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Emerging Gender Gaps in Education

This chapter examines trends in achievement among girls and boys and identifies the school subjects – and the specific sets of skills associated with those subjects – in which boys and girls appear to excel – or fail.



Over the past century, OECD countries have made significant progress in narrowing or closing long-standing gender gaps in many areas of education and employment, including educational attainment, pay and labour market participation. This one fact implies another: that aptitude knows no gender. Given equal opportunities, boys and girls, men and women have equal chances of fulfilling their potential.

But new gender gaps are opening. Young men are significantly more likely than young women to have low levels of skills and poor academic achievement, and are more likely to leave school early, often with no qualifications. Meanwhile, in higher education and beyond, young women are under-represented in the fields of mathematics, physical science and computing, but dominate the fields of biology, medicine, agriculture and humanities (Osborne et al., 2003; Charles and Grusky, 2004).

Many boys find school out of sync with their interests and preferences and, as a result, often feel disaffected and not motivated to work in school. Given the findings of the 2012 Survey of Adult Skills¹ – that poor proficiency in numeracy and literacy severely limits access to better paying and more rewarding occupations, and has a negative impact on health and on social and political participation (OECD, 2013) – the underachievement of young men has severe consequences not only for their own futures (Erikson et al., 2005; Rose and Betts, 2004), but for societies as a whole (OECD, 2010). Indeed, poor performance in school is a strong predictor of early school dropout, which is related to far worse social outcomes later in life (Balfanz et al., 2007; OECD, 2010; Oreopoulos, 2007; Rumberger, 2011).

What the data tell us

- Across OECD countries in 2012, 14% of boys and 9% of girls did not attain the PISA baseline level of proficiency in any of the three core subjects.
- In 2012, boys outperformed girls in mathematics in 38 participating countries and economies by an average of 11 score points (across OECD countries) while no gender gap was observed in science performance. However, among the top 10% of students in mathematics performance, the gender gap averages 20 score points; and among the top 10% in science, boys score an average of 11 points higher than girls.
- Only 14% of young women who entered university for the first time in 2012 chose science-related fields, including engineering, manufacturing and construction; by contrast, 39% of young men who entered university that year chose to pursue one of those fields of study.

There are other, and considerable, social costs associated with low-performing students. If a large share of the workforce does not have basic skills, the long-term growth of an economy is compromised. Public finances may be squeezed to fund social benefits and higher healthcare costs. Moreover, since low-performing students are less likely to engage politically later on, the government has fewer incentives to unearth and examine the roots of their underperformance at school.



According to a recent estimate based on data from the OECD Programme for International Student Assessment (PISA), there would be massive long-term economic gains for OECD countries if reforms to reduce the number of low-performing students were implemented today (OECD, 2010).

Equality of opportunity for men and women is first and foremost a moral imperative; but it is also key to economic growth and well-being. Investments in education improve economic and social opportunities, helping to reduce poverty and foster technological progress. The overall increase in educational attainment in OECD countries over the past 50 years accounted for about 50% of the economic growth in those countries during that period; and more than half of that growth can be attributed to higher educational attainment among women. In addition, education – especially education for girls and women – reduces child mortality rates, improves individual health and, in doing so, promotes investment in the education and health of future generations (OECD, 2012).

