5

How Family, School and Society Affect Boys' and Girls' Performance at School

This chapter examines various factors in the family, the school and throughout society that may be related to gender differences in student performance. These factors include the socio-economic status of a family and parents' expectations for their child, the socio-economic profile of schools and teaching practices at school, and the level of gender equality in society.

Previous chapters detailed some of the attitudes and behaviours that may shape gender differences in reading and mathematics performance, to the extent that many boys underperform in school and many high-achieving girls do not fully realise their potential. Boys are significantly more likely to be among the lowest-performing students – those who score below the PISA baseline level of proficiency in all subjects – largely because of their much greater likelihood of being low-achievers in reading, while girls are less likely to be top performers in mathematics, science and problem solving. Research finds that some family, school and country-level factors can influence boys' and girls' achievement in school.

What the data tell us

- In all countries and economies that distributed the parent questionnaire, parents were more likely to expect their sons, rather than their daughters, to work in a STEM field, even when boys and girls perform at the same level in mathematics.
- PISA does not provide strong evidence that the gender gap in mathematics performance is narrower in households where the mother works in a STEM occupation.
- Boys tend to underachieve when they attend disadvantaged schools.
- In eight countries, teachers' use of cognitive-activation strategies in mathematics courses (when students are required to solve problems themselves) is associated with better performance among girls.
- Greater female participation in the labour market is associated with better mathematics performance among girls.

THE ROLE OF FAMILIES

Research has suggested that boys may be particularly likely to fare poorly at school when they come from socio-economically disadvantaged households (DiPrete and Buchmann, 2013). Because both gender and socio-economic status are risk factors related to achievement and to attitudes towards school and learning, it is important to examine whether each of these risks adds to or amplifies the other.

Results presented in Tables 5.1a, 5.1b, 5.1c, 5.1d and 5.1e show the performance of boys and girls and the gender gap in mathematics, reading, science and problem solving, according to the students' socio-economic status. Results suggest that gender gaps tend to be broadly the same among disadvantaged and advantaged households (socio-economic advantage and disadvantage are defined by whether students are among those in the bottom quarter of the *PISA index of economic, social and cultural status* [ESCS] or in the top quarter of the ESCS index within their country).

PISA also examines whether gender differences in mathematics, reading, science and problem-solving performance are associated with parents' educational attainment and occupation, family wealth and/or household possessions. The results shown in Table 5.2 suggest that in some countries, boys may be at a particular disadvantage when their parents are low-educated

and work in low-skilled jobs, and when the family has few possessions. For example, in Bulgaria, the Czech Republic, Finland, Greece, Israel, Jordan, Lithuania, Montenegro, Qatar and the United Arab Emirates, the gender gap in reading, in favour of girls, is at least 10 score points narrower when comparing boys and girls who come from similar households (Table 5.2).

Having an immigrant background is also associated with differences in performance. The gender gap in mathematics, reading and science tends to be similar among students who have at least one parent who was born outside of the country where they sat the PISA test and among students whose two parents were born in the country (Table 5.3). But in some countries/economies – notably Argentina, Chile and Macao-China – the gender gap in mathematics, in favour of boys, tends to be less pronounced among the children of immigrants. Similarly, in Argentina, Chile, the Netherlands, Peru, Qatar and the United Arab Emirates, the gender gap in reading, in favour of girls, tends to be wider among the children of immigrants.

Parents' expectations for their children

Results presented in Table 5.4 suggest that parents still hold different expectations for their sons and daughters. This could be because parents still harbour stereotypical notions of what women and men excel at and the career they can pursue when they enter the labour market – which is, in turn, related to occupational segregation in the labour market.

In Chile, Croatia, the Flemish Community of Belgium, Germany, Hong Kong-China, Hungary, Italy, Korea, Macao-China, Mexico and Portugal, students who participated in PISA 2012 were asked to take home a questionnaire for their parents to complete. The responses collected allow for more in-depth analyses of parents' attitudes and perceptions. Among other things, parents were asked what occupation they expected their 15-year-old child to work in when he or she is 30 years old.

