2

Adults' proficiency in key information-processing skills

This chapter describes the level and distribution of proficiency in the three information-processing skills assessed – literacy, numeracy and problem solving in technology-rich environments – among adults in the participating countries and economies. To help readers interpret the findings, the results are linked to descriptions of what particular scores mean in concrete terms. In addition to presenting the distribution of scores across countries/economies, the chapter also shows the variation in scores among adults in individual countries/economies, and the relationship between the average proficiency level and the degree of variation in scores within a given country. The chapter describes the relationship among the three proficiencies and compares results from this survey with the two previous surveys of adult skills: the International Adult Literacy Survey (IALS) and the Adult Literacy and Life Skills Survey (ALL).

A 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.

The Survey of Adult Skills, a product of the OECD Programme for the International Assessment of Adult Competencies (PIAAC), assesses the proficiency of adults in literacy, numeracy and problem solving in technology-rich environments. These are considered to be "key information-processing skills" (OECD, 2013a, p.94) in that they are:

- Necessary for fully integrating and participating in the labour market, education and training, and in social and civic life
- Highly transferable, in that they are relevant to many social contexts and work situations
- "Learnable" and, therefore, subject to the influence of policy.

Literacy and numeracy skills constitute a foundation for developing higher-order cognitive skills, such as analytic reasoning, and are essential for gaining access to and understanding specific domains of knowledge. In addition, these skills are relevant across the range of life contexts, from education through work to home and social life and interaction with public authorities. The capacity to manage information and solve problems in technology-rich environments is becoming a necessity as information and communication technology (ICT) applications permeate the workplace, the classroom and lecture hall, the home, and social interaction more generally. Adults who are highly proficient in the skills measured by the Survey of Adult Skills are likely to be able to make the most of the opportunities created by the technological and structural changes modern societies are going through. Those who struggle to use new technologies are at greater risk of losing out.

The skills assessed in the Survey of Adult Skills are each defined by a framework that guided the development of the assessment and that provides a reference point for interpreting results. Each framework defines the skills assessed in terms of:

- **Content** – the texts, artefacts, tools, knowledge, representations and cognitive challenges that constitute the corpus to which adults must respond or use when they read, act in a numerate way or solve problems in technology-rich environments.
- **Cognitive strategies** – the processes that adults must bring into play to respond to or use a given content in an appropriate manner.
- **Context** – the different situations in which adults have to read, display numerate behaviour, and solve problems.

For an overview of the conceptual frameworks of each of the three domains, please consult the *Reader's Companion* (OECD, 2016a).

Among the main findings discussed in this chapter:

- Variation across countries/economies in adults' average proficiency in the three domains assessed in the Survey of Adult Skills is substantial: some 97 and 82 score points separate the highest- and lowest-scoring countries in literacy and numeracy proficiency, respectively, although many countries score within a relatively close range of each other.
- While the proficiency of adults differs across countries/economies, it varies to an even larger degree within countries, with a difference of 62 and 68 score points between the 25% of adults who attained the highest and lowest scores in literacy and numeracy, respectively. Countries with higher mean scores tend to have less variation in scores, with negative correlations at the country level ranging between r=-0.44 in literacy and r=-0.52 in numeracy.
- Among the countries/economies participating in Round 2 of the study, adults in New Zealand performed the best, scoring significantly above average in all three domains. Adults in Lithuania and Singapore performed better than average in some domains (numeracy and problem solving, respectively) and at around the average or slightly below in others. Adults in Greece, Israel and Slovenia performed below average in all three domains but, with the exception of problem solving in technology-rich environments in Greece, scored relatively close to the OECD average. Mean scores in all three domains in Chile and Turkey were substantially below the OECD average. In addition, Chile, Israel and Singapore showed the widest dispersion of scores among adults, indicating the need for policies to focus specifically on adults with low proficiency.
- As expected, proficiency in literacy and numeracy is closely related. Adults who are highly proficient in one domain are likely to be highly proficient in the other. There is also a strong positive relationship between literacy and numeracy, on the one hand, and problem solving in technology-rich environments on the other.
- Low-skilled adults represent a significant proportion of the population in all countries/economies. At least one in ten adults is proficient at or below Level 1 in literacy or numeracy in all countries in the study except Japan; more than one in two adults in Chile and Jakarta (Indonesia) score at these levels in literacy. At these levels, individuals can usually complete simple reading and numeracy tasks, such as locating information in a short text or performing simple one-step

arithmetic operations; but they have trouble extracting information from longer and more complex texts or performing numerical tasks involving several steps and mathematical information represented in different ways.

