Introduction

A CHANGING YARDSTICK FOR EDUCATIONAL SUCCESS

Rapid globalisation and modernisation are posing new and demanding challenges to individuals and societies alike. Increasingly diverse and interconnected populations, rapid technological change in the workplace and in everyday life, and the instantaneous availability of vast amounts of information are just a few of the factors contributing to these new demands. In a globalised world, people compete for jobs not just locally but internationally. In this integrated worldwide labour market, highly-paid workers in wealthier countries are competing directly with people with much the same skills in lower-wage countries. The same is true for people with low skills. The competition among countries now revolves around the quality of their human capital.

The effect of these developments is to raise wages in less-developed countries and depress wages in the most industrialised countries. But these developments do not affect all workers equally. Job automation is proceeding even faster than the integration of the job market. If the work is routine, it is increasingly likely to be automated, although some jobs will always be done by human beings. The effect of automation, and more generally of the progress of technological change, is to reduce the demand for people who are only capable of doing routine work, and to increase the demand for people who are capable of doing knowledge-based work. This means that a greater proportion of people will need to be educated as professionals. High-wage countries will find that they can only maintain their relative wage levels if they can develop a high proportion of such knowledge workers and keep them in their work force. Increasingly, such work will require very high skills levels and will demand increasing levels of creativity and innovation.

This is not a description of one possible future, but of the economic dynamics that are now in play. In the high-wage countries of the OECD, demand for highly skilled people is increasing faster than supply (which OECD indicators show in rising wage premiums for highly-skilled individuals); and demand for low-skilled workers is decreasing faster than supply (which OECD indicators reveal in growing unemployment rates or declining wages for low-skilled individuals). Jobs are moving rapidly to countries that can provide the skills needed for any particular operation at the best rates. And the rate of automation of jobs is steadily increasing in both high- and low-wage countries.

In this context, governments need to create education systems that are accessible to everyone, not just a favoured few; that are globally competitive in quality; that provide people from all classes a fair chance to get the right kind of education to succeed; and to achieve all this at a price that the nation can afford. The aim is no longer just to provide a basic education for all, but to provide an education that will make it possible for everyone to become "knowledge workers". Such education will need to build the very high skills levels required to solve complex problems never seen before, to be creative, to synthesise material from a wide variety of sources, to see patterns in the information that computers cannot see, to work with others in productive ways, and to be able to both lead and be a good team member when necessary. This is what is required in today's "flat" world – where all work that cannot be digitised, automated and outsourced can be done by the most effective and competitive individuals, enterprises or countries, regardless of their location. The implication is that the yardstick for educational success is no longer simply improvement against national standards, but against the best-performing education systems worldwide (Box I.1).

ABOUT THIS REPORT

This report is the second in a series. The first volume – *Strong Performers, Successful Reformers: Lessons from PISA for the United States* (OECD, 2010a) – highlighted insights from the education systems of a selection of top-scoring and rapidly improving countries as measured by the OECD Programme for International Student Assessment (PISA – described in the Annex). As with the first volume, this second report is likely to have resonance not only in Japan, but also in a wide range of countries and different types of education systems striving for excellence in educating their young people. The aim of this report is to focus more on how countries are reforming their education systems not only to produce better learning outcomes, but, in particular, to ensure that their students acquire the skills needed for the unpredictable labour market of the future.

At the request of the Japanese Ministry of Education, Culture, Sports, Science and Technology, this second volume builds on the first to draw lessons for the education reform agenda in Japan. It also takes advantage of some fresh information regarding Japan from *PISA 2009 Results: Students On Line: Digital Technologies and Performance* (OECD, 2010b). This recent assessment of digital reading skills among 15-year-olds investigates students' proficiency at tasks that require them to access, understand, evaluate and integrate digital texts across a wide range of reading contexts and tasks. It also examines issues surrounding access to and use of computers and the Internet at home and at school.

With this in mind, this report examines a bit more closely than the first report how policy makers are reforming their education systems to better prepare students for the technological developments that are reshaping the nature of the workplace and work in the 21st century. The largest technological force currently influencing the world of work is the computer. The premise in this second volume, highlighted in Chapter 2, is that the labour market of the 21st century requires not only foundational skills like numeracy and literacy, but also advanced problem-solving skills characterised as expert thinking and complex communication (Levy, 2010).[1]

Box I.1 The pace of change in educational improvement

It is no accident that Japan has been at or near the top of the international rankings on education surveys since those surveys began. The country has persistently benchmarked and regularly reformed its education system since the Meiji Restoration in the mid-19th century (see Chapter 2). The Japanese education system is grounded in a deep commitment to children, a first-rate teaching force, a judicious use of resources and a curriculum that has consistently centred on core topics with high standards. These, and many other factors, have combined to produce one of the world's best-educated and most productive workforces.