Figure 5.1 shows that, in all countries and economies that distributed the parent questionnaire, parents were more likely to expect their sons, rather than their daughters, to work in a science, technology, engineering or mathematics (STEM) field (Table 5.4). For example, in Chile, 50% of 15-year-old boys' parents expected that they would work in STEM occupations; only 16% of girls' parents reported so. The gender gap in the percentage of 15-year-old boys and girls whose parents expected them to work in STEM occupations is larger than 30 percentage points in Chile, Hungary and Portugal. In Korea, relatively few students have parents who expected them to work in STEM occupations – 17% of boys and 9% of girls; but even so, the gender gap is a substantial 7 percentage points (Table 5.4). Because STEM occupations generally require a university degree and command high wages, these results are limited to those parents who expected their children to work as managers, professionals or associate professionals, in careers of similar prestige and with similar requirements as STEM occupations.

Results presented in Figure 5.1 and Table 5.4 suggest that gender differences in academic performance do not explain the observed differences in parents' expectations for their sons and daughters to work in STEM fields. These differences are large and significant in all participating countries and economies, even when accounting for students' performance in reading, mathematics and science. As expected, results indicate that parents are more likely to expect

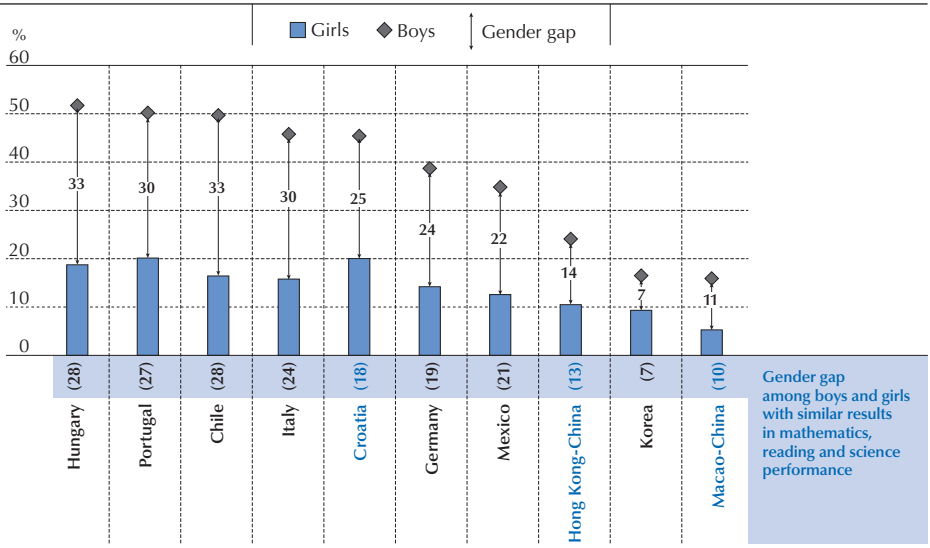
that their children will work in STEM fields if they perform better in mathematics. In Croatia and Italy, parents are less likely to expect their children to work in STEM occupations if they perform better in reading.

PISA results also suggest that in Hong Kong-China, Korea, Macao-China, Mexico and Portugal, when comparing students of similar performance in reading, mathematics and science, students from socio-economically advantaged households are more likely than students from disadvantaged households to have parents who expect them to work in STEM occupations. Italy is the only country where advantaged students are less likely to have parents who expect them to work in STEM occupations. In fact, Table 5.4 reveals that in Croatia and Italy, while boys are more likely than girls to have parents who expect that they will work in STEM occupations, the gender gap in parents' expectations is narrower in advantaged households.

■ Figure 5.1 ■

Parents' expectations for their children's careers

Percentage of students whose parents expect that they will work in STEM occupations



Notes: All gender differences are statistically significant. STEM stands for science, technology, engineering, and mathematics. *Countries and economies are ranked in descending order of the percentage of boys whose parents expect that they will work in STEM occupations when they are 30 years old.*
Source: OECD, PISA 2012 Database, Table 5.4.