- Around one in four adults has no or only limited experience with computers or lacks confidence in their ability to use computers. In addition, nearly one in two adults is proficient only at or below Level 1 in problem solving in technology-rich environments. This means they are able to use only familiar applications to solve problems that involve few steps and explicit criteria, such as sorting e-mails into pre-existing folders.

Box 2.1 A context for cross-national comparisons of adult proficiency

The Survey of Adult Skills is conducted in rounds within the same cycle, using the same survey protocols and survey instruments. Round 1, which involved 24 countries/economies, took place in 2011-2012; nine additional countries/economies participated in Round 2, which was conducted during 2014-15; and six other countries will participate in Round 3 (2017-18).

The survey was designed to ensure that the cross-national comparisons of proficiency in literacy, numeracy and problem solving in technology-rich environments are as robust as possible and that the content of the assessment was equivalent in difficulty in each of the 28 language versions. Care was taken to standardise implementation, including sample design and field operations, in the 33 participating countries/economies. The quality-assurance and quality-control procedures put in place are among the most comprehensive and stringent ever implemented for an international household survey. The details of the technical standards guiding the design and implementation of the survey can be found in the Reader's Companion to the previous and this report (OECD, 2013a; OECD, 2016a) and in the *Technical Report of the Survey of Adult Skills, Second Edition* (OECD, forthcoming).

Interpreting differences in results among countries is nonetheless a challenging task, particularly as the Survey of Adult Skills covers adults born between 1946 and 1996 (countries included in Round 1) and between 1948 and 1998 (countries included in Round 2). These adults started their schooling from the early 1950s to the early 2000s and entered the labour market from the early 1960s to the present day. The results observed for each participating country, at least at the aggregate level reported in this chapter, represent the outcomes of a period of history that extends as far back as the immediate post-war era, which has been marked by significant social, political and economic change. For this reason, the results of the Survey of Adult Skills should not be interpreted only, or even primarily, in light of current policy settings or those of the recent past, important as these may be. The opportunities to develop, maintain and enhance the skills assessed will have varied significantly among countries over this period, and among different age cohorts within countries, depending on the evolution of education and training systems and policies, the path of national economic development, and changes in social norms and expectations.

The diversity of the countries/economies in the Survey of Adult Skills is evident in the timing and extent of economic development and educational expansion, and the growth of the countries' immigrant population. As Figure 2.1 illustrates, while there has been an overall increase in per capita GDP from 1970, through 1995, to 2014 in all of the participating countries/economies, Ireland, Korea, Norway and Singapore have seen particularly large increases during the period. Chile, Estonia, Lithuania and the Russian Federation have also seen a rapid expansion of per capita GDP in the past two decades or so.

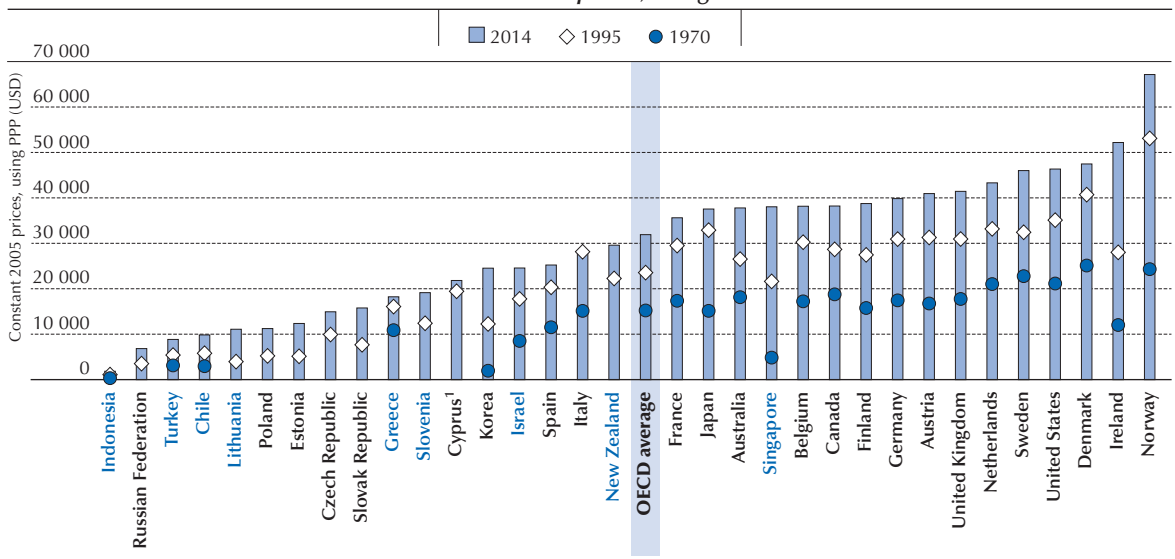
At the same time, some participating countries, such as Korea, Poland and Singapore, have seen rapid expansion in higher education (Figure 2.2) from a relatively low starting point, reflected in larger differences in the rates of tertiary attainment between older and younger age groups. Other countries, such as Canada, Estonia, Israel, New Zealand, the Russian Federation and the United States, have had high levels of participation in tertiary education throughout the post-war period. By contrast, in some participating countries, large proportions of older adults have not completed upper secondary education (Figure 2.3). While some of these countries, such as Greece, Ireland, Korea and Singapore, have seen substantial decreases in the proportion of young adults without upper secondary education, more than half of young adults in Turkey, and one-quarter of young adults in Italy and Spain have not attained upper secondary education.