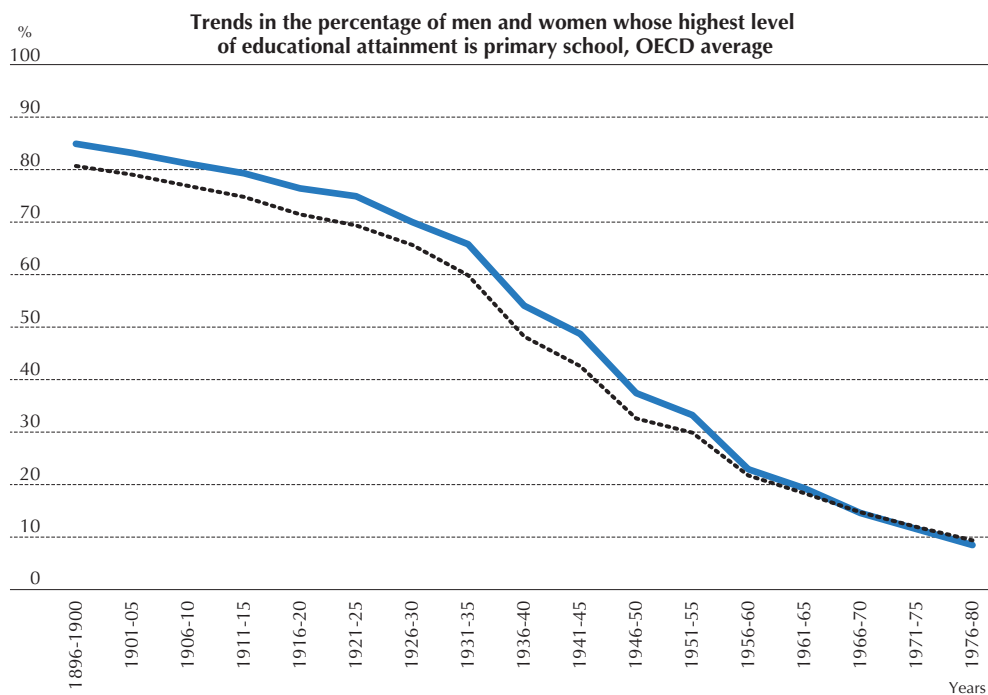
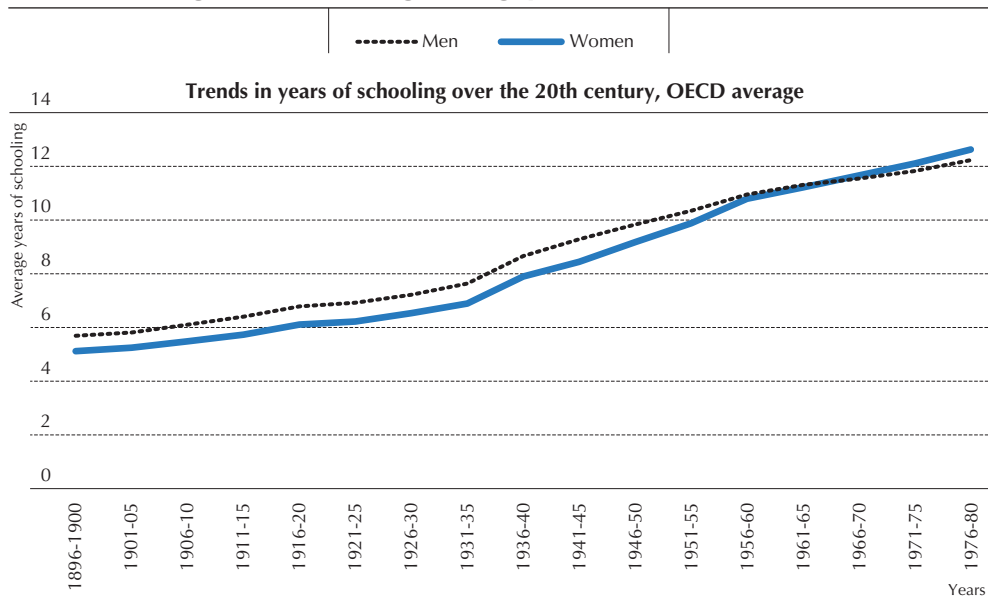
Progress in addressing gender segregation in occupations has been far slower (Sikora and Pokropek, 2011). Yet reducing occupation segregation could pay off in a couple of important ways. First, segregation suggests that there are impediments to choosing an occupation that are related to gender. Identifying and removing such impediments may improve efficiency in the transition from school to work, since then all students will feel encouraged to pursue studies in the field that interests them and in which they can fully express their potential. As a result, participation in the labour market will grow. Dismantling such barriers can also help the economy to respond to rapid changes in the demand for skills stemming from technological change. In addition, greater occupation equality may help to eliminate gender stereotypes that have a negative impact on the status of women (Anker, 1997).

To tackle the double disadvantage of having too many boys who drop out of school or leave school with low skills and/or skills that are not well matched with labour market requirements, and not having enough students, particularly female students, enrolled in the science, technology, engineering and mathematics (STEM) fields of study, countries need first to understand why there are gender gaps in academic achievement. Knowing how boys and girls develop their skills while at school and what factors – including such intangibles as behaviour and self-confidence – influence their decisions about their future education and career pathways is critical. Only then will educators and policy makers be able to ensure that each individual has the opportunity to realise his or her potential. Only then will countries be able to develop strong, dynamic and inclusive economies, particularly as they confront the economic, demographic and fiscal challenges that are sure to arise in the years ahead.

HISTORIC PROGRESS IN YOUNG WOMEN'S EDUCATION

Figure 1.1 shows that, since the early 1900s, the average number of years spent in education among the working-age population in OECD countries increased from 6 to 12 years for men and from 5 to 13 years for women. As OECD countries have made education compulsory, usually between the ages of 5 to 7 and 14 to 16, attaining secondary education has become the norm for men and women.

■ Figure 1.1 [1/2] ■

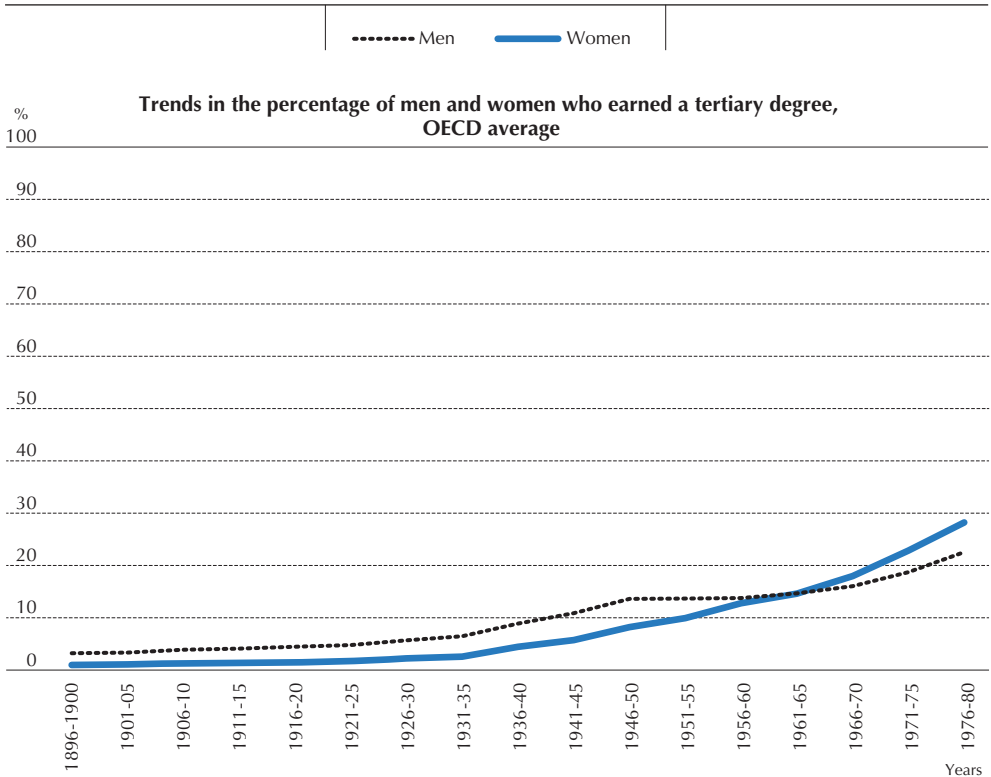
Long-term trends in gender gaps in education, 1896-1980

Source: Barro and Lee, 2013.



