposure to female role models, and offering internship opportunities targeting secondary school girls.

LOOKING FORWARD

Notwithstanding the studies reviewed in this report, there are areas ripe for more data and further research, especially from low and middle-income contexts using rigorous methodologies and larger samples.

Starting with the basics, better sex-disaggregated and comparable test scores in primary and secondary levels, and enrollment statistics by field of study in tertiary education would help inform understanding of gender gaps. More rigorous and comparable global data is needed to track male/female gaps in STEM jobs, especially more data on jobs outside of academia. While challenging, building consensus on defining STEM jobs in labor force and other surveys would be of value.

Innovative not-at-scale initiatives need testing and impact evaluation. Interestingly, some recent studies have found that in some male-dominated sectors, male role models help women enter higher-paying industries. However, in the case of STEM, the emphasis has been on female role models who help girls and women overcome negative gender stereotypes. More testing on the relative influence of female versus male role models would enhance the evidence base, as would experiments that seek to influence parents (mothers or fathers) and thereby shift their aspirations for their sons and daughters with regard to STEM.

Finally, greater coordinated engagement with the private sector will be pivotal, both for funding initiatives to get girls into STEM studies but also to understand what works in largely private sector STEM careers.

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