The literature often suggests that girls' lack of confidence in their abilities in mathematics and science may be due to an absence of role models. The paucity of women scientists means that young girls have little in the way of tangible evidence to disprove the stereotypical notion that mathematics and science are somehow more "masculine" disciplines. PISA results show that few mothers of 15-year-olds, worldwide, work in STEM occupations; indeed, in all countries and economies there are far fewer women than men employed in these sectors (Table 5.5).

But PISA does not provide strong evidence that the gender gap in mathematics performance is narrower in households where the mother does work in a STEM occupation (Table 5.6). In fact, in Belgium, Bulgaria, Canada, France, Greece, the Netherlands, Qatar, the Slovak Republic, Turkey and Uruguay, the gender gap in mathematics performance, in favour of boys, appears to be much wider among students whose mother works in a STEM field. This apparent paradox may arise from the fact that STEM occupations are generally prestigious and well-paid, and require university-level qualifications. In some countries, advantaged boys perform better across the board. And given the fact that relatively few mothers work in STEM fields, those families with a mother who does work in one of those fields tend to be particularly keen to see their children excel in mathematics. In these cases, both boys and girls benefit from such an environment.

What these results suggest is that many parents still expect their sons and daughters to pursue different occupations, even when they perform similarly in mathematics. While having positive role models is important for girls, many girls who have parents, and mothers in particular, who work in science- and mathematics-related fields often underperform in mathematics compared to boys from similar households. One reason may be the much higher level of anxiety towards mathematics that girls report, and the fact that girls are often more driven to perform well in school and achieve at a high level. High anxiety coupled with high expectations often lead to choking under pressure.

THE ROLE OF SCHOOLS

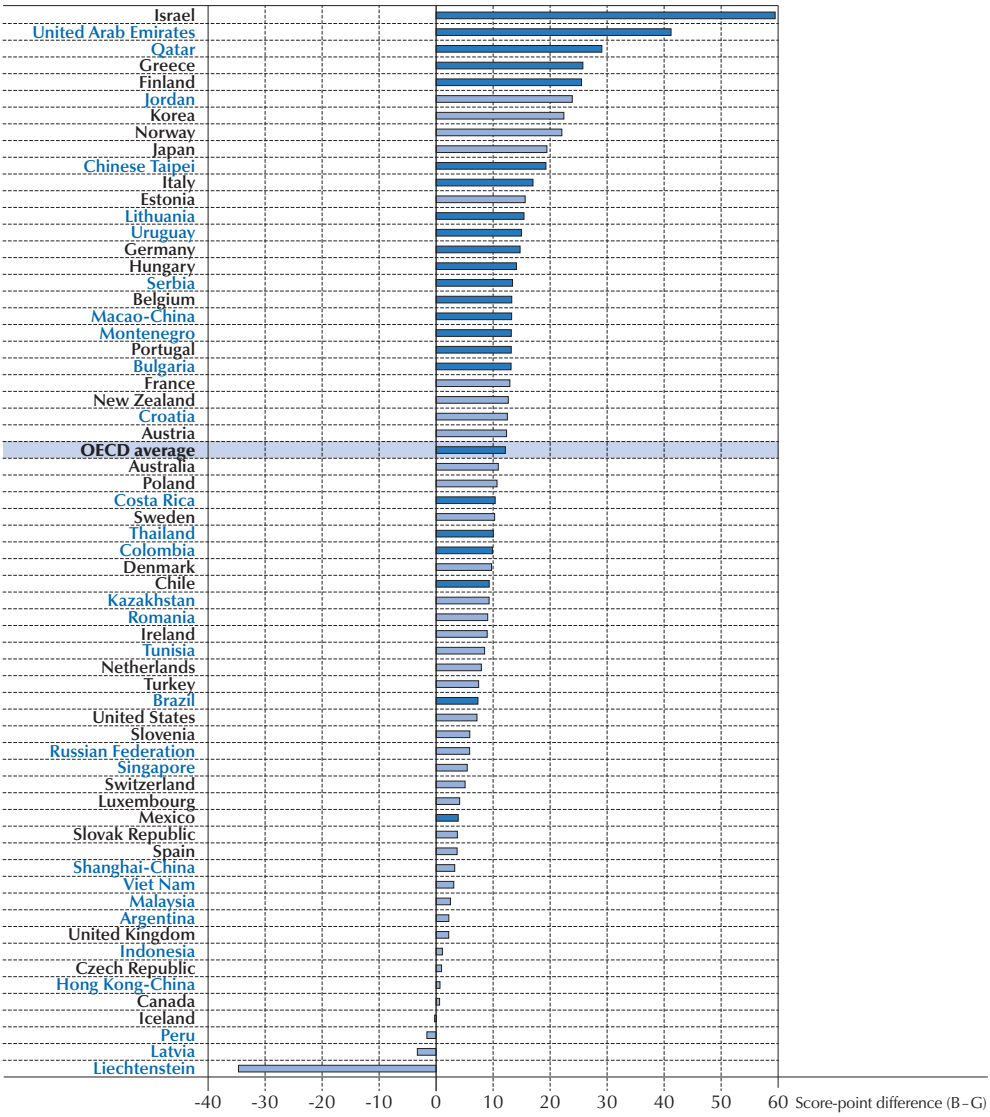
Results presented in the previous section suggest that, in some countries, disadvantaged boys may be at a particularly high risk of underachieving in school, and that parents' expectations and attitudes are related to the gender of their child. This section focuses on schools, and whether the socio-economic composition of their student bodies, the learning environment they establish, and the practices adopted by teachers are associated with gender gaps in performance. The literature suggests that the socio-economic composition of schools and the learning environment are related to the underperformance of boys in reading (Legewie and DiPrete, 2012; Legewie and DiPrete, 2014), and that girls in same-sex schools may perform better in mathematics and be more willing to take risks in their school work (Booth and Nolen, 2012; Pahlke et al., 2014).

