April 2026

Gender Gaps in Mathematics

Society of Family and Gender Economics (GeFam)

Abstract

This GeFam Letter (April 2026) analyzes gender disparities in mathematics performance among Brazilian students. Understanding the characteristics of this disparity is essential, given its implications for various dimensions of gender inequality. To this end, it is crucial to identify when in life these differences begin and which factors—both school-related and environmental—contribute to their persistence. Moreover, given the evidence of a performance gap between boys and girls, it is important to assess how this inequality affects their educational and professional trajectories. Once the problem is understood, it becomes necessary for both the community and public policymakers to reflect on what can be done to ensure that this difference no longer acts as a barrier to the development of boys and girls in Brazil. The analysis presented in this Letter is based on the literature on gender disparities in mathematics, as well as on data from SAEB (Basic Education Assessment System) and the Higher Education Census (INEP).

Highlights

- Gender inequality in mathematics in SAEB
  A gender gap in mathematics performance between girls and boys persists in assessments administered in the 5th and 9th grades of elementary school and in the 3rd year of high school. The gap is more pronounced in the 3rd year, where girls' scores are 6% to 7% lower.
- Gender inequality in mathematics in PISA
  Based on PISA (Program for International Student Assessment) data, girls in Brazil score, on average, 2.1% lower in mathematics. They also report less interest in pursuing careers in science, technology, engineering, and mathematics (STEM).
- Gender gap in mathematics and sociodemographic factors
  The gender disparity in mathematics performance varies according to students' characteristics: it is more pronounced among those whose mothers have lower levels of education and among those living in state capitals and urban areas. The gap is also larger among Black students than among White students.
- Gender gap in mathematics by skill level
  The gender disparity in mathematics also varies by performance level, being more pronounced among students at the top of the skill distribution.

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Society of Family and Gender Economics

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Gender inequality is a multifaceted issue, and one of its manifestations is the difference in performance between boys and girls in mathematics assessments. This inequality, which is more pronounced in the later years of basic education, may have long-term consequences for students' lives. Based on the results of PISA 2022, conducted among Brazilian students aged approximately 15, boys outperform girls in mathematics by eight points, corresponding to a gap of 2.1% (in 2018, the gap was 2.4%). In addition, a smaller proportion of girls report an interest in pursuing careers in STEM (Science, Technology, Engineering, and Mathematics), reflecting gender inequality in mathematics and signaling the emergence of further disadvantages these young women may face in the labor market.

This pattern is also observed in Brazilian schools, according to SAEB (National Basic Education Assessment System), administered by INEP every two years to students in the 5th and 9th grades of elementary school and the 3rd year of high school. Figure 1 presents the average proficiency of boys and girls. The gender gap is less pronounced among 5th-grade students, with boys and girls showing similar average proficiency levels. In the 9th grade of elementary school and the 3rd year of high school, however, this disparity becomes more pronounced. The figure illustrates students' trajectories: they begin their schooling with similar levels of mathematics performance but diverge as they progress.

To better understand how this disparity has evolved over time, Figure 2 presents the percentage difference between boys' and girls' average scores, which we refer to as the gender gap in mathematics performance. For most of the period, the gap is more pronounced in the 3rd year of high school, at around 6–7%. In the 9th grade of elementary school, the gap is intermediate, ranging between 3% and 5%, and shows a downward trend over time. In the 5th grade, the gap is the smallest, at around 1–3%, with a slight increase since 2017, suggesting that performance differences intensify over the course of schooling. In terms of the historical evolution of the gender gap in mathematics, the two most recent assessment cycles—following the COVID-19 pandemic—show a reduction in the gap and convergence across education levels.