The proportion of the population that is foreign-born adds to the diversity of country contexts. As shown in Figure 2.4, the proportion of the population that was foreign-born in 2011 varied from less than 1% in Korea to more than 25% in Australia. During the period from 1995 or 2000 to 2011, the proportion of the population in Spain, Norway and Ireland that was foreign-born more than doubled, while the proportion of foreign-born persons shrank in Israel and, to a lesser extent, in Estonia.

...

Figure 2.1 ■ **Per capita GDP, USD**

Constant 2005 prices, using PPP



1. *Note by Turkey:* The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the "Cyprus issue".

Note by all the European Union Member States of the OECD and the European Union: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

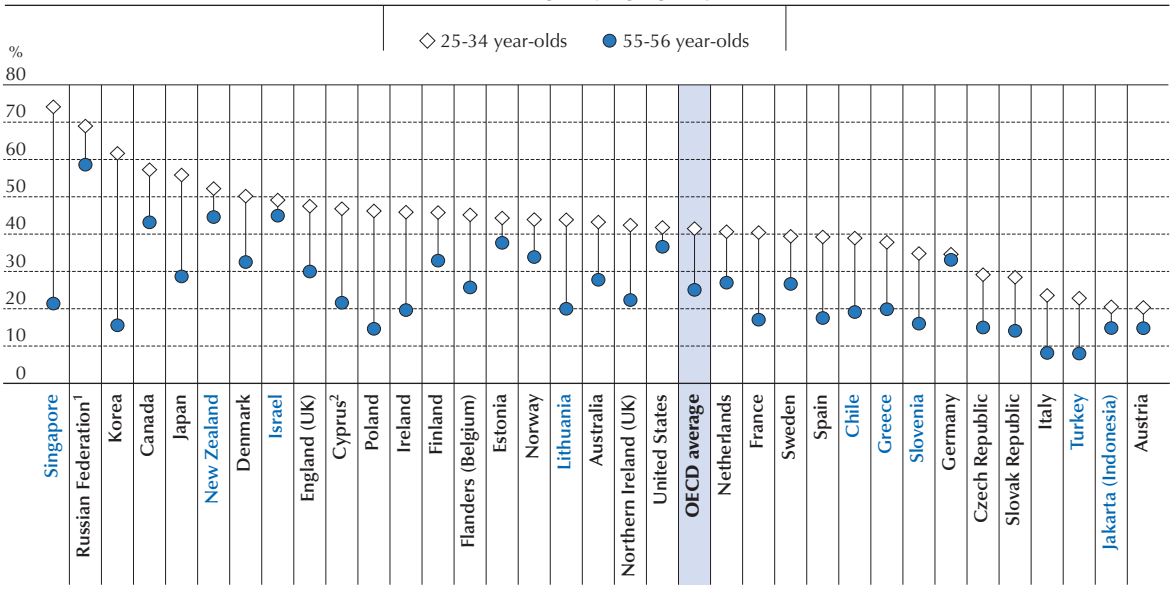
Countries are ranked in ascending order of per capita GDP in 2014.

Source: World Bank, World Development Indicators; Table B2.1.

StatLink http://dx.doi.org/10.1787/888933365757

Figure 2.2 ■ **Population with tertiary education**

Percentage, by age group



1. See note at the end of this chapter.

2. See note 1 under Figure 2.1.

Countries and economies are ranked in descending order of the percentage of 25-34 year-olds with tertiary education.