There is a large body of evidence on how classmates and friends can influence the academic achievement and the behaviour of individual students (Coleman, 1961; Dornbusch,1989; Akerlof and Kranton, 2002). Peer influence may operate differently among boys and among girls. Some observational and interview studies, for example, indicate that boys often feel that it is "inappropriate" and "contrary to their masculine identity" to show interest in school (Francis, 2000; Paechter, 1998; Warrington et al., 2000). Boys also appear to confront – and succumb to – greater peer pressure to conform to gender identities more than girls do (Younger and Warrington, 1996; Warrington et al., 2000). For boys, this identity is marked by a relative lack of interest in school, in general, and in reading, in particular (Clark, 1995; Smith and Wilhelm, 2002). Girls, on the other hand, may be less likely to be affected by low-achieving peers; but their likelihood of excelling in mathematics and choosing mathematics courses may be influenced by the performance of other girls around them (Crosnoe et al., 2008; Correll, 2001).

■ Figure 5.2 ■

Relationship between schools' socio-economic composition and the gender gap in reading

Additional score points for boys when students attend more advantaged schools

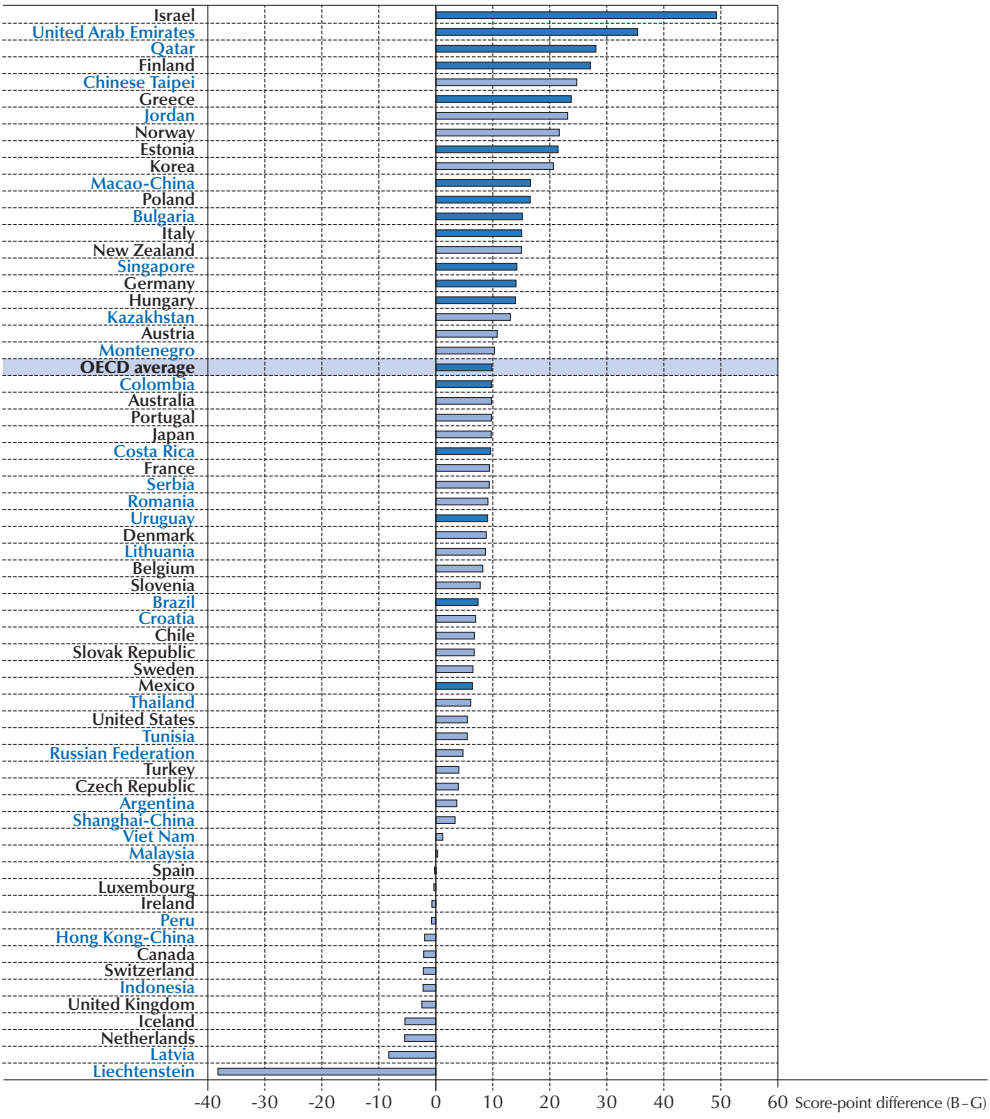


Note: Gender differences that are statistically significant are marked in a darker tone.
Countries and economies are ranked in descending order of the score points in reading added for boys when they attend more advantaged schools (corresponding to a one-unit difference in the PISA index of economic, social and cultural status *of the school).*
Source: OECD, PISA 2012 Database, Table 5.7e.

■ Figure 5.3 ■

Relationship between schools' socio-economic composition and the gender gap in mathematics

Additional score points for boys when students attend more advantaged schools



Note: Gender differences that are statistically significant are marked in a darker tone.
Countries and economies are ranked in descending order of the score points in mathematics added for boys when they attend more advantaged schools (corresponding to a one-unit difference in the PISA index of economic, social and cultural status *of the school).*
Source: OECD, PISA 2012 Database, Table 5.7e.

Results presented in Tables 5.7a, 5.7b, 5.7c, 5.7d and 5.7e suggest that the socio-economic composition of the school a student attends may be more important for a boy's performance than his socio-economic status. Table 5.7e shows that while both boys and girls tend to benefit from attending schools with more advantaged peers, the performance difference that is associated with the socio-economic composition of schools is much more pronounced among boys than it is among girls. In nine OECD countries and in nine partner countries and economies, the gender gap in mathematics performance, in favour of boys, is much wider in advantaged schools (Figure 5.3). Meanwhile, in 10 OECD countries and 13 partner countries and economies, boys' underachievement in reading is less pronounced if their schoolmates are more socio-economically advantaged (Figure 5.2).