■ Figure 1.1 [2/2] ■

Long-term trends in gender gaps in education, 1896-1980



Source: Barro and Lee, 2013.

Not only are more young women than ever before participating in formal education and enrolling in higher education, over the past decade the gender hierarchy in educational attainment has been inverted. In 2000, adult men had higher tertiary attainment rates than adult women; but by 2012, that had changed: 34% of women across OECD countries had attained a tertiary education compared with 30% of men (Table 1.1a). That same year, more young women (87%) than young men (81%) had graduated from an upper secondary programme (Table 1.1b). This trend is even more striking among students younger than 25. In 2012, 54% of graduates from upper secondary general programmes were women and 43% were men of that age group, on average. In Austria, the Czech Republic, Italy, Poland, the Slovak Republic and Slovenia, women outnumbered men as upper secondary graduates by at least three to two (Table 1.1b). Women are also participating more in advanced research programmes. In 2010, the proportion of advanced research degrees awarded to women ranged between 40% and 50% in most OECD countries (Table 1.1c).



Young women are even making inroads into some education pathways that had traditionally attracted mostly men. Graduation rates from pre-vocational and vocational upper secondary programmes have been higher among men (50%, on average across OECD countries) than among women (46%, on average) (Table 1.1b). But in recent years, this trend has reversed in some countries. For example, in 2012 in Belgium, Denmark, Finland, Ireland, the Netherlands and Spain, the proportions of young women who graduated from upper secondary pre-vocational and vocational programmes were at least 5 percentage points larger than the proportions of men who did.

And, as results from PISA have shown, girls do very well in school, too. In all countries and economies that participated in PISA 2012, girls outperformed boys in reading by an average of 38 score points (across OECD countries) – the equivalent of one year of school – as they have done consistently throughout all the PISA cycles since 2000. Boys, however, continued to outperform girls in mathematics in 38 participating countries and economies by an average of 11 score points (across OECD countries) – equivalent to around three months of school. PISA also reveals that there is very little difference in science performance between boys and girls (Tables 1.2a, 1.3a, 1.4a).

The changing landscape in education and labour markets has been accompanied by major shifts in what young boys and girls expect for their future. Over the past decade, PISA has asked the 15-year-old students who sit the triennial test in reading, mathematics and science to describe what they expect for their future education and occupation. Their reports suggest that girls hold more ambitious educational and occupational expectations than boys. At the same time, not only do boys seem less ambitious than girls, they are also more likely – far more likely – to expect that their formal education will end after earning an upper secondary degree, even when they do just as well as girls on the PISA assessment.

What these results imply is that, in the shadow of the progress that has been made in both education and employment over the past century, other problems are festering.

LOW-PERFORMING BOYS

Among the countries and economies that showed a gender gap, in favour of boys, in mathematics performance in 2003, by 2012 the gender gap had narrowed by nine PISA score points or more in Finland, Greece, Macao-China, the Russian Federation and Sweden. In Greece, while boys outperformed girls in mathematics by 19 points in 2003, by 2012 this difference had shrunk to 8 score points. In Finland, Macao-China, the Russian Federation, Sweden, Turkey and the United States, there was no longer a gender gap in mathematics performance favouring boys in 2012 compared to 2003. In Austria, Luxembourg and Spain, the gender gap favouring boys widened between 2003 and 2012. For example, in Austria in 2003, there was no observed gender gap in mathematics performance; but by 2012 there was a 22 score-point difference in performance in favour of boys. Iceland was one of the few countries where girls outperformed boys in mathematics in 2003; in 2012, girls still outperformed boys, but the gender gap had narrowed (Table 1.3b).



While a narrower gender gap in mathematics, in favour of boys, is undeniably good news, it comes as the result of a worrying trend: many low-performing boys are failing to improve. In Latvia, Portugal, the Russian Federation and Thailand, the share of girls who perform below proficiency Level 2 shrunk between 2003 and 2012 with no concurrent change in the share of low-performing boys. In Macao-China and the Russian Federation during the period, the share of top-performing girls increased with no such increase among boys. In addition, Italy, Poland, Portugal and the Russian Federation show a reduction in the share of girls who perform below Level 2 and an increase in the share of girls who perform at Level 5 or 6 (see Table I.2.2b in OECD, 2014a).

Across all three of the core school subjects that PISA assesses – reading, mathematics and science – and across all PISA-participating countries and economies, girls are as likely as boys to be academic all-rounders, meaning that they score at PISA proficiency Level 5 or 6 in all subjects. On average across OECD countries, 4% of girls and 4% of boys are academic all-rounders, meaning that they are top performers in all three subjects. But while the gender gap among students who are top performers only in science is small (1% of boys and girls), it is large among top performers in mathematics only (3% of girls and 6% of boys) and in reading only (3% of girls and less than 1% of boys) (Table 1.7).