However, Japan cannot rest on its laurels. According to the OECD, a high school diploma is the baseline qualification for reasonable earnings and employment prospects. Among OECD countries, the average proportion of young adults with at least a high school diploma has now risen to 80%; in Japan this figure exceeds 95%. Yet just two generations ago, South Korea had the economic output equivalent to that of Afghanistan today, and was 23rd in terms of educational output among OECD countries. Today, South Korea is one of the top performers in terms of the proportion of successful school-leavers, with 94% obtaining a high school diploma. Similarly, Chile moved up by nine rank order positions, Ireland by eight and Belgium and Finland by four.

Changes are not just seen in the quantitative output of education systems; many countries have also shown impressive improvements in the quality of learning outcomes. A major overhaul of Poland's school system helped to dramatically reduce performance variation among schools, reduce the share of poorly performing students, and raise overall performance by the equivalent of more than half a school year. Germany was jolted into action when PISA 2000 revealed below-average performance and large social disparities in results. The country has subsequently made progress on both fronts. Korea's average performance was already high in 2000, but policy makers were concerned that it was only the elite who were achieving these levels of excellence in PISA. Within less than a decade, Korea was able to double the share of students demonstrating excellence in reading literacy.

The remainder of this chapter describes the framework of analysis for this report, the PISA measures used, the methodology for developing the country chapters, and the conceptual framework for viewing policies for skills of the 21st century.

Chapter 2 sets the stage by analysing in detail Japan's performance in PISA, contrasting its relative strengths and weaknesses with those of other countries, and offering new insights provided through the results of the PISA 2009 digital reading assessment.

The subsequent chapters present detailed analyses of high-performing education systems – Canada (Ontario), Finland, Singapore, and China (Hong Kong and Shanghai). For each country, desk reviews and interviews with a range of experts in the field of education were conducted. Each chapter briefly reviews the country's history and culture as context for understanding its education system. The chapters then go on to outline the main elements of the country's education system and reforms intended to develop the skills needed for the unpredictable labour market of the future. These elements vary across the education systems described, but generally include standards, examination systems, instructional systems, school finance, teacher quality, accountability, student motivation, the use of Information and Communication Technologies (ICT), and innovations in pedagogical practices. Recent policy developments are highlighted in the context of past reforms. Each chapter concludes by drawing wider lessons.

The final chapter draws together the threads of the preceding chapters to present some policy lessons for Japan's education systems, and for other countries too.

COUNTRY COMPARISONS

Table I.1 compares the countries covered in this report according to learning outcomes, equity in the distribution of learning opportunities, spending on education and the economic context. These countries were chosen not only to provide a variety of relevant policies and practices, and to illustrate a range of education structures and models, but also to build on the analyses begun in the first volume:

- Japan ranked high on the initial PISA assessment in 2000 and has maintained its standing on subsequent assessments. However, the government constantly designs reforms to improve its already impressive level of system performance – particularly in light of future skills needs.

- Canada has been among the top performers in PISA over the past decade. Given its decentralised education system, it is methodologically prudent to look at provincial education policies. Ontario, the most populous province, provides a window onto some key reforms.
- Finland was the highest-performing country in the first PISA assessment in 2000 and has performed consistently well in subsequent assessments.
- Singapore conducted its first PISA assessment in 2009, where it scored near the top, having improved its education system in dramatic ways since its independence in 1965.
- China is a country newly covered in PISA. This report focuses on the performance of Hong Kong and Shanghai, two cities each with a population as large as or larger than some OECD countries. Hong Kong has long been a top performer on the PISA league tables; Shanghai was only assessed for the first time in PISA 2009, yet it is already among the star performers. These two cities, despite being in the same country, have markedly different histories and school systems with very different governance arrangements. Contrasting them provides valuable insights into the impressive accomplishments in education in a country now taking a prominent position on the world stage.