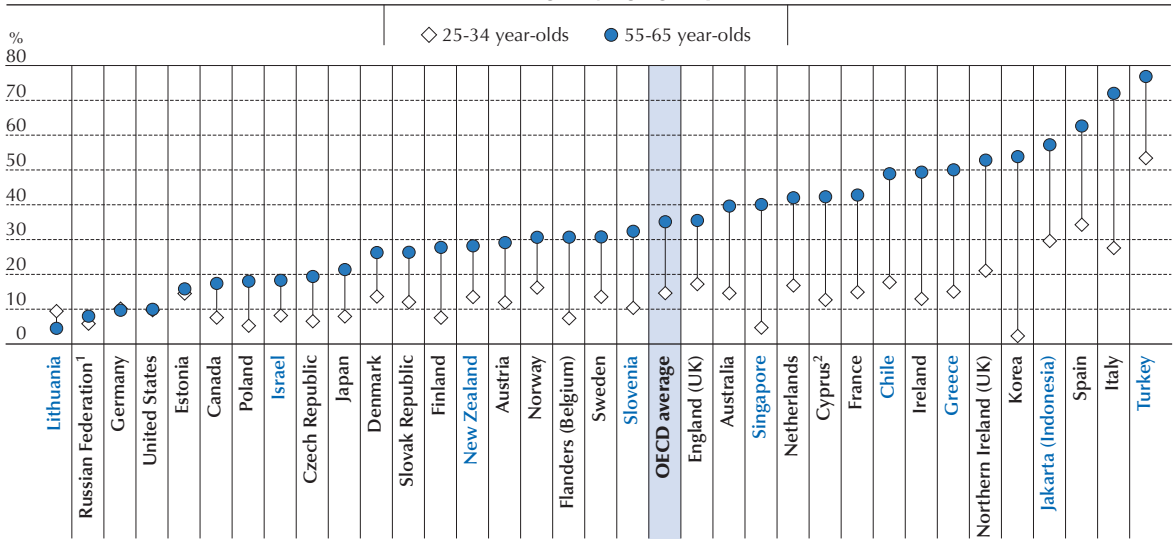
Source: Survey of Adult Skills (PIAAC) (2012, 2015), Table B2.2.

StatLink http://dx.doi.org/10.1787/888933365761

...

Figure 2.3 ■ **Population without upper secondary education**

Percentage, by age group



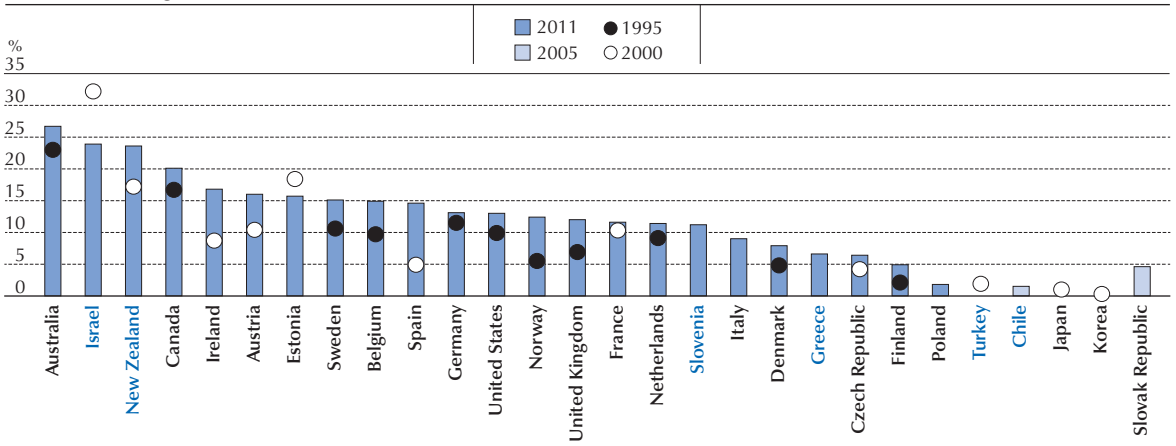
1. See note at the end of this chapter.
2. See note 1 under Figure 2.1.

Countries and economies are ranked in ascending order of the percentage of 55-65 year-olds without upper secondary education.

Source: Survey of Adult Skills (PIAAC) (2012, 2015), Table B2.2.

StatLink http://dx.doi.org/10.1787/888933365773

Figure 2.4 ■ **Foreign-born population as a percentage of total population**



Countries are ranked in descending order of the percentage of total population that was foreign-born in 2011.

Source: OECD.Stat, Country profiles database; Table B2.3.

