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Defining and Measuring Equity in Education

This chapter discusses how PISA defines and measures equity in education and identifies some of the groups of students across all PISA-participating countries and economies, who are most at risk when education systems do not give all students the same chances to succeed.

By measuring the knowledge and skills of 15-year-olds, PISA offers insights into how participating countries and economies are beginning to develop their future talent pools. Indeed, the new Survey of Adult Skills (PIAAC), finds a close correlation between countries' performance in the different cycles of PISA and the proficiency of the corresponding age groups in literacy and numeracy in the OECD Skills Outlook 2013 (OECD, 2013). In analysing results of the PISA assessment in the context of various social characteristics of students and schools, such as socio-economic status, gender and immigrant background, PISA also shows how equitably participating countries and economies are providing education opportunities and realising education outcomes – an indication of the level of equity in the society, as a whole.

What the data tell us

- Of the 39 countries and economies that participated in both PISA 2003 and 2012, Mexico, Turkey and Germany improved both their mathematics performance and their levels of equity in education during the period.
- Australia, Canada, Estonia, Finland, Hong Kong-China, Japan, Korea, Liechtenstein and Macao-China achieve high levels of performance and equity in education outcomes as assessed in PISA 2012.

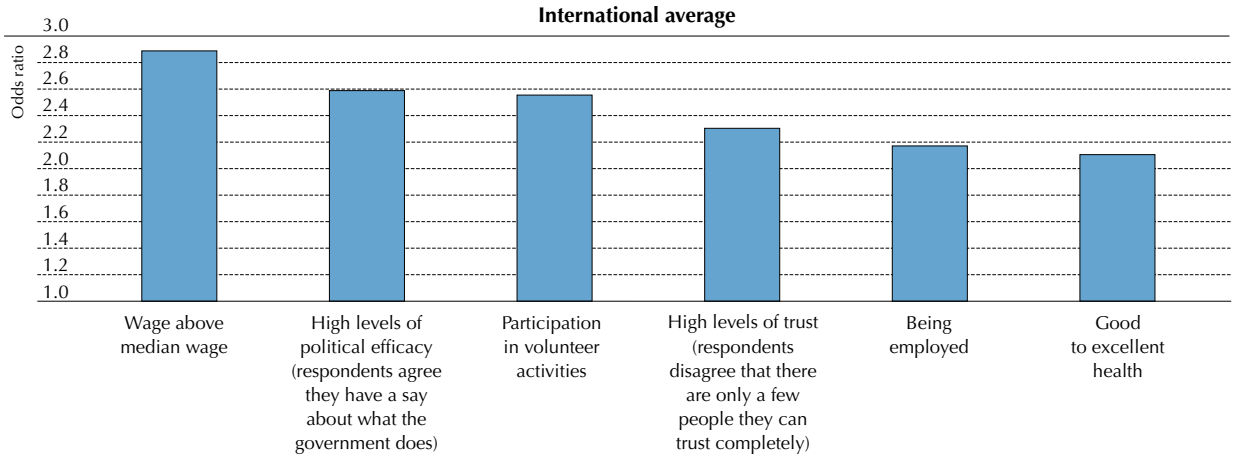
What people know and what they can do with what they know has a major impact on their life chances (Figure II.1.1). The Survey of Adult Skills (PIAAC) shows, for example, that individuals scoring at the highest levels in literacy are almost three times as likely to enjoy higher wages than those scoring at the lowest levels, and those with low literacy skills are also more than twice as likely to be unemployed (OECD, 2013).

How skills are distributed across the population also has significant implications on how economic and social outcomes are distributed within society. The skills survey shows, for example, that higher levels of inequality in literacy and numeracy skills are associated with greater inequality in the distribution of income. If large proportions of adults have low reading and numeracy skills, the introduction and wider diffusion of productivity-improving technologies and work organisation practices can be hampered and that, in turn, will stall improvements in living standards. In other words, today's education is tomorrow's economy.