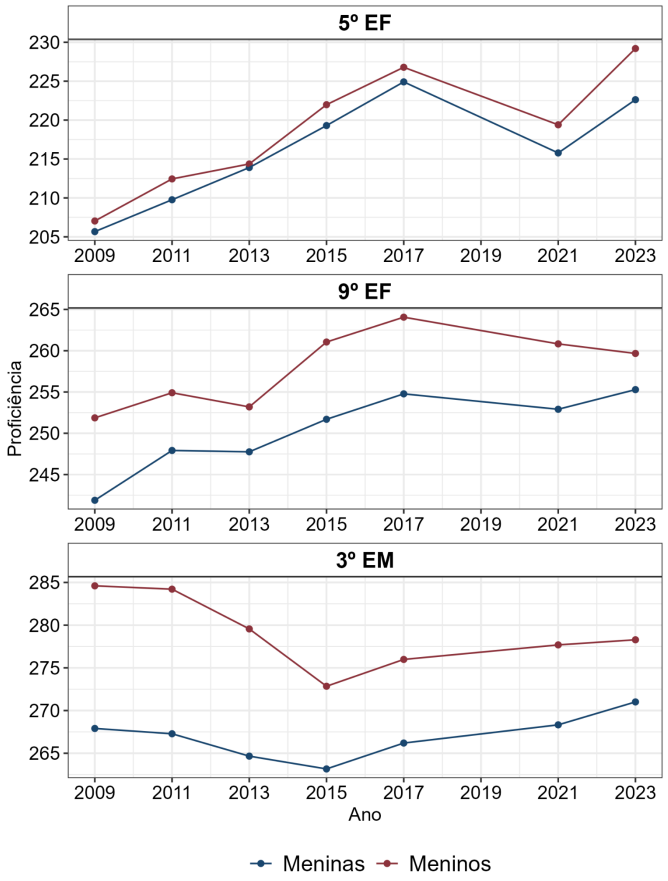

Figure 1 – Mathematics proficiency of girls and boys in the 5th and 9th grades of elementary school and the 3rd year of high school

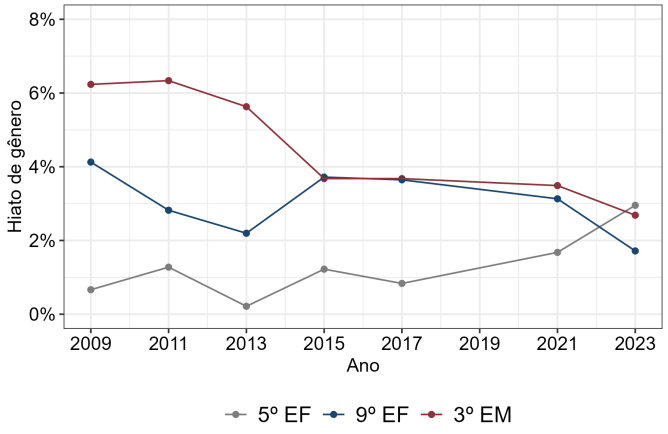

Figure 2 – Gender gap (in %) in mathematics for girls and boys in the 5th and 9th grades of elementary school and the 3rd year of high school

This facet of gender inequality overlaps with others. As shown in Figure 3, it varies according to parental education, school location, and the student's race. Among Black (preto and pardo),

Indigenous, and Asian students, the disparity relative to White students is even more pronounced. A similar pattern is observed across urban and rural areas. By contrast, there is no statistically significant difference between students in state capitals and those in non-capital areas. This suggests that local factors and social expectations may play a crucial role in shaping this inequality.

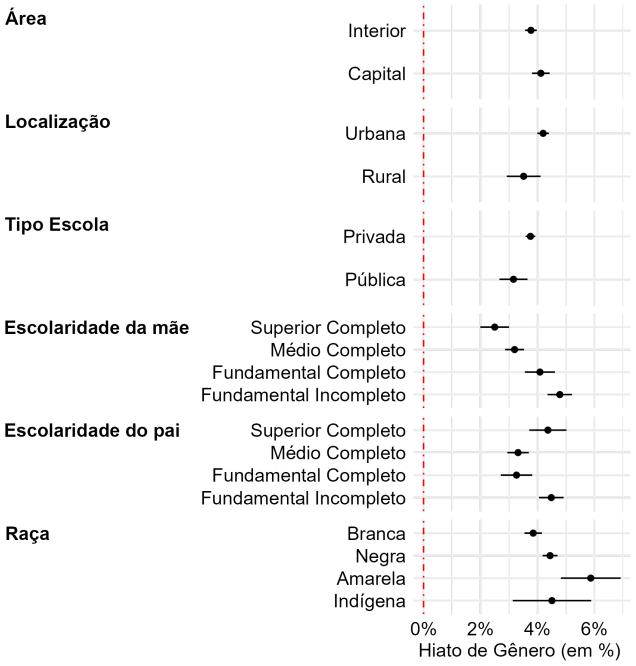

Figure 3 – Gender gap (in %) in mathematics, by sociodemographic characteristics, among 3rd-year high school students

Gender inequality in mathematics also varies by students' performance levels. Among the bottom 10% of students, the gender gap reverses: girls outperform boys across all educational levels in 2023. However, as average scores increase, the gender gap widens among both 5th-grade students and 3rd-year high school students, as shown in Figure 4.