StatLink http://dx.doi.org/10.1787/888933365785

REPORTING THE RESULTS

In each of the three domains assessed, proficiency is considered as a continuum of ability involving the mastery of information-processing tasks of increasing complexity. The results are represented on a 500-point scale, ranging from 0 to 500.

Each of the three proficiency scales was divided into "proficiency levels", defined by particular score-point ranges and the level of difficulty of the tasks within these ranges. The descriptors provide a summary of the types of tasks that can be successfully completed by adults with proficiency scores in a particular range. In other words, they suggest what adults with particular proficiency scores in a particular skills domain can do. Six proficiency levels are defined for literacy

and numeracy (Levels 1 through 5 plus below Level 1) and four for problem solving in technology-rich environments (Levels 1 through 3 plus below Level 1).[1] The value ranges defining the levels and their respective descriptors are presented in Tables 2.1, 2.2 and 2.3 in this chapter, and in Chapter 4 of the Reader's Companion to this report[2] (OECD, 2016a).

Tasks (test items) vary in difficulty and as such are located at different points on the proficiency scales. For example, some tasks are easy and can be correctly solved by most of the respondents with low proficiency while others are difficult and can be successfully completed only by those with high proficiency. A person with a score at the middle of a certain proficiency level can successfully complete tasks located at this level around two-thirds of the time; a person with a score at the bottom of the level would successfully complete tasks at that level only about half the time; and someone with a score at the top of the level would successfully complete tasks at that level about 80% of the time.

The proficiency levels have a descriptive purpose. They are intended to aid in the interpretation and understanding of the reporting scales by describing the attributes of the tasks that adults with particular proficiency scores can successfully complete. In particular, they have no normative element and should not be understood as "standards" or "benchmarks" in the sense of defining levels of proficiency appropriate for particular purposes (e.g. access to post-secondary education or fully participating in a modern economy) or for particular population groups. The division between Level 2 and below and Level 3 and above in literacy and numeracy and Level 2 and above and Level 1 or below in problem solving in technology-rich environments in the figures showing the distribution of the population by proficiency level has been made for ease of presentation. It does not reflect a judgement that Level 3 in literacy or Level 2 in problem solving represents a performance benchmark in any sense.

PROFICIENCY IN LITERACY

The Survey of Adult Skills defines literacy as the ability to understand, evaluate, use and engage with written texts in order to participate in society, achieve one's goals, and develop one's knowledge and potential. In the survey, the term "literacy" refers to reading written texts; it does not involve either comprehending or producing spoken language or producing text (writing). In addition, given the growing importance of digital devices and applications as a means of generating, accessing and storing written text, reading digital texts is an integral part of literacy measured in the Survey of Adult Skills (Box 2.2).

Digital texts are texts that are stored as digital information and accessed in the form of screen-based displays on devices such as computers and smart phones. Digital texts have a range of features that distinguish them from print-based texts: in addition to being displayed on screens, they include hypertext links to other documents, specific navigation features (e.g. scroll bars, use of menus) and interactivity. The Survey of Adult Skills is the first international assessment of adult literacy to cover this dimension of reading.

Box 2.2 Reading on a screen or on paper: Does it affect proficiency in literacy?

The assessment component of the Survey of Adult Skills was delivered in both a computer-based and a paper-based version. On average across OECD countries and economies 72% of respondents took the computer-based assessment and some 24% took the paper-based assessment as they had no or poor computer skills or expressed a preference to do so (Figure 2.5).

The computer-based and paper-based assessments of literacy differ in two main ways. First, the paper-based assessment tests the reading of print texts exclusively whereas the computer-based version covers the reading of digital texts, such as simulated websites, results pages from search engines and blog posts, in addition to the reading of print texts presented on a screen. Thus, while a set of items that contains print text is common to both modes, a subset of items with digital text is used only in the computer-based assessment.

Second, the response modes differ. In the paper-based test, respondents provide written answers in paper test booklets. In the computer-based test, responding to the assessment tasks involves interacting with text and visual displays on a computer screen using devices, such as a keyboard and a mouse, and functions, such as highlighting and drag-and-drop.