The relationship between what happens in the classroom and the gender gap in achievement

Teachers can play a significant role in shaping students' attitudes towards learning, and in encouraging them to work to the best of their abilities, through the teaching strategies they use (Hipkins, 2012; Wigfield, Cambria and Eccles, 2012). Students who participated in PISA 2012 were asked to think about the mathematics teacher who taught their most recent mathematics class and to report the frequency with which the following eight actions occur: the teacher asks questions that make students reflect on the problem; the teacher gives problems that require students to think for an extended time; the teacher asks students to decide, on their own, procedures for solving complex problems; the teacher presents problems in different contexts so that students know whether they have understood the concepts; the teacher helps students to learn from mistakes they have made; the teacher asks students to explain how they solved a problem; the teacher presents problems that require students to apply what they have learned in new contexts; and the teacher gives problems that can be solved in different ways.

Students were asked to report whether these actions occurred always or almost always, often, sometimes, or never or rarely. Student responses were used to develop the *index of teachers' use of cognitive-activation strategies*, which was standardised to have a mean of 0 and a standard deviation of 1 across OECD countries. Higher values on the index suggest that students reported that their most recent mathematics teacher more frequently used cognitive-activation strategies than the most recent mathematics teacher of the average student in OECD countries.

Students were also asked to report how often a series of situations arises during their mathematics lessons. Students' reports on whether these situations arise in every lesson, in most lessons, in some lessons, or never or hardly ever, were used to develop three indices reflecting teachers' use of different strategies to foster student learning: the *index of teacher-directed instruction*, the *index of teachers' student orientation*, and the *index of teachers' use of formative assessment*.

- The *index of teacher-directed instruction* was constructed using students' reports on the frequency with which, in mathematics lessons, the teacher sets clear goals for student learning; the teacher asks students to present their thinking or reasoning at some length; the teacher asks questions to check whether students understood what was taught; and the teacher tells students what they have to learn.

- The *index of teachers' student orientation* was constructed using students' reports on the frequency with which, in mathematics lessons, the teacher gives different work to classmates who have difficulties learning and/or to those who can advance faster; the teacher assigns projects that require at least one week to complete; the teacher has students work in small groups to come up with a joint solution to a problem or task; and the teacher asks students to help plan classroom activities or topics.
- The *index of teachers' use of formative assessment* was constructed using students' reports on the frequency with which, in mathematics lessons, the teacher tells students how well they are doing in mathematics class; the teacher gives students feedback on their strengths and weaknesses in mathematics; and the teacher tells students what they need to do to become better in mathematics.

Results shown in Figure 5.4 and Table 5.8a suggest that teachers' use of cognitive-activation strategies in mathematics courses is associated with better performance in mathematics. In eight countries, the performance difference tends to be particularly wide among girls, while among boys in these countries it is either not associated with performance at all or the association is much weaker than it is among girls. For example, in Germany, a one-unit change in the *index of teachers' use of cognitive-activation strategies* is associated with a difference of 11 points in mathematics among girls but no difference among boys. In Italy, the difference is 10 score points among girls and 5 points among boys, while in Poland it is 17 points among girls and 8 points among boys. By contrast, teachers' use of formative assessment and student orientation in mathematics class was not positively associated with mathematics performance (Tables 5.8b and 5.8c).