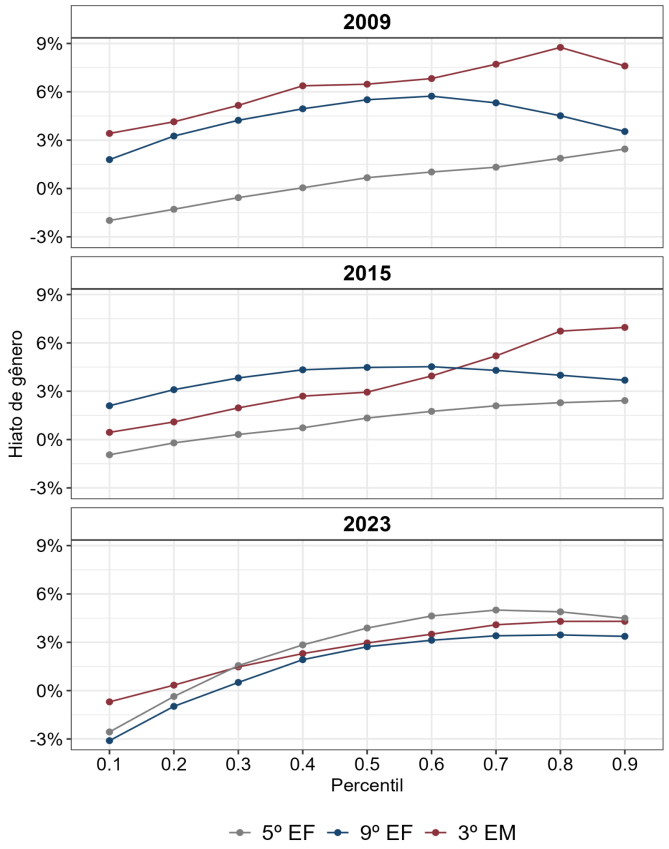

Figure 4 – Gender gap (in %) by score percentile in 2009, 2015, and 2023

Figure 5 shows the gender gap in mathematics performance, comparing boys and girls across different states and stages of basic education in 2023. Overall, the gap tends to widen as students progress through school: while differences across states are smaller in the 5th grade, they become more pronounced in the 9th grade and especially in the 3rd year of high school. In several Southern and Southeastern states, the largest gaps favor boys. These regional differences suggest that both pedagogical and sociocultural factors influence the mathematics performance of boys and girls.

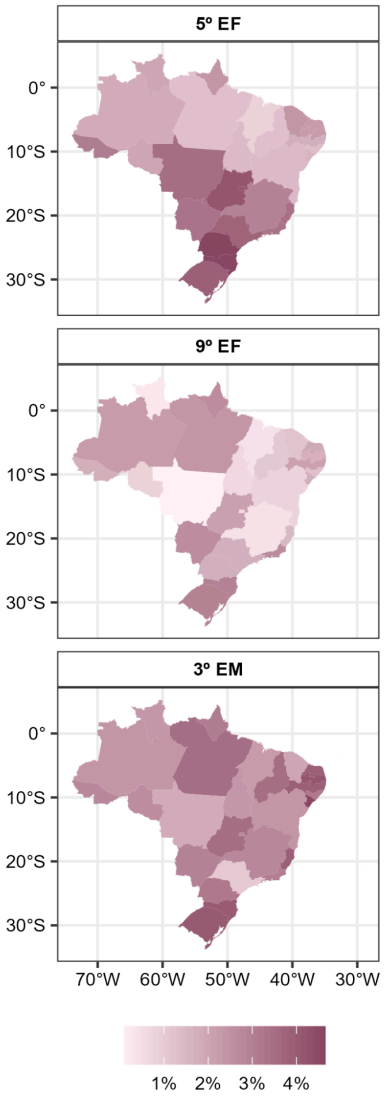

Figure 5 – Gender gap (in %) in mathematics by state in 2023

The economics literature offers several explanations for these disparities. One explanation focuses on cognitive abilities, as boys tend to develop stronger spatial skills (Fennema & Tartre, 1985). However, this theory does not account for the absence of such a gap before school age (Fryer & Levitt, 2010). More recent literature highlights factors such as teachers' gender stereotypes and implicit discrimination (Card & Payne, 2021), parental investment—where parents tend to spend more time with boys (Fryer & Levitt, 2010)—individual preferences (Bharadwaj et al., 2016), and the influence of role models (Breda et al., 2023). Class size and the proportion of boys in a classroom are also considered potential explanations (Gneezy, Niederle, & Rustichini, 2003; Huguet & Regner, 2007; Paredes, 2022).