Table I.1 Basic data on the countries studied in this volume

	Quality										Equity	Coherence	Efficiency	Income	Equality
	Mean PISA score on the reading scale 2009		Mean PISA score on the reading scale 2000		PISA score difference in reading between 2000 and 2009		Mean PISA score on the mathematics scale 2009		Mean PISA score on the science scale 2009		Percentage of the variance in student performance explained by student socio-economic background	Total variance between schools expressed as a percentage of the total variance within the country	Annual expenditure per student on educational core services (below tertiary) 2007	GDP per capita	Gini Index
	Score	S.E.[1]	Score	S.E.[1]	Score	S.E.[1]	Score	S.E.[1]	Score	S.E.[1]	%	%	USD PPP	Value	Value
Canada	524	1.5	534	1.6	-10	3.4	527	1.6	529	1.6	8.6	22	7 609	36 397	0.30
Shanghai-China	556	2.4	m	m	m	m	600	2.8	575	2.3	12.3	38	42 064[3]	5 340	0.42
Hong Kong-China	533	2.1	m	m	m	m	555	2.7	549	2.8	4.5	42	32 896[4]	42 178	0.43
Finland	536	2.3	546	2.6	-11	4.3	541	2.2	554	2.3	7.8	9	6 430	35 322	0.26
Japan	520	3.5	522	5.2	-2	6.8	529	3.4	539	3.4	8.6	49	8 012[2]	33 635	0.34
Singapore	526	1.1	m	m	m	m	562	1.4	542	1.4	15.3	35	23 699[5]	51 462	0.42
OECD average	494	0.5	497	0.6	- 2	2.7	497	0.5	501	0.5	14	39	6 675	32 962	0.31

1. Standard error.
2. Value for core and ancillary services.
3. Cumulative expenditure per student over the theoretical duration of primary studies (OECD, 2010a).
4. Recurrent government expenditure on education, including primary, secondary and special education and departmental support (Hong Kong Annual Digest of Statistics 2010).
5. Cumulative expenditure per student for 6 to 15-year-olds (OECD, 2010a).

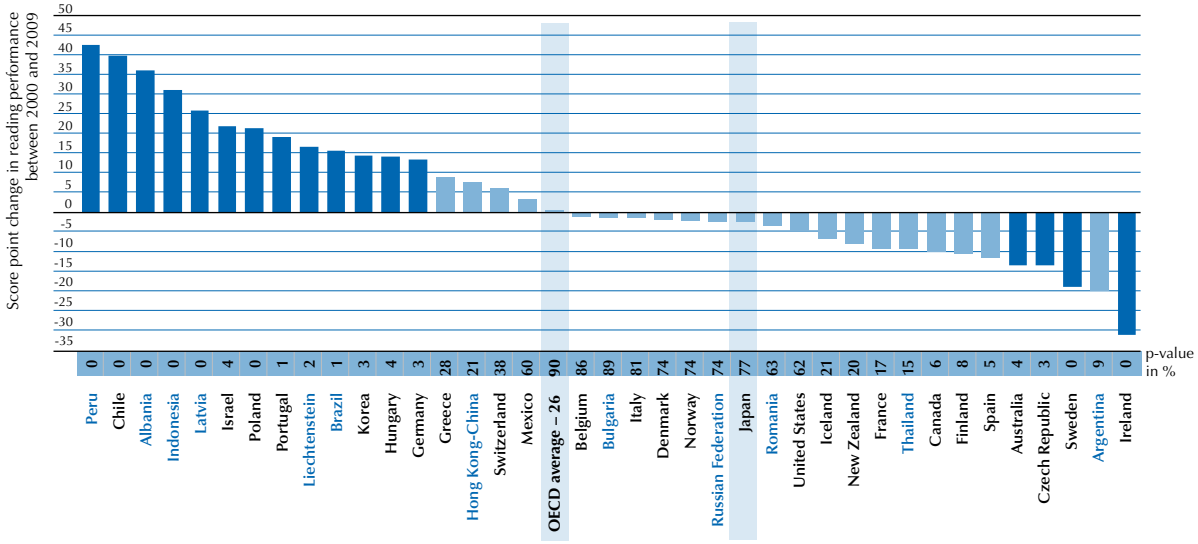
Source: OECD, *PISA 2009 Database,* and OECD (2010d).

Comparing the OECD averages across the various PISA assessments must be made with great care. Not all the OECD members participated in every PISA assessment and the list of participating partner countries and economies has widened substantially since 2000, as has the number of OECD member states. The group of OECD countries for which the OECD average can be compared across time differs between assessment areas (reading, mathematics, and science). For methodological reasons, some countries have not been included in comparisons between 2000, 2003, 2006 and 2009. This is explained in Chapter 1 and Annex A5 in OECD (2010c).

The most appropriate way to compare trends in reading, mathematics and science performance is shown in Figures 1.1, 1.2 and 1.3.