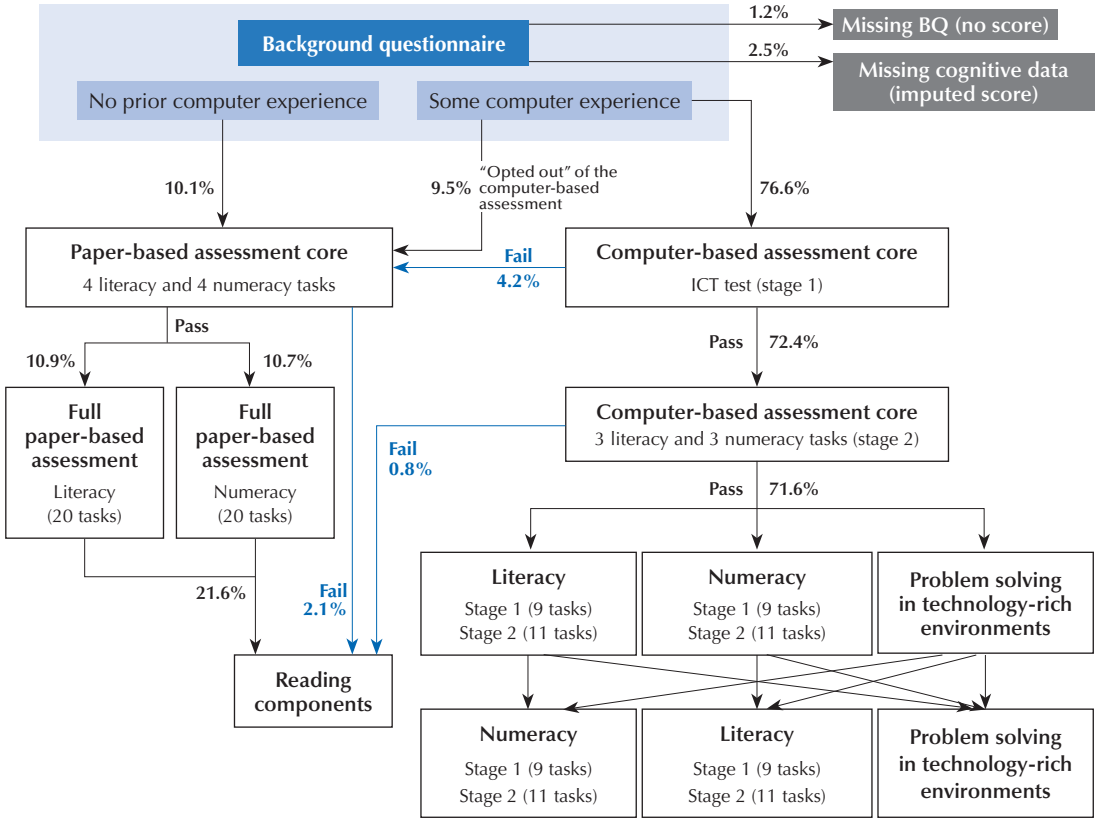
In spite of these differences, most of the test items that are common to both versions are found to have equal difficulty and discrimination properties (for details, see OECD, 2013b). In other words, their measurement properties are unaffected by the mode in which the test was taken and as such can be placed on the same scale.

…

This means that the processes of understanding the meaning of text are fundamentally the same for all types of text.

Analyses of the results from the Survey of Adult Skills show that once socio-demographic factors (age, educational attainment, immigrant background and gender) are taken into account, there are no systematic differences between the scores of adults who took the paper-based assessment and those who took the computer-based assessment (differences across several variables between adults who took the paper-based assessment and those who took the computer-based assessment are shown in Tables B2.4, B2.5, B2.6, B2.7 and B2.8 in Annex B).

Figure 2.5 ■ **Percentage of respondents taking different pathways in the Survey of Adult Skills (PIAAC)**



Note: The figures presented in this diagram are based on the average of OECD countries/economies participating in the Survey of Adult Skills (PIAAC).
StatLink http://dx.doi.org/10.1787/888933365791

Levels of literacy proficiency across countries and economies

The literacy proficiency scale is divided into six levels of proficiency: Levels 1 through 5 and below Level 1. The features of the tasks at these levels are described in detail in Table 2.1 (examples of literacy items are available in OECD, 2013c) and the Reader's Companion to this report (OECD, 2016a).

Figure 2.6 presents the percentage of adults in each participating country who scored at each of the six levels of proficiency on the literacy scale.

On average, one in ten adults (10.6%) scored at Level 4 or higher and one in three (35.4%) scored at Level 3. Overall, almost half of all adults (46.0%) scored at the three highest levels (Level 3, 4 or 5). The largest proportions of adults who scored at Level 3 or higher are found in Japan (71.1%), Finland (62.9%) and the Netherlands (59.6%). Fewer than one in six adults in Turkey (12.0%) and Chile (14.5%) attained these levels of proficiency in literacy. In Jakarta (Indonesia), only 6% of adults scored at the three highest proficiency levels in literacy.