Stark gender differences are observed among the lowest-performing students – those who score below PISA proficiency Level 2, which is considered to be the baseline level of proficiency, in all subjects. While the proportion of girls is marginally larger than that of boys among poor performers in mathematics, in all but six countries, a larger proportion of boys than girls does not even achieve the baseline level of proficiency in any of the three PISA core subjects. In fact, six out of ten students who are low achievers in all three subjects are boys (Table 1.8).

Results presented in Figure 1.2 suggest that, across OECD countries, boys are 4 percentage points more likely than girls to be low-achievers in reading, science and mathematics. In 2012, 14% of boys and 9% of girls did not attain the PISA baseline level of proficiency in any of the three core subjects. The percentage of boys who failed to reach the baseline level of proficiency in any subject is worryingly high in many countries. More than one in five students in Chile, Greece, Israel, Mexico, the Slovak Republic and Turkey failed to make the grade in any of the three core PISA subjects. Among partner countries and economies, the proportions are even larger. In Indonesia, Jordan, Peru and Qatar more than one in two students failed to make the grade.

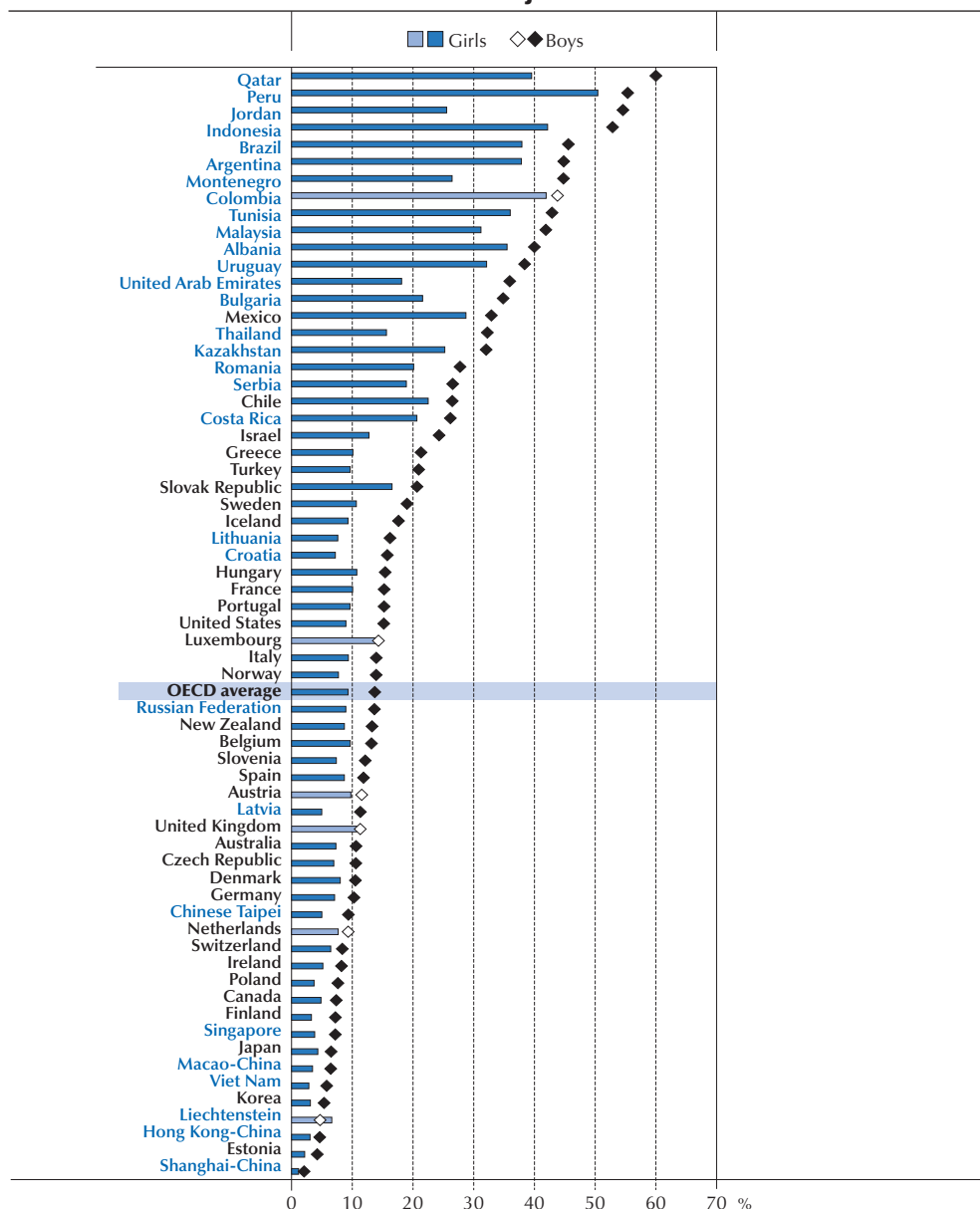
The proportion of girls who failed to make the grade is much smaller. Peru is the only country that participated in PISA 2012 where more than one in two girls did not reach the baseline level of proficiency in any of the three subjects. In Chile and Mexico, more than one in five girls failed to make the grade in all three subjects, and in eight partner countries, more than one in three girls failed to make the grade (Table 1.8).

Among OECD countries, gender differences were particularly large in Israel, where the proportion of boys who scored below the baseline level in all three subjects was 12 percentage points larger than the proportion of girls with similar scores. The gender gap was 11 percentage points wide in Greece and Turkey, and more than 10 percentage points wide in the partner countries Bulgaria, Indonesia, Jordan, Malaysia, Montenegro, Qatar, Thailand and the United Arab Emirates.