■ Figure II.1.1 ■

Likelihood of positive social and economic outcomes among highly literate adults

Increased likelihood (odds ratio) of adults scoring at Level 4/5 in literacy on the Survey of Adult Skills (PIAAC) reporting high earnings, high levels of trust and political efficacy, good health, participating in volunteer activities and being employed, compared with adults scoring at or below Level 1 in literacy (adjusted)



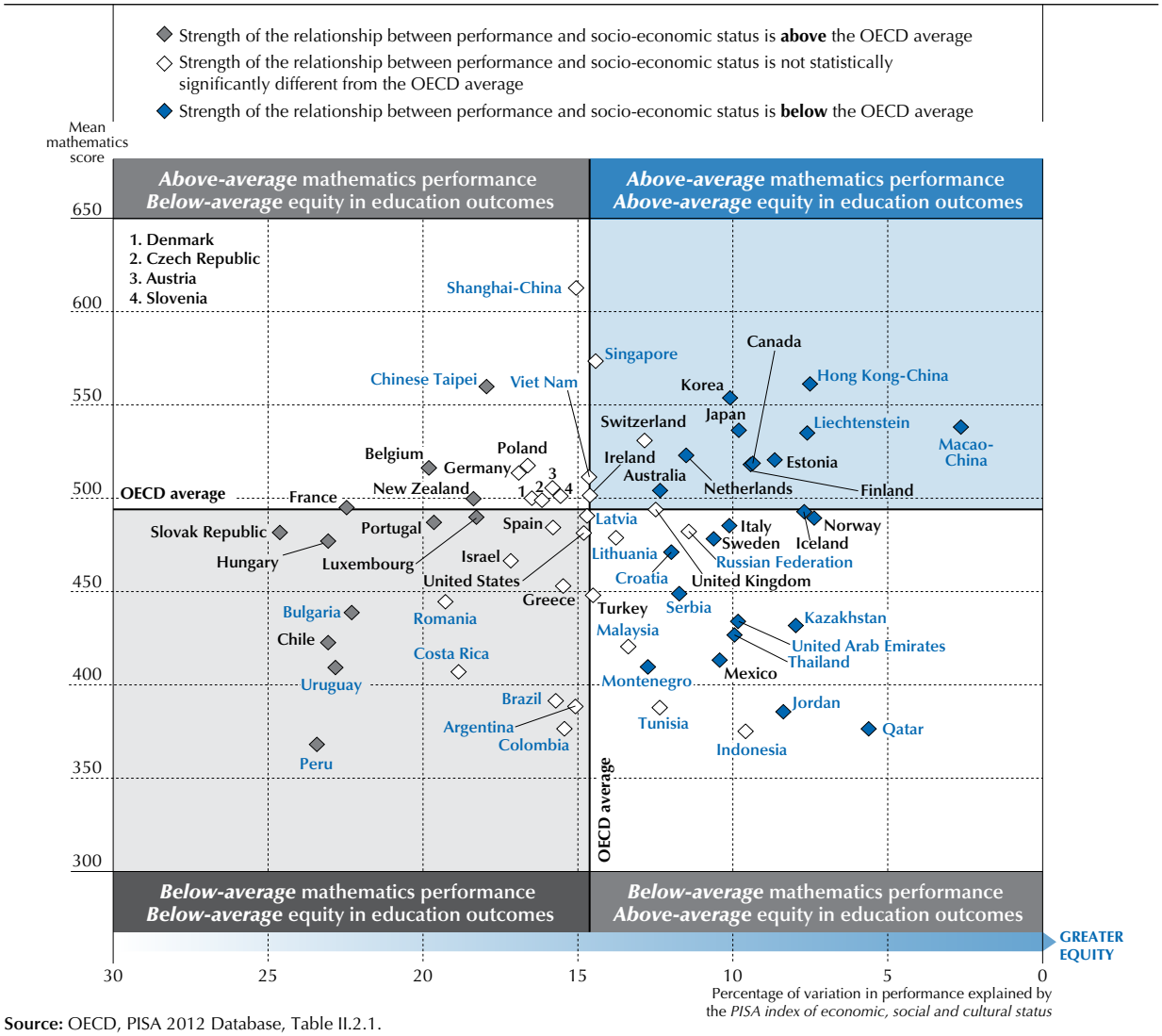
Notes: Odds ratios are adjusted for age, gender, educational attainment and immigrant and language background.
High wages are defined as workers' hourly earnings that are above the country's median.
Source: Based on data from the Survey of Adult Skills (PIAAC) 2012.
StatLink http://dx.doi.org/10.1787/888932964794

And the impact of skills goes far beyond earnings, employment, economic growth and prosperity: in all countries, individuals with lower literacy proficiency are more likely than those with better literacy skills to report poor health, believe that they have little impact on political processes, and are less likely to trust others. Inequity in the distribution of skills across societies is thus reflected in broader social inequities.