■ Figure I.1 ■

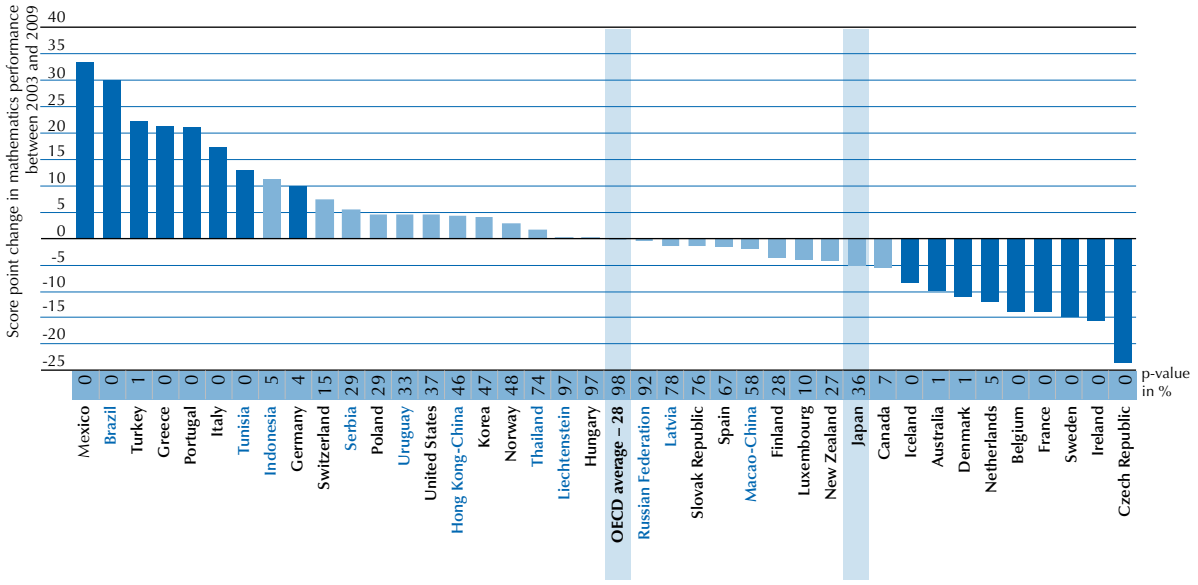
Change in reading performance between 2000 and 2009



Note: Statistically significant score point changes are marked in a darker tone.
Countries are ranked in descending order of the score point change in reading performance between 2000 and 2009.
Source: OECD, *PISA 2009 Database*.

■ Figure I.2 ■

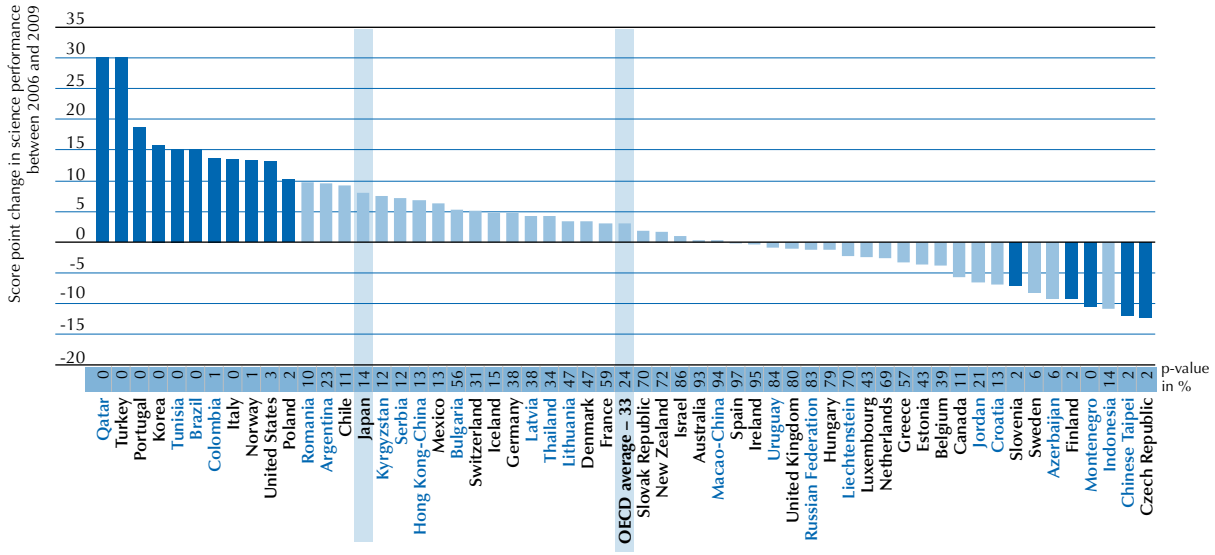
Change in mathematics performance between 2003 and 2009



Note: Statistically significant score point changes are marked in a darker tone.
Countries are ranked in descending order of the score point change on the mathematical scale between 2003 and 2009.
Source: OECD, *PISA 2009 Database*.