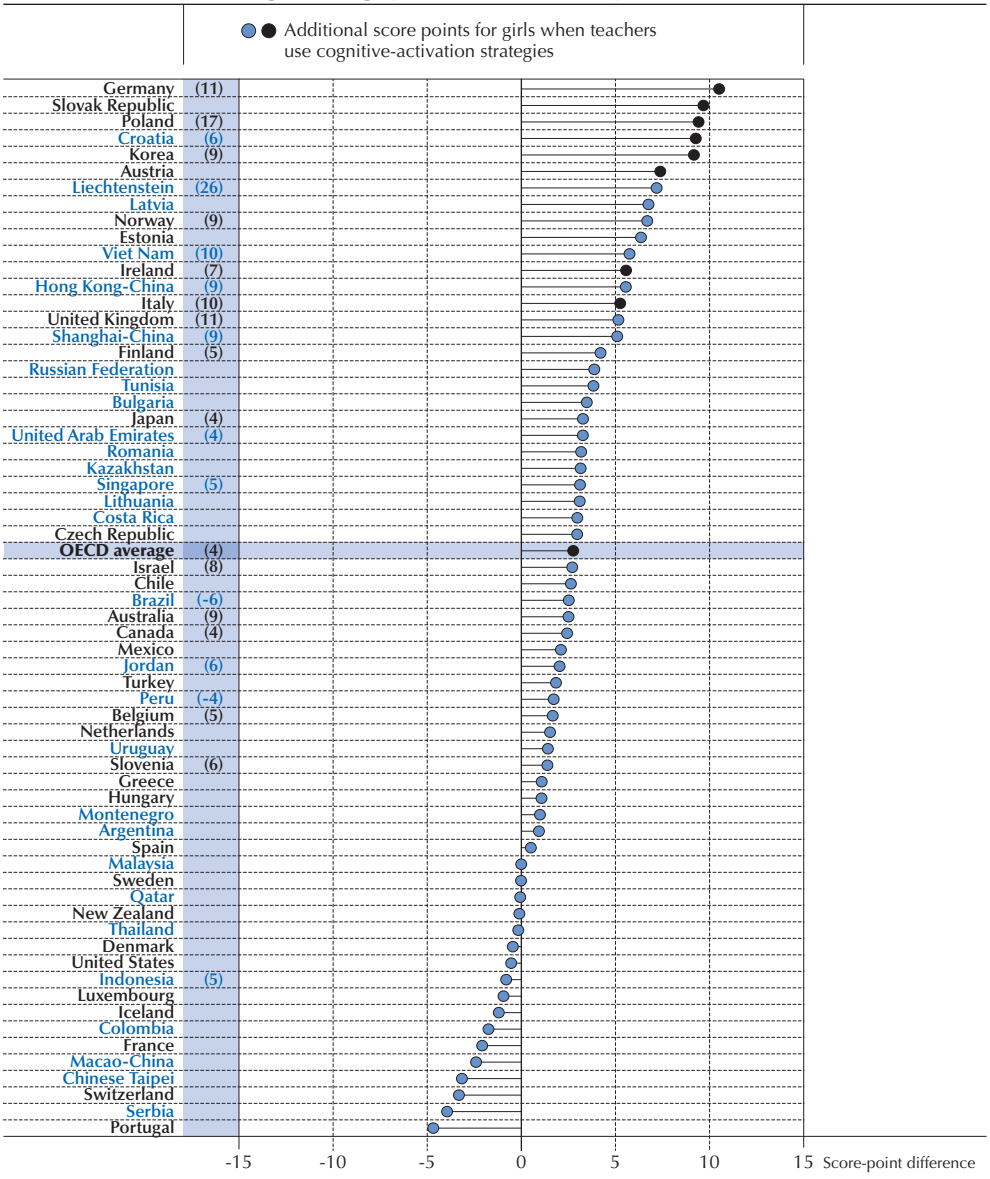
Data from PISA 2009 reveal that teachers' use of practices aimed at stimulating their students' enjoyment of reading – such as asking students the meaning of a text, asking questions that challenge students to get a better understanding of a text, giving students enough time to think about their answers, recommending a book or author to read, encouraging students to express their opinion about a text, helping them relate the stories they read to their own lives, and showing students how the information in texts builds on what they already know – is positively associated with reading achievement in 42 countries and economies. That positive relationship is as strong among girls as it is among boys in all but three countries (Table 5.9).

THE IMPACT OF SOCIAL NORMS

PISA results show how students' attitudes towards learnings, their beliefs in their own abilities, and their parents' encouragement can all influence how they perform at school. But do the broader norms in society – the kinds of practices and attitudes that create and perpetuate gender stereotypes – have an impact on gender differences in student performance? If a society discourages women from working outside the home, for example, will young girls in that society be more likely to abandon their studies or be unwilling to work hard to achieve at school? If boys see that being a star at sports is a more lucrative pursuit than being able to read the contract they hope one day to sign, will they choose to spend their afternoons at the sports field instead of with their books?