PISA defines equity in education[1] as providing all students, regardless of gender, family background or socio-economic status, with similar opportunities to benefit from education. For example, the stronger the impact of a student's socio-economic status on his or her performance, the less equitable the school system. Equity, defined in this way, does not imply that everyone should have the same results, nor does it imply teaching the same material or providing the same resources to all students.

■ Figure II.1.2 ■

Student performance and equity



Source: OECD, PISA 2012 Database, Table II.2.1.

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PISA consistently finds that high performance and greater equity in education opportunities and outcomes are not mutually exclusive: one does not have to be sacrificed to achieve the other. In 20 of the 23 countries and economies that scored above the OECD average in mathematics in PISA 2012, the strength of the relationship between student performance and socio-economic status (the proportion of the variation in performance described by the variation in socio-economic status) is at or below the OECD average. School systems in Australia, Canada, Estonia, Finland,

Hong Kong-China, Japan, Korea, Liechtenstein, Macao-China and the Netherlands achieve high mathematics performance[2] while the relationship between student performance and socio-economic status is weaker than average. School systems in Austria, Denmark, Germany, Ireland, Poland, Slovenia, Shanghai-China, Singapore, Switzerland and Viet Nam achieve high mathematics performance without introducing greater inequities in education outcomes (Figure II.1.2).

Even more encouraging, trend data from 2003 to 2012 show that, of the 39 countries and economies that participated in both PISA assessments, 13 improved their average mathematics performance. Of these improving countries and economies, Mexico, Turkey and Germany also improved their equity levels, either by reducing the extent to which students' socio-economic background predicts their mathematics performance or by reducing the average difference in performance between advantaged and disadvantaged students. Ten additional countries and economies improved their average performance between PISA 2003 and PISA 2012 while maintaining their equity levels.

Performance differences between socio-economically advantaged and disadvantaged students, immigrant and non-immigrant students, or between those attending rural and urban schools indicate the degree to which an education system is equitable. They often reveal how various student characteristics, or the environment in which students learn, are related to performance. Box II.1.1 provides details on how to interpret performance differences in PISA. Tracking the evolution of these disparities over time can help school systems monitor whether and how inequities in education opportunities and outcomes are growing or shrinking.

Box II.1.1. What do the PISA scores mean?

Mathematics was first assessed as the main domain in PISA in 2003. At that time, the mathematics performance scale was standardised to have a mean of 500 score points and a standard deviation of 100 score points. This means that across all OECD countries that participated in PISA 2003, the typical student scored 500 points in mathematics and about two-thirds of students in OECD countries scored between 400 and 600 points. Almost 40% of students scored between 450 and 550 points. A performance gap of 100 points thus represents a large difference in performance. Test results are best understood when compared against a specific standard, such as the average performance of OECD countries or the described proficiency levels on each of the PISA scales. There is neither a top/maximum nor bottom/minimum score in PISA; an individual student, school or school system cannot "pass" or "fail" the PISA test.

An entire proficiency level in mathematics spans about 70 score points – a large difference in the skills and knowledge students at that level possess. Such a gap represents the equivalent of about two years of schooling in the typical OECD country. The average performance difference between two students, each enrolled in one of two consecutive grades (for example, Grades 9 and 10) in the typical OECD country, is about 41 score points. As reported in Volume I, the difference in mean performance between the highest- and lowest-performing country in mathematics in PISA 2012 is 245 score points (see Table II.2.1). The average difference in mathematics performance between the top and bottom quarters of students in OECD countries is 128 score points (see Table I.2.3a).

However, most differences in mathematics performance related to socio-demographic characteristics of students or schools are much smaller than an entire proficiency level. In the typical OECD country, boys outscore girls in mathematics by 11 points (see Table I.2.3a), while non-immigrant students score 34 points higher, on average, than their peers with an immigrant background (see Table II.3.4a). Socio-economically advantaged students (in the top quarter of socio-economic status in their country) score an average of 90 points higher than their disadvantaged peers (bottom quarter) (see Table II.2.4a), and students in city schools score about 31 points higher than students in rural schools, on average (see Table II.3.3a).