In addition, non-cognitive skills—such as competitiveness, self-esteem, and confidence in one's relative ability—also play a substantial role in the gender gap in mathematics (Niederle & Vesterlund, 2007). These factors, more closely related to how gender norms affect women, may also support Griselda's (2024) argument that the observed disparity reflects how large-scale tests are administered rather than necessarily indicating differences in actual knowledge between boys and girls.

Nevertheless, further research is needed to fully understand the underlying causes of gender disparities in mathematics, particularly in Brazil.

The consequences of this disparity in mathematics extend beyond the classroom. They are reflected in career choices, particularly in the low participation of women in Science, Technology, Engineering, and Mathematics (STEM) programs. As shown in Figure 6, women's participation in these fields in Brazil remains stable at around 30%. This underrepresentation has important implications for the labor market, as these careers are associated with higher earnings.

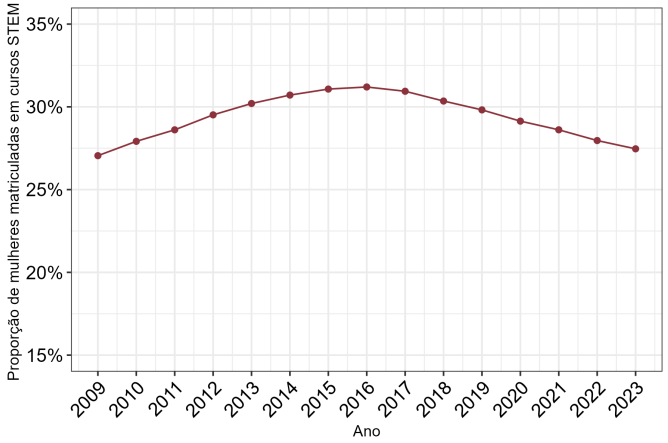

Figure 6 – Proportion of women enrolled in STEM programs between 2009 and 2023

According to the World Bank (Hammond et al., 2020), in the report The Equality Equation: Advancing the Participation of Women and Girls in STEM, several public policy recommendations are proposed to increase the participation of women and girls in STEM fields. One of the main suggestions is to address gender biases in educational materials by highlighting, for example, the biographies of women who have succeeded in

traditionally male-dominated fields, thereby positively influencing girls' career aspirations. In addition, involving parents can help shift family attitudes toward female participation in fields such as engineering. Encouraging participation in extracurricular activities—such as museum visits, competitions, and robotics clubs—is also seen as a promising way to foster interest in STEM among both boys and girls. Moreover, the presence of successful female role models is essential, as it not only inspires young women but also provides examples of behaviors and strategies for achieving success. Finally, the report recommends promoting partnerships with the private sector, which can provide financial support for STEM initiatives, facilitate access to female role models, and create internship opportunities specifically targeted at high school girls.

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Summary of Results and Discussion

The GeFam Letter – April 2026 presents an analysis of gender disparities in mathematics performance among Brazilian students. Based on empirical literature and aggregated PISA data, girls tend to perform worse than boys, as reflected in their career choices.

Using SAEB data, we highlight the persistence of the gender gap, which intensifies throughout basic education, particularly in the 9th grade of elementary school and the 3rd year of high school. Moreover, this inequality varies according to parental education, family structure, location, and students' race, as observed in other dimensions of gender inequality.

The gender gap is nonexistent—or even reversed (with girls outperforming boys)—among lower-performing students, but it widens as performance increases, becoming more pronounced among high-performing students. In addition, the data indicate a correlation between the gender gap in mathematics performance and other dimensions of gender inequality, such as differences in labor market participation between men and women.

The economics literature offers several explanations for these disparities, which, together with the results presented here, underscore the need for further investigation of this phenomenon in order to understand when these differences emerge and how they affect various aspects of students' lives. These patterns illustrate broader gender inequalities, highlighting the need for policies and programs that promote equal opportunities for boys and girls. In this context, in addition to longitudinal research examining gender disparities in mathematics across students' educational trajectories, intervention strategies to reduce these disparities should be encouraged and implemented.