■ Figure I.3 ■

Change in science performance between 2006 and 2009



Note: Statistically significant score point changes are marked in a darker tone.
Countries are ranked in descending order of the score point change in science performance between 2006 and 2009.
Source: OECD, *PISA 2009 Database*.

FRAMEWORK FOR ANALYSIS

This report builds on the framework for analysis applied in the first volume (OECD, 2010a), which suggests a continuum of approaches to education reform linked, in part, to a country's economic advancement. Developing countries with few resources to invest in education are likely to invest more heavily in educating a small elite well to lead the country's industries and government operations. As economies become more industrialised, citizens and policy makers tend to converge around a different philosophy: that the best way to compete in the global economy is to provide all citizens with the type and quality of education formerly provided only to the elite. To provide high-quality education to the broader population, education systems must recruit their teachers from the top of the higher education pool.

More recently policy efforts have emerged to develop education systems that are intended also to inculcate students with a range of higher-order capacities that encompass the notions of expert thinking and complex communication skills. Each education system and cultural context has developed unique ways to achieve this, such as nurturing student creativity, critical thinking, and networking skills that are considered important to knowledge-based economies and innovation. Governments have used many approaches, but policies and practices intended to develop in students the skills needed for the unpredictable labour market of the future tend to fall into three categories:

Over time, governments, education systems and schools develop a unique blend of these mechanisms to help students acquire the habits of the mind for performing well in the knowledge economy. Nations that try to emphasise one mechanism over another will likely face challenges. In this framework, there is no ideal balance, so policy makers will see the need for coherence in the policies and relative investment of resources.

■ Figure I.4 ■

Which policies and practices can help students develop skills for future labour markets?

1
Indirect mechanisms to create greater space for multiple methods of learning, understanding, and interpretation of concepts, whether by providing more free time to students or reducing rigidity in their learning environments.
2
Incentive mechanisms for reducing the use of rote learning, encouraging teachers, students, schools, and systems to move away from a focus on factual recall and high-stakes testing toward an emphasis on learning to learn.
3
Direct mechanisms that have an explicit focus on pedagogical practices to promote problem solving, integrative learning and collaboration.

■ Figure I.5 ■

Framework of analysis for policies to nurture skills for the future

Economic development		
Impoverished, preindustrial low-wage	← →	High value-added, high wage
Teacher quality		
Few years more than lower secondary	← →	High level professional knowledge workers
Curriculum, instruction and assessment		
Basic literacy, rote learning	← →	Complex skills, creativity
Work organisation		
Hierarchical, authoritarian	← →	Flat, collegial
Accountability		
Primary accountability to authorities	← →	Primary accountability to peers and stakeholders
Student inclusion		
The best students must learn at high levels	← →	All students must learn at high levels
Development of skills for the future		
Indirect mechanisms	← →	Direct mechanisms

WHAT IS PISA AND WHAT CAN WE LEARN FROM IT?