■ Figure 5.4 ■

Role of teachers' use of cognitive-activation strategies in narrowing the gender gap in mathematics performance



Notes: Gender differences that are statistically significant are marked in a darker tone.
Statistically significant gender differences in mathematics associated with the *index of teachers' use of cognitive-activation strategies* are indicated next to the country/economy name.
Countries and economies are ranked in descending order of the score points added for girls when teachers use cognitive-activation strategies.
Source: OECD, PISA 2012 Database, Table 5.8a.

Previous studies (Guiso et al., 2008; González de San Román and De la Rica Goiricelaya, 2012) find that countries with greater gender equality – as measured by the level of women's participation in the labour force, women's political empowerment, gender differences in who does the housework, and general attitudes towards women's equality – also tend to have narrower gender gaps in mathematics performance, although still in favour of boys, and wider gender gaps in reading, in favour of girls.

Table 5.10a examines the relationship between the level of gender equality at the country level and student performance by looking at two factors: women's participation in the labour force and an index of gender-equal attitudes in the country. The former uses the rate of labour force participation among women aged 35 to 54 to reflect gender equality in employment within the generation of individuals who are the parents of the students who sat the PISA test in 2012. The latter is an index of attitudes towards women based on data gathered through the World Value Survey.

The World Value Survey is an international survey that examines people's values and beliefs across countries. It was first conducted in 1981 and included six waves in 2014, with a different set of countries surveyed over the various waves. The index measures the level of disagreement with the following four statements that appear in the World Value Survey: "When jobs are scarce, men should have more right to a job than women"; "Being a housewife is just as fulfilling as working for pay"; "Men make better political leaders than women do"; and "A university education is more important for a boy than a girl". The level of disagreement varies between 1 and 4 with higher values indicating more gender-equal attitudes.

An analysis of PISA data from the 41 countries with information on relevant country-level indicators finds that students in more economically developed countries do better in reading, mathematics and science than those in less-developed countries, and this association is particularly strong among boys. After accounting for a country's level of economic development and women's participation in the country's labour force, those countries with greater gender equality tend to perform worse in reading, mathematics and science, but this negative association is less pronounced among girls. At the same time, in countries where a larger proportion of women participates in the labour force, girls perform better in mathematics – even to the extent that the gender gap in mathematics performance narrows considerably – while boys' performance in mathematics is little, if at all, affected.

A wealth of studies have shown a positive association between women's empowerment, gender-equal social norms, labour force participation and economic development (Guiso et al., 2008; González de San Román and De la Rica Goiricelaya, 2012; McDaniel 2012; Nollenberger et al., 2014; OECD, 2012a). The results suggest that the economic, social and political payoffs stemming from greater gender equality and participation of women in the labour market are good for students too; but they also imply that when women assume a more active role outside the home, men are not necessarily filling the void.

For example, previous PISA analyses have revealed the importance of parents reading to their children at an early age (OECD, 2012b). Boys tend to be lower performers in reading and tend to be less likely than girls to read for enjoyment. They may need more encouragement than girls

to become better readers. When women play a more active role in the labour market, parents may have less time at home to devote to parent-child activities, such as reading together. In these societies, boys may be most at risk of underperforming, particularly in reading. These results may mean that, even though full gender equality in society and the labour market has yet to be achieved, there is even more work to be done to build societies in which both men and women can play an active role in the labour market *and* be fully engaged in the lives of their children.

The finding that girls' performance in school tends to benefit from greater gender equality in the society as a whole, while boys' performance is little, if at all, affected may mean that standard measures of gender equality reflect women's empowerment rather than truly gender-neutral attitudes and norms. Just because more women work outside the home doesn't mean that men and women (or boys and girls) enjoy equal opportunities – at work, at school or in society, in general. Achieving gender equality in education thus requires more gender-neutral attitudes: encouraging both boys and girls to read more, encouraging both boys and girls to solve mathematics problems, and encouraging both men and women to share care responsibilities at home more equitably (OECD, 2012a).

Note regarding Israel

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

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