HOW PISA EXAMINES EQUITY IN EDUCATION OPPORTUNITIES

The quantity and quality of educational resources

Education systems that are successful, both in quality and equity, attract the highest-quality resources to where these resources can make the most difference. PISA provides information on how school systems allocate their resources for education and whether that allocation is related to student or school characteristics, such as socio-economic status, immigrant background or school location.

PISA distributes questionnaires to students and school principals to collect information about the quantity and quality of educational resources available to them. For example, schools are asked about the quality of school infrastructure and the availability of qualified teachers. Students are asked about how much class time is devoted to the subjects they learn and the extent of their after-school learning activities.

PISA measures equity in resource allocation across school systems by analysing the responses to the questionnaires and comparing those responses with performance results. This volume provides a glimpse of some school policies and practices, including resource allocation. Volume IV explores in detail some of the school- and system-based policies and practices, including allocation of educational resources, related to student and school performance and how they reflect the level of equity in a system.

Instructional content and practices

The quantity and quality of educational resources will have no effect on learning if students are not exposed to the course content that they need to master to be able to participate fully in society. For this reason, PISA measures the kinds of mathematics tasks 15-year-olds have encountered in their mathematics classes and their relative familiarity with those tasks, as developed over their school lives. This volume explores how exposure to and familiarity with mathematics concepts and processes, also known as "opportunity to learn" mathematics, varies by student, school and school system, and how that variation affects equity in education outcomes.

PISA also monitors equity in education by exploring the learning environment at school. Data on such issues as teacher-student relations, teacher morale and classroom discipline, all gathered through the questionnaires distributed among students and school authorities, are correlated among themselves and with student performance. Large disparities in the quality of the learning environment within and between schools could indicate inequities in education opportunities.

Combining better performance with greater equity

The countries and economies participating in PISA demonstrate that excellence and equity are attainable under a wide variety of conditions.

National income

High income is neither a prerequisite for nor a guarantee of high performance and equity. As discussed in Volume I, a country's per capita GDP explains about 12% of the between-country variation in average performance among OECD countries, and 21% of the variation among partner countries and economies (see Figure I.2.1).[3] Countries and economies of similar wealth show very different mean performance in PISA. For example, Canada and Poland score 518 points on the mathematics assessment, yet per capita GDP in Poland is half that of Canada. Per capita GDP in Japan and France is around the OECD average of USD 35 000, yet mathematics performance in these countries ranges from well above the OECD average in Japan (536 points) to around the OECD average in France. Furthermore, countries with very different per capita GDP show similar performance: Latvia and Luxembourg both perform slightly below the OECD average, but per capita GDP in Latvia is under USD 17 000 while it is more than USD 84 000 in Luxembourg (see Table I.2.27).

Countries and economies such as Estonia, Hong Kong-China, Poland, Shanghai-China, Singapore, Slovenia, Chinese Taipei and Viet Nam show that the notion of a world neatly divided between highly developed, educated countries and emerging, low-educated countries is no longer valid. Some emerging economies, particularly in East Asia, are rapidly raising the level and quality of their population's education. As discussed in Volume IV, at first glance it may appear that high-income countries and economies (defined here as those with a per capita GDP above USD 20 000) – and those that can and do spend more on education – show better student performance in PISA. Indeed, high-income countries and economies have an average mathematics performance almost 70 score points higher than that of countries whose per capita GDP is below the USD 20 000 threshold. However, while the relationship between higher income and better performance is marked among those countries below the threshold, among high-income countries, there is no significant relationship between higher income and better performance.

A similar pattern is observed for equity in education. Across all participating countries and economies, per capita GDP is only weakly related with equity in education. There appears to be no relationship between per capita GDP and the strength of the relationship between performance and socio-economic status. Among countries whose per capita

GDP is below the USD 20 000 threshold, higher per capita GDP is positively associated with larger differences in performance between socio-economically advantaged and disadvantaged students and school – in other words, less equity in education outcomes. This relationship is no longer apparent, however, among high-income countries.