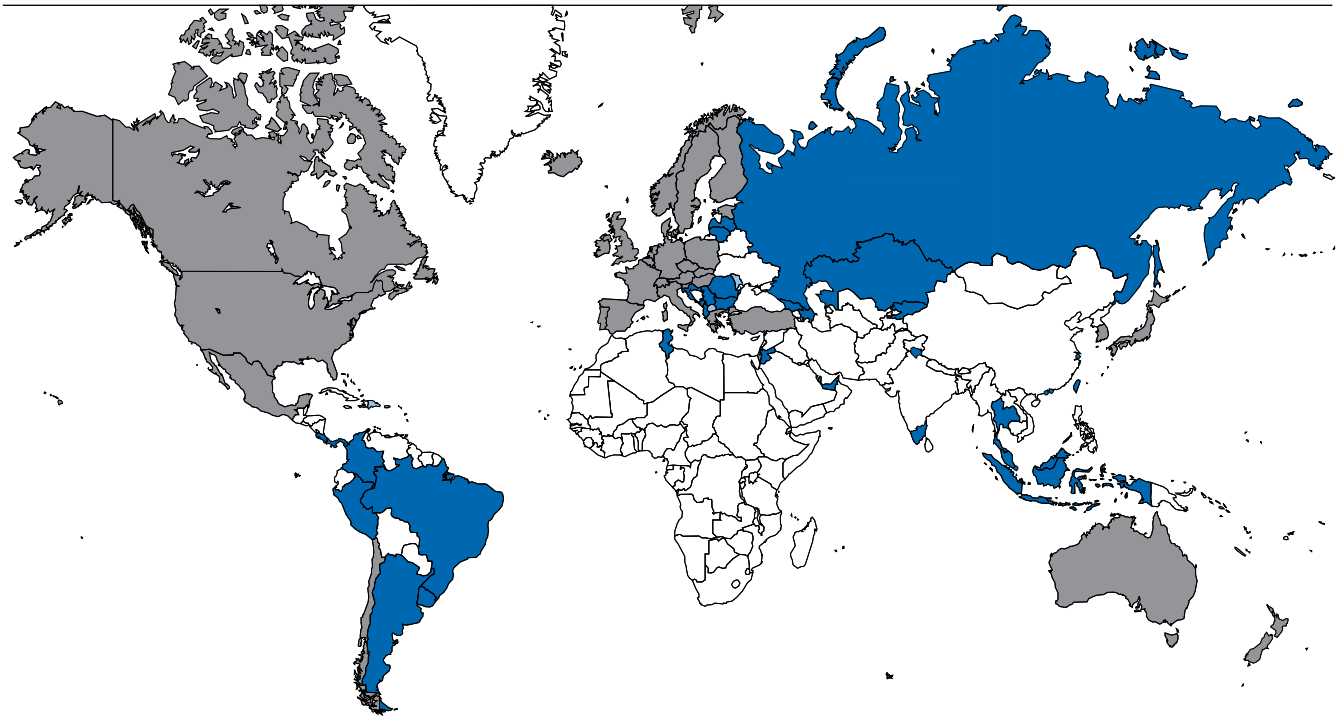
Parents, students, teachers and those who run education systems are looking for sound information on how well their education systems prepare students for life. Most countries monitor their own students' learning outcomes in order to provide answers to this question. Comparative international assessments can extend and enrich the national picture by providing a larger context within which to interpret national performance. Countries inevitably want to know how they are doing relative to others, and, if other countries are outperforming them, they want to know how they do it. Such assessments have gained prominence in recent years partly due to pressures from an increasingly competitive global economy that is more than ever driven by the quality of human capital. As a result, the yardstick for judging public policy in education is no longer improvement against national educational standards, but also improvement against the most successful education systems in the world.

The OECD's PISA , which assesses the knowledge and skills of 15-year-old students around the world, is the result of collaboration among 70 countries interested in comparing their own students' achievement with that in other countries (Figure I.6). Every three years since 2000, PISA compares student performance in reading, mathematics and science (Annex). PISA's assessments are designed not only to find out whether students have mastered a particular curriculum, but also whether they can apply the knowledge and skills they have acquired in real-life situations. Decisions about the scope and nature of the PISA assessments and the background information to be collected are made by leading experts in participating countries. Considerable efforts and resources are devoted to achieving cultural and linguistic breadth and balance in the assessment materials. Stringent quality-assurance mechanisms are applied in designing the test, in translation, sampling and data collection. As a result, PISA findings have a high degree of validity and reliability.

Because PISA reports on the achievements of many countries against a common set of benchmarks, it inevitably prompts discussion within participating countries about their education policies. Citizens recognise that their countries' educational performance will not simply need to match average performance, but that they will need to do better if their children want to ensure above-average wages and competitive standards of living. PISA assists this discussion by collecting a wide range of background information about each country's education system and about the perspectives of various stakeholders. This makes it possible to relate aspects of performance with important features of those systems.

■ Figure I.6 ■

A map of PISA countries and economies



OECD countries

Australia
Austria
Belgium
Canada
Chile
Czech Republic
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Israel
Italy
Japan
Korea
Luxembourg
Mexico
Netherlands
New Zealand
Norway
Poland
Portugal
Slovak Republic
Slovenia
Spain
Sweden
Switzerland
Turkey
United Kingdom
United States

Partner countries and economies in PISA 2009

Albania
Argentina
Azerbaijan
Brazil
Bulgaria
Colombia
Costa Rica*
Croatia
Georgia*
Himachal Pradesh-India*
Hong Kong-China
Indonesia
Jordan
Kazakhstan
Kyrgyzstan
Latvia
Liechtenstein
Lithuania
Macao-China
Malaysia*
Malta*
Mauritius*
Miranda-Venezuela*
Moldova*
Montenegro
Netherlands-Antilles*
Panama
Peru
Qatar
Romania
Russian Federation
Serbia
Shanghai-China
Singapore
Tamil Nadu-India*
Chinese Taipei
Thailand
Trinidad and Tobago
Tunisia
Uruguay
United Arab Emirates*

Partner country in previous PISA surveys

Macedonia

* These partner countries and economies carried out the assessment in 2010 instead of 2009.