■ Figure 1.2 ■

Gender differences in the percentage of students who are low achievers in all subjects



Note: Gender differences that are statistically significant are marked in a darker tone.

Countries and economies are ranked in descending order of the percentage of boys who are low performers (below PISA proficiency Level 2) in reading, mathematics and science.

Source: OECD, PISA 2012 Database, Table 1.8.



The sizeable number of boys who fail to make the grade in all three core PISA subjects is a major challenge for education systems. Students who perform poorly in all subjects are hard to motivate and keep in school because there is very little that teachers, school principals and parents can build on to promote improvement. Because of their very low levels of skills, these students may also feel disconnected from and disengaged with school. It may then become easier for these students to build an identity based on rebellion against school and formal education than to engage and invest the effort needed to break the vicious cycle of low performance and low motivation.

As Chapter 2 shows, boys' behaviour, both in and outside of school, has a strong impact on their performance. Education systems in most countries appear to be unable to develop learning environments, pedagogical practices and curricula that relate to and engage the interests and dispositions of many teenage boys. What emerges from the analyses in Chapter 4 on the skills of adult men and women suggests that once young men have opportunities to practice their skills in real-world settings, they often thrive and pick up some of the skills, like reading skills, that they had failed to develop while at school.

HIGH-PERFORMING GIRLS

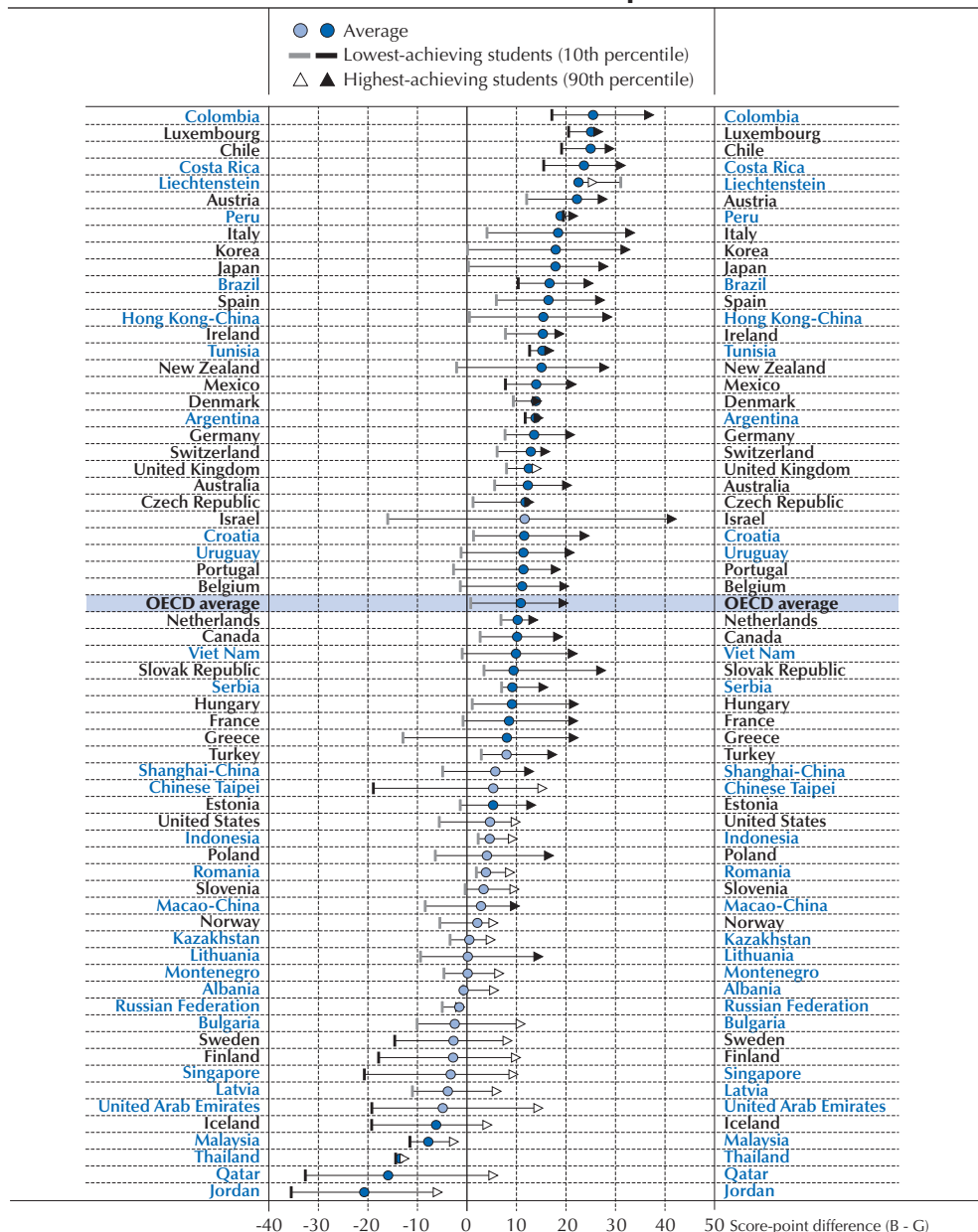
Across OECD countries in 2012, women were awarded only a small proportion of university degrees in the fields of engineering, manufacturing and construction (28%) and computing (20%). Only in Estonia, Iceland, Italy, Luxembourg and Poland – and the partner countries Argentina and Colombia – was at least one in three graduates from these fields a woman (OECD, 2014b). This situation has changed only slightly since 2000, despite many initiatives to promote gender equality in OECD countries. In 2000, the European Union established a goal to increase the number of university graduates in mathematics, science and technology by at least 15% by 2010, and to reduce the gender imbalance in these subjects. So far, however, progress towards this goal has been marginal. The Czech Republic, Germany, Portugal, the Slovak Republic and Switzerland are the only five OECD countries in which the proportion of women in the broad field of science (which includes life sciences, physical sciences, mathematics and statistics, and computing) grew by at least 10 percentage points between 2000 and 2012. As a result, these countries are now closer to or even above the OECD average in this respect. Across OECD countries, the proportion of women in these fields has grown slightly, from 40% in 2000 to 41% in 2012 – even as the proportion of female graduates in all fields grew from 54% to 58% during the same period (Table 1.1d).