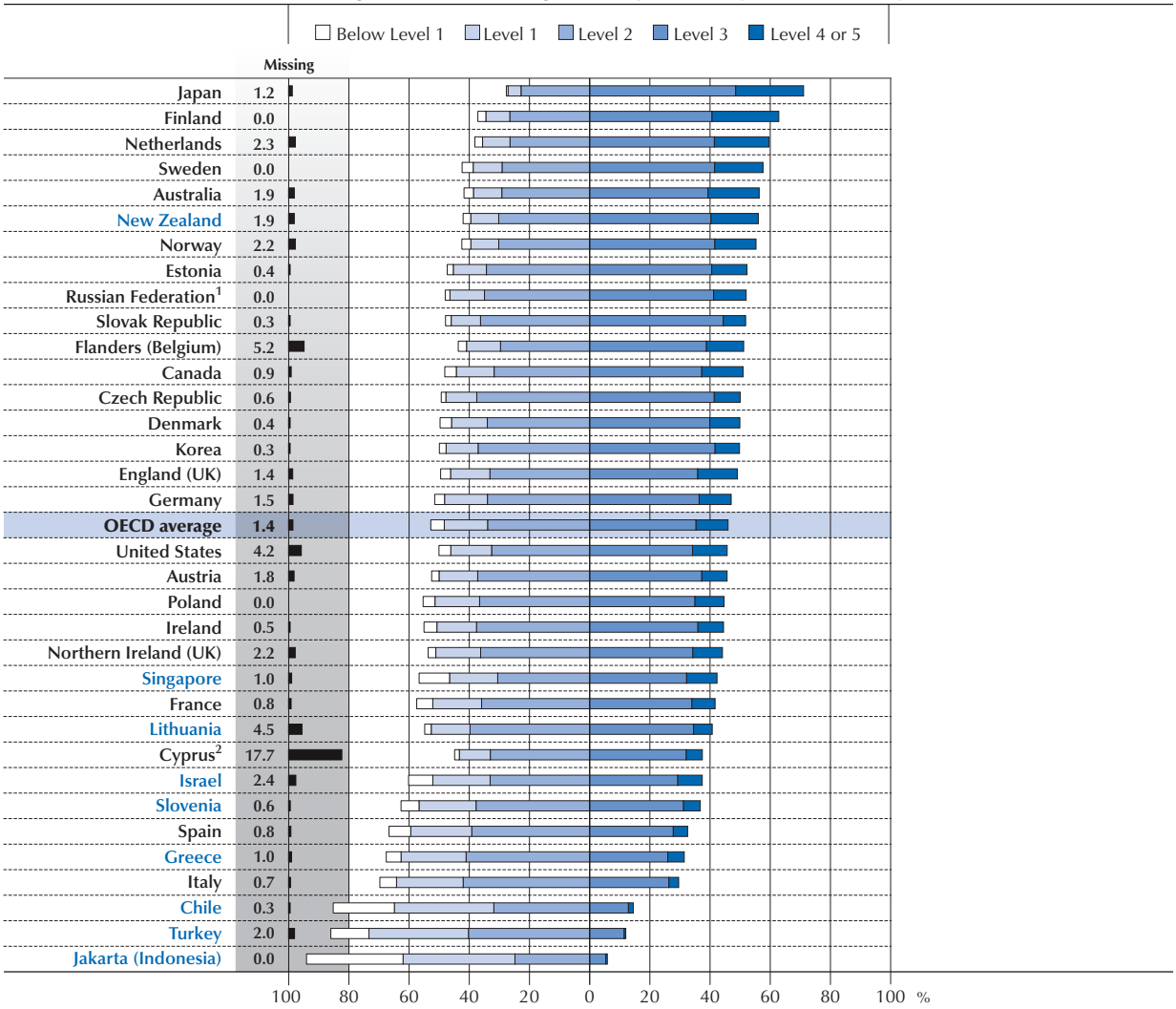
Table 2.1 Description of proficiency levels in literacy