HOW CAN PISA BE USED TO HELP IMPROVE EDUCATION SYSTEMS?

On their own, cross-sectional international comparisons such as PISA cannot identify cause-and-effect relationships between certain factors and educational outcomes, especially in relation to the classroom and the processes of teaching and learning that take place there. However, they are an important tool to assess and drive educational change in several ways:

- PISA shows what achievements are possible in education. For example, PISA shows that Canadian 15-year-olds, on average, are over one school year ahead of 15-year-olds in the United States in mathematics and more than half a school year ahead in reading and science.[6] They also show that socio-economically disadvantaged Canadians are much less at risk of poor educational performance than their counterparts in the United States. More generally, whether in Asia (e.g. Japan or Korea), Europe (e.g. Finland) or North America (e.g. Canada), many OECD countries display strong overall performance in international assessments and, equally important, some of these countries also show that poor performance in school does not automatically follow from a disadvantaged socio-economic background. Some countries also show a consistent and predictable educational outcome for their children regardless of where they send their children to school. In Finland, for example, which has some of the strongest overall PISA results, there is hardly any variation in average performance between schools.

- PISA is also used to ***set policy targets in terms of measurable goals achieved by other systems and to establish trajectories for educational reform***. For example, Japan's 2010 Growth Strategy sets the goal for Japan to achieve by 2020 a reduction in the proportion of low achievers and an increase of that of high achievers to the level of the highest performing PISA country and to increase the proportion of students with an interest in reading, mathematics and science to a level above the OECD average (Ministry of Economy, Trade and Industry, 2010). Similarly, in 2010 the Prime Minister of the United Kingdom set the goal of raising the country's average student performance to Rank 3 on the PISA mathematics assessment and to Rank 6 on the PISA science assessment (Chapter 7). This announcement was accompanied by a range of policies to achieve these targets. The Mexican President established a "PISA performance target" in 2006, to be achieved by 2012, which highlights the gap between national performance and international standards and allows monitoring of how educational strategies succeed in closing this gap. The reform trajectory includes a delivery chain of support systems, incentive structures as well as improved access to professional development to assist school leaders and teachers in meeting the target.
- Some countries have systematically ***related national performance to international assessments***, for example by embedding components of the PISA assessments into their national assessments. For example, by linking its national assessment with PISA, Brazil is providing each secondary school with information on the progress it must make to match the average PISA performance level by 2021. Germany, Japan and the US state of Oregon have embedded PISA items in their national/state assessments.
- PISA can help countries ***gauge the pace of their educational progress***. Educators are often faced with a dilemma: if, at the national level, the percentage of students obtaining high scores increases, some will claim that the school system has improved. Others will claim that standards must have been lowered, and behind the suspicion that better results reflect lowered standards is often a belief that overall performance in education cannot be raised. International assessments allow improvements to be validated internationally. Poland raised the performance of its 15-year-olds in PISA reading by the equivalent of well over half a school year's progress within six years, catching up with United States performance in 2009 from levels well below United States performance in 2000. It also reduced the proportion of students performing below the baseline level of reading performance from 23% in 2000 to 15% in 2009 (the proportion of bottom performers remained unchanged at 18% in the US during this time). Last but not least, Poland succeeded in halving performance differences between schools.
- PISA can help governments to optimise existing policies or consider more fundamental alternatives when researchers combine ***advanced forms of educational assessment with sophisticated survey research methods***. For example, PISA collects reliable data on students' ability to apply high levels of knowledge and highly complex thinking to real-world problems. PISA's survey research also gathers a wide range of background data surrounding the education of the students being assessed. By linking these two bodies of data one can associate certain patterns of student performance with a multitude of background data such as the qualifications of their teachers, how much those teachers are paid, the degree to which decisions are devolved from higher authorities to the school faculty, the socio-economic or minority status of the students, the nature of the assessments that students must take, the nature of the qualifications they might earn and so on, in great detail. In this way, while the causal nature of such relationships might not be established, an extensive web of correlations can be drawn between certain dimensions of student performance and a large range of factors that could conceivably affect that performance.

RESEARCH METHODS EMPLOYED FOR THE COUNTRY CHAPTERS

The research undertaken for this report entailed an enquiry of historians, policy makers, economists, education experts, ordinary citizens, journalists, industrialists, and educators that have allowed for an alternative benchmarking. The research began with a document review and was enriched by interviews with current and former leading policy makers and other education stakeholders in the countries and education systems concerned. The PISA data provided the basis for country selection as well as important clues for the points of investigation.