Although the proportion of women in engineering, manufacturing and construction is small, it also increased slightly, from 23% to 28%, over the past decade. But in 2012, only 14% of young women who entered university for the first time chose science-related fields, including engineering, manufacturing and construction; by contrast, 39% of young men who entered university that year chose to pursue one of those fields of study (Table 1.1e). This is significant not only because women are severely under-represented in the STEM fields of study and occupations, but also because graduates of these fields are in high demand in the labour market and because jobs in these fields are among the most highly paid (OECD, 2012).



■ Figure 1.3 ■

Gender differences in mathematics across the performance distribution



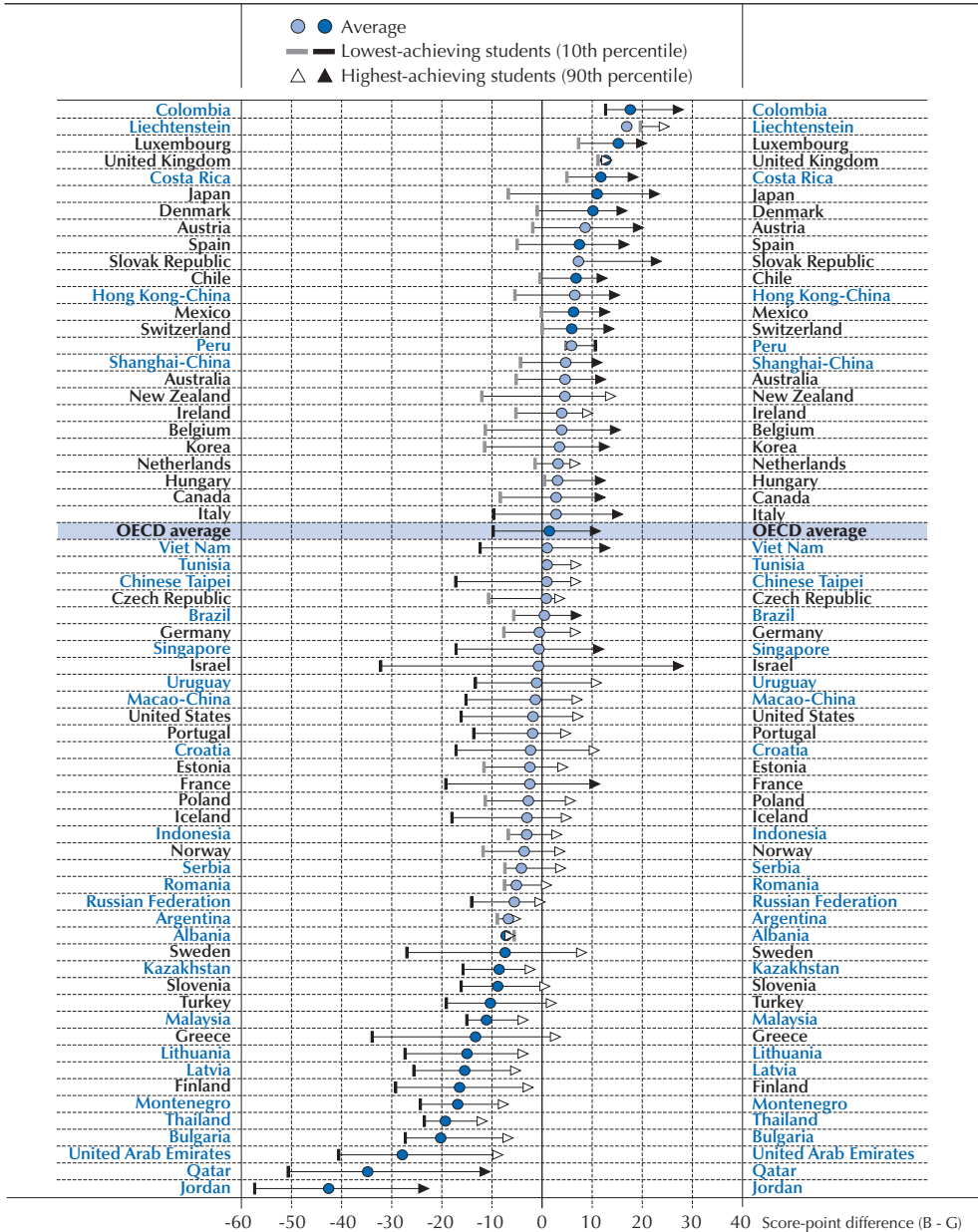
Note: Gender differences among each group that are statistically significant are marked in a darker tone. Countries and economies are ranked in descending order of the score-point difference between boys and girls (boys - girls) among average students.