Level	Score range	Percentage of adults scoring at each level (average)	Types of tasks completed successfully at each level of proficiency
Below Level 1	Below 176 points	4.5%	The tasks at this level require the respondent to read brief texts on familiar topics to locate a single piece of specific information. There is seldom any competing information in the text and the requested information is identical in form to information in the question or directive. The respondent may be required to locate information in short continuous texts. However, in this case, the information can be located as if the text were non-continuous in format. Only basic vocabulary knowledge is required, and the reader is not required to understand the structure of sentences or paragraphs or make use of other text features. Tasks below Level 1 do not make use of any features specific to digital texts.
1	176 to less than 226 points	14.4%	Most of the tasks at this level require the respondent to read relatively short digital or print continuous, non-continuous, or mixed texts to locate a single piece of information that is identical to or synonymous with the information given in the question or directive. Some tasks, such as those involving non-continuous texts, may require the respondent to enter personal information onto a document. Little, if any, competing information is present. Some tasks may require simple cycling through more than one piece of information. Knowledge and skill in recognising basic vocabulary determining the meaning of sentences, and reading paragraphs of text is expected.
2	226 to less than 276 points	33.9%	At this level, the medium of texts may be digital or printed, and texts may comprise continuous, non-continuous, or mixed types. Tasks at this level require respondents to make matches between the text and information, and may require paraphrasing or low-level inferences. Some competing pieces of information may be present. Some tasks require the respondent to: ▪ Cycle through or integrate two or more pieces of information based on criteria ▪ Compare and contrast or reason about information requested in the question ▪ Navigate within digital texts to access and identify information from various parts of a document.
3	276 to less than 326 points	35.4%	Texts at this level are often dense or lengthy, and include continuous, non-continuous, mixed or multiple pages of text. Understanding text and rhetorical structures become more central to successfully completing tasks, especially navigating complex digital texts. Tasks require the respondent to identify, interpret or evaluate one or more pieces of information, and often require varying levels of inference. Many tasks require the respondent to construct meaning across larger chunks of text or perform multi-step operations in order to identify and formulate responses. Often tasks also demand that the respondent disregard irrelevant or inappropriate content to answer accurately. Competing information is often present, but it is not more prominent than the correct information.
4	326 to less than 376 points	10.0%	Tasks at this level often require respondents to perform multiple-step operations to integrate, interpret or synthesise information from complex or lengthy continuous, non-continuous, mixed, or multiple type texts. Complex inferences and application of background knowledge may be needed to perform the task successfully. Many tasks require identifying and understanding one or more specific, non-central idea(s) in the text in order to interpret or evaluate subtle evidence-claim or persuasive discourse relationships. Conditional information is frequently present in tasks at this level and must be taken into consideration by the respondent. Competing information is present and sometimes seemingly as prominent as correct information.
5	Equal or higher than 376 points	0.7%	At this level, tasks may require the respondent to search for and integrate information across multiple, dense texts; construct syntheses of similar and contrasting ideas or points of view; or evaluate evidence-based arguments. Application and evaluation of logical and conceptual models of ideas may be required to accomplish tasks. Evaluating the reliability of evidentiary sources and selecting key information is frequently a requirement. Tasks often require respondents to be aware of subtle, rhetorical cues and to make high-level inferences or use specialised background knowledge.

Note: The percentage of adults scoring at different levels of proficiency adds up to 100% when 1.4% of literacy-related non-respondents across countries/economies are taken into account. Adults in this category were not able to complete the background questionnaire due to language difficulties or learning and mental disabilities (see section on literacy-related non-response).

Figure 2.6 ■ **Literacy proficiency among adults**

Percentage of adults scoring at each proficiency level in literacy



Note: Adults in the missing category were not able to provide enough background information to impute proficiency scores because of language difficulties, or learning or mental disabilities (referred to as literacy-related non-response).

1. See note at the end of this chapter.

2. See note 1 under Figure 2.1.

Countries and economies are ranked in descending order of the combined percentages of adults scoring at Level 3 and at Level 4 or 5.

Source: Survey of Adult Skills (PIAAC) (2012, 2015), Table A2.1.

StatLink http://dx.doi.org/10.1787/888933365800

Overall, less than 1% (0.7%) of adults performed at the highest proficiency, Level 5. Apart from Finland (2.2%), no other country/economy, had more than 1.3% of adults performing at this level. In a number of countries, such as Chile, Italy and Turkey, very few adults scored at this proficiency level in literacy (see Table A2.1 in Annex A). Given the growing demand for complex information-processing skills in the labour market (Autor, Levy and Murnane, 2003; Levy and Murnane, 2006), these proportions are worryingly small.

On average, around one in three adults (33.9%) performed at Level 2. Italy (42.0%), Turkey (40.2%) and Greece (41%) have the largest proportions of adults scoring at this level. In contrast, Japan (22.8%), the Netherlands (26.4%) and Finland (26.5%) have the smallest proportions of adults scoring at Level 2.

Overall, around one in five adults scored at Level 1 (14.4%) or below Level 1 (4.5%). Countries/economies with the largest proportions of adults who scored at Level 1 or below include Chile (53.4%), Turkey (45.7%), Italy (27.7%), Spain (27.5