As explored in Volume IV, there is no overall relationship between spending on education and average performance. PISA results show that once a certain level of spending is reached, more resources no longer predict higher achievement (see Figure IV.1.8). Expenditure of up to about USD 50 000 per student from the age of 6 to 15 is positively related to higher mean performance but also to disparities in performance between students of different socio-economic status. This finding highlights the importance for countries that are boosting public spending on education from relatively low levels to adopt effective policies on equity.

How countries spend their limited resources matters as much as, if not more than, the amount they are spending. As explored in Volume IV, differences in the allocation of educational resources are generally related to better performance (see Table IV.1.20). In particular, greater equity in the distribution of educational resources is associated with higher mathematics performance. As shown in Figure IV.1.11, even after accounting for per capita GDP, 30% of the variation in mathematics performance across OECD countries can be explained by differences in how educational resources are allocated between advantaged and disadvantaged schools.

Socio-economic heterogeneity

Socio-economic diversity in student populations can coexist with high performance and equity. Of the 23 countries with mean performance above the OECD average, Hong Kong-China and Macao-China have above-average equity and greater socio-economic diversity than average (as measured by the range of socio-economic status between the 5th and 95th percentiles, see Figure II.5.1a) and in Finland socio-economic diversity is average. Among those countries/economies with high performance and average levels of equity (as measured by the strength of the relationship between performance and socio-economic status), Shanghai-China and Singapore both show above-average socio-economic diversity, while the Netherlands, Switzerland, Denmark and Germany have average socio-economic diversity.

Similarly, the proportion of low performers relative to top performers, the range of performance between the top and bottom 25% of students, or simply the variation in performance, is either weakly or not at all related to equity in education. Higher-performing countries and economies tend to show greater variation in performance (see Figure I.2.24), but those differences are only weakly related to socio-economic disparities. For example, in Shanghai-China, Singapore and Chinese Taipei, average performance is high and so is overall variation in student performance (see Table II.2.8a).

Immigrant students

Canada, Hong Kong-China and Macao-China combine high levels of achievement and above-average equity – and more than 30% of students in these countries and economies are immigrants. In fact, performance differences between immigrant and non-immigrant students are relatively small in Canada and Hong Kong-China. By contrast, Spain and Greece show relatively large differences in performance between immigrant and non-immigrant students despite having smaller, although still significant, populations of immigrant students (see Table II.3.4a).

EXAMINING EQUITY THROUGHOUT THIS REPORT

Chapter 2 of this volume analyses equity in education outcomes, particularly the relationship between performance and socio-economic status, at both the student and school levels. Chapter 3 examines an array of student and school characteristics and their relationship with performance. It focuses on family structure, immigrant background, language spoken at home and school location and explores what, if any, impact these characteristics have on student performance. Chapter 4 describes how exposure and familiarity with formal mathematics, opportunity to learn, and resources are distributed across different groups of students. Chapter 5 concludes with a discussion of policy options and implications countries can draw on from the evidence and analysis presented in this volume.

This is not the only volume of the *PISA 2012 Results* publication that covers the issue of equity in education. Volume I introduces gender as an important equity issue. It addresses the myth that girls are systematically worse at mathematics than boys and discusses the complexity of the issue. It also proposes that since mathematics skills are critical for both boys and girls as they pursue further education or a career, inequities related to gender are not only unfair, but also ultimately damaging to the wider society and economy.

Volume III looks at differences in attitudes, behaviour and approaches to learning across gender, socio-economic status, family characteristics and school location. These, too, are associated with inequities in the acquisition of knowledge and skills.

Volume IV examines how the policies and practices adopted in schools and school systems are related to performance and equity. While some of these policies are introduced in this volume, Volume IV discusses them in greater depth.

Notes

1. This definition builds previous PISA cycles and the educational equity framework published in *Education at a Glance 2011: OECD Indicators* (OECD, 2011). In particular, the conceptual framework for this chapter draws heavily from Levin (2010).

2. The focus in this volume is on mathematics performance. Most of the analyses presented in this volume can be replicated for each of the domains assessed in PISA 2012. For the most part, the results are likely to be similar, regardless of the domain, but there may be substantial differences in some areas.

3. Here the measure of per capita GDP used is in PPP terms, that is, in equivalent units or as typically known in purchasing power parity.

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