Source: OECD, PISA 2012 Database, Table 1.3a.



■ Figure 1.4 ■

Gender differences in science across the performance distribution



Note: Gender differences among each group that are statistically significant are marked in a darker tone.

Countries and economies are ranked in descending order of the score-point difference between boys and girls (boys-girls) among average students.

Source: OECD, PISA 2012 Database, Table 1.4a.

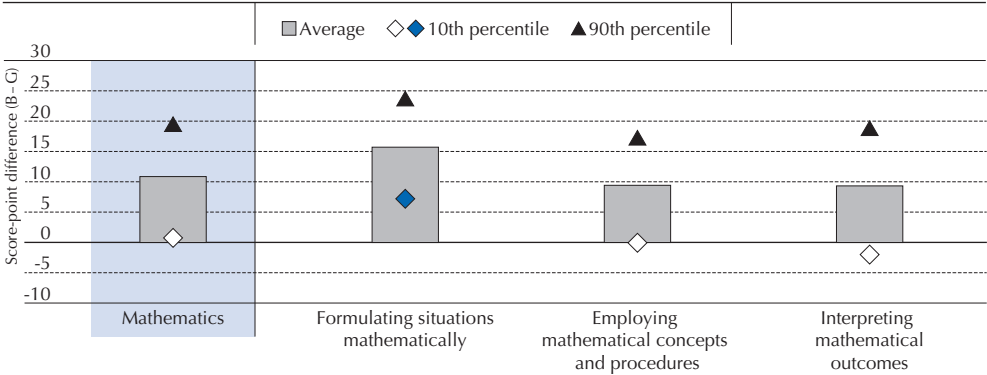


PISA results show that boys continue to perform better than girls in mathematics, particularly among the highest-achieving students. While gender differences in science and problem-solving performance are small, on average, boys tend to be over-represented among the highest achievers. As noted above, in PISA 2012 boys outperformed girls in mathematics in 38 participating countries and economies by an average of 11 score points (across OECD countries); but among the top 10% of students in mathematics performance, this gap is as wide as 20 score points, on average across OECD countries (Figure 1.3 and Table 1.3a). In science, among the best-performing 10% of students, boys have an advantage of 11 points over girls. Only in Jordan and Qatar do high-achieving girls have better scores in science than high-achieving boys. On average, however, girls outperform boys in science in 16 countries and economies, while boys outperform girls in 10 countries and economies (Figure 1.4 and Table 1.4a).

A closer look at girls' performance in mathematics and science reveals that girls still lag behind boys in being able to "think like scientists". For example, girls tend to underachieve compared to boys when they are asked to formulate situations mathematically, translating a word problem into a mathematical expression (Table 1.10a). On average across OECD countries, boys outperform girls in this skill by around 16 points, while the average gender gap in mathematics as a whole is 11 score points. The largest differences in favour of boys are observed in Luxembourg (33 points), Austria (32 points), Chile (29 points), Italy (24 points), New Zealand (23 points) and Korea (22 points). Ireland, Mexico and Switzerland show a gender difference of 20 points, while the United States shows a gender gap of 8 points. Among partner countries and economies, boys outperform girls in this skill by 33 points in Costa Rica, and by between 20 and 30 points in Brazil, Colombia, Hong Kong-China, Liechtenstein, Peru, Tunisia and Uruguay. In several partner countries and economies, the gap is less than 10 points: Macao-China (9 points), Shanghai-China (8 points), Kazakhstan (7 points) and Montenegro (6 points). Only in Qatar do girls outperform boys (by 9 points) in this specific skill (Table 1.10a).

■ Figure 1.5 ■

Boys' and girls' strengths and weaknesses in mathematics
Score-point difference between boys and girls, OECD countries



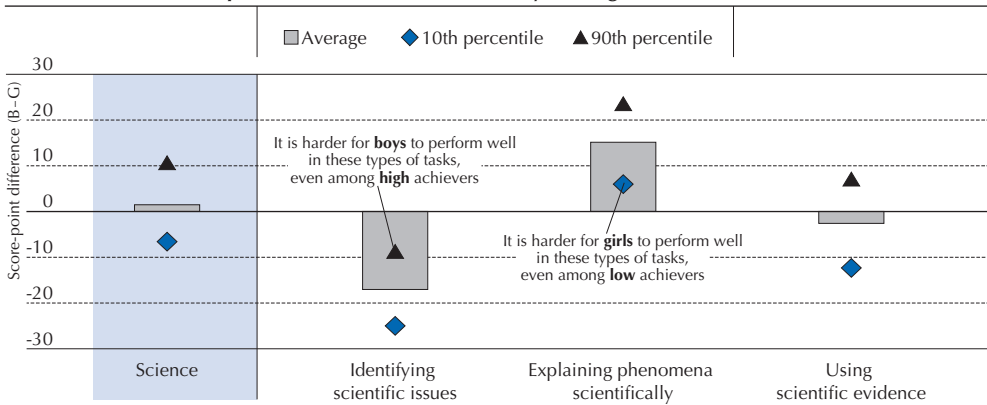
Note: Gender differences that are statistically significant are marked in a darker tone.
Source: OECD, PISA 2012 Database, Tables 1.3a, 1.10a, 1.10b and 1.10c.



■ Figure 1.6 ■

Boys' and girls' strengths and weaknesses in science

Score-point difference between boys and girls, OECD countries



Note: All gender differences are statistically significant.

Source: OECD, PISA 2006 Database, Tables 1.4b, 1.11a, 1.11b and 1.11c.

Girls also lag behind boys when they are required to explain phenomena scientifically (Table 1.11b). Boys' strength in science lies in their greater capacity, on average, to apply their knowledge of science to a given situation, to describe or interpret phenomena scientifically and predict changes. On average across OECD countries, boys outperform girls in this specific skill by 15 score points. The gender gap is particularly large in Chile (34 score points), Luxembourg (25 points), Hungary and the Slovak Republic (both 22 points), and in the Czech Republic, Denmark, Germany and the United Kingdom (21 points) (Table 1.11b).

The analysis presented in Chapter 3 suggests that high-performing girls' underachievement in mathematics and science, particularly in tasks that require them to formulate problems mathematically or to explain phenomena scientifically, may have a lot to do with girls' confidence in their own ability in these subjects. When students are more self-confident, they give themselves the freedom to fail, to engage in trial-and-error processes that are fundamental to acquiring knowledge in mathematics and science. Girls tend to be more fearful of making mistakes, perhaps because they cannot distinguish, psychologically, between "I made a mistake" and "I am mistaken".

Self-confidence is also what enables high-achieving students to reach their potential and not choke under pressure. PISA reveals that self-efficacy (the extent to which students believe in their own ability to solve specific mathematics tasks) and self-concept (students' beliefs in their own mathematics abilities) are much more strongly associated with performance among high-achieving than low-achieving students (see Chapter 3); but at every level of performance, girls tend to have much lower levels of self-efficacy and self-concept in mathematics and science. For example, among students who perform at Level 5 or 6 in mathematics, boys have much higher levels of mathematics self-efficacy and mathematics self-concept, and much less mathematics



anxiety than girls (Table 3.6c). And while girls have less self-efficacy and lower self-concept, they tend to be highly motivated to do well in school and to believe that doing well at school is important (Table 2.15). They also tend to fear negative evaluations by others more than boys do, and are eager to meet others' expectations for them. Given girls' keen desire to succeed in school and to please others, their fear of negative evaluations, and their lower self-confidence in mathematics and science, it is hardly surprising that high-achieving girls choke under (often self-imposed) pressure.

WHAT HAPPENS AS GIRLS AND BOYS PURSUE FURTHER EDUCATION OR WORK

The underachievement of boys in reading and in completing secondary and tertiary education, and the underachievement of girls in STEM subjects are particularly worrying because they are likely to have long-lasting consequences for young people's participation in the labour market and on countries' economic growth. For example, educational attainment, literacy proficiency and field of study jointly determine the likelihood that 16-29 year-olds will find themselves neither employed nor in education or training (NEET). Educational attainment and field of study also have an impact on people's wages, especially young people's wages. According to analyses conducted across countries, fields like teacher training, education science and humanities appear to carry a wage penalty for young workers (OECD, 2014b).

When individuals' potential is realised through education, people are more productive at work and their capacity to innovate may increase (Lucas, 1988; Romer, 1990; Howitt and Aghion, 1998; Nelson and Phelps, 1966; Benhabib and Spiegel, 2005; Arnold et al., 2011; Eberhardt and Teal, 2010; Canton, 2007; Thévenon et al., 2012). Conversely, economic growth is hindered when parts of the population do not reach their full potential. When young people choose to pursue a field of study based on someone else's idea of what is appropriate, rather than on their own preference, it is both a waste of individual potential and a loss for society.

Not surprisingly, PISA has consistently found that 15-year-old girls have higher expectations for their future careers than boys. But as the Survey of Adult Skills shows, by the time those students are in their late 20s, their reality looks very different. As noted in Chapter 4, in 2000, 36% of 15-year-old boys and 43% of girls that age expected to work as managers or professionals when they were 30; but in 2012, when those students were around 27 years old, only 22% of 25-34 year-old men and 23% of 25-34 year-old women worked in such occupations.

What the findings above imply is that there is something going on at the two ends of the performance spectrum, specifically among boys who are low achievers, particularly in reading, and among girls who are high achievers, particularly in mathematics. Low-achieving boys appear to be trapped in a cycle of poor performance, low motivation, disengagement with school and lack of ambition, while high-achieving girls are somehow thwarted from using their mathematical skills in more specialised higher education and, ultimately, in their careers.

What's going on? An analysis of results from PISA 2012 can try to answer that question. With a sample of more than 400 000 students from over 65 education systems around the world and data collection at regular intervals since the year 2000, PISA is invaluable for understanding the origins



of gender differences in academic achievement. PISA data indicate that students' performance varies more depending on where the student lives than on whether the student is a boy or a girl, and that, across countries, boys and girls show similar, albeit gender-specific, approaches to school and learning. PISA also collects a wealth of information about how individual students use their time, and how they feel about school and about the subjects they study in school, so that performance results can be analysed in the context of students' attitudes and behaviours. While PISA cannot measure the effect of gender stereotyping on students' academic achievement, it can go a long way towards showing how students' actions and attitudes – which are often, even unconsciously, influenced by social norms, including gender stereotypes – can make all the difference in whether or not boys and girls succeed in school – and beyond.

Note

1. The Survey of Adult Skills is a product of the OECD Programme for the International Assessment of Adult Competencies (PIAAC).

Note regarding Israel

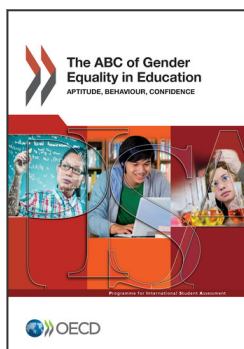
The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

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