This report complements the uses of PISA just described with a form of industrial benchmarking (Box I.2). The aim of the research presented in this report is to relate differences in student achievement between one country and another to certain features of those countries' education systems. Education is highly value-laden. Systems develop for historical reasons that reflect the values and preferences of parents, students, administrators, politicians and many others. Yet such values and preferences evolve and education systems must change to accommodate them. Decision makers in the education arena can benefit from benchmarking research in the same way as heads of firms. This involves learning about the range of factors that lead to success, taking inspiration from the lessons of others, and then adapting the operational elements to the local context while adding unique elements that make their own education system one of a kind.

The intent of this report is not to specify a formula for success – this report contains no policy prescriptions. Rather the objective is to describe the experience of countries whose education systems have proven exceptionally successful to help identify policy options for consideration. It is intended as a resource for decision making.

While quantitative analysis can be used to apportion the relative influence of a variety of factors in determining variations in student performance in PISA, the data collected by PISA alone leave many questions unanswered. For instance, it is not possible to

determine from PISA results whether teachers in the schools of a particular country are using a very powerful instructional system that would be equally effective in another country with very different class sizes. PISA data do not reveal whether new political leadership reframed the issues in education policy in such a way that facilitated the introduction of new reforms. PISA data do not show how awareness of weak education performance can mobilise a country's education establishment to reform and radically improve its education outcomes. Nor do PISA data reveal how a country's industrial and educational institutions are able to work together to leverage a qualifications structure that produces incentives for high-level student performance.

Box I.2 **Industrial benchmarking**

Industrial benchmarking gained currency at the close of the 1970s and the early 1980s when Japanese firms began to challenge large multi-national American firms globally. Many American firms did not survive that challenge. But those that did owe their survival to their use of benchmarking techniques.

The aim of the American firms was to learn enough from their competitors to beat them at their own game. To do this, they identified their most successful competitors. But they also identified the companies that led the league tables in each of their major business process areas (e.g. accounting, sales, inventory). They collected all the information they could possibly find concerning their direct competitors and the companies that led the league tables in the relevant business processes. Some of this information appeared in the business press, some in major academic studies usually conducted and published by business school faculty, some through papers presented by staff members of their competitors in industry journals. After they had learned everything they could possibly learn in this way, they did their best to visit their competitors' work sites, sending their own leading experts to examine product designs, manufacturing techniques, forms of work organisation, training methods, anything they thought might contribute to their competitor's success.

When this research was complete, they would analyse all the information and research they had gathered. Their aim was not to replicate anything they had seen, but to combine the best they had seen in one place with the best they had seen in another, added with their own ideas, to make something that would be superior to anything they had seen anywhere, and which would be adapted to their own specific needs and circumstances.

The lessons suggested in this report emerge from instances in which PISA data and country analysis tend to converge. The report provides complementary qualitative analysis of high-performing and rapidly-reforming improving education systems to reveal possible contextual influences on education performance. The country studies have not only suggested some possible answers to interesting questions, but have also uncovered some new questions for consideration in future PISA assessments.

Notes

1. *OECD Working Paper No. 45* (2010) is based on ideas that first appeared in Autor, Levy and Murnane (2003); and Levy and Murnane (2005).

2. The progress students typically achieve over a school year was estimated as follows. Data on the grade in which students are enrolled were obtained both from the Student Questionnaire and from the Student Tracking Forms. The relationship between the grade and student performance was estimated through a multilevel model accounting for the following background variables: *1)* the *PISA index of economic, social and cultural status*; *2)* the *PISA index of economic, social and cultural status* squared; *3)* the school mean of the *PISA index of economic, social and cultural status*; *4)* an indicator as to whether students were foreign born (first-generation students); *5)* the percentage of first-generation students in the school; and *6)* students' gender. Table A2.1 in the PISA 2009 report (OECD, 2010c) presents the results of the multilevel model, which are fairly consistent across countries. Column 1 in Table A2.1 estimates the score point difference that is associated with one grade level (or school year). This difference can be estimated for the 28 OECD countries in which a sizeable number of 15-year-olds in the PISA samples were enrolled in at least two different grades. Since 15-year-olds cannot be assumed to be distributed at random across the grade levels, adjustments had to be made for the above-mentioned contextual factors that may relate to the assignment of students to the different grade levels. These adjustments are documented in columns 2 to 7 of the table. While it is possible to estimate the typical performance difference among students in two adjacent grades net of the effects of selection and contextual factors, this difference cannot automatically be equated with the progress that students have made over the past school year but should be interpreted as a lower boundary of the progress achieved. This is not only because different students were assessed, but also because the content of the PISA assessment was not expressly designed to match what students had learned in the preceding school year but rather broadly to assess the cumulative outcome of learning in school up to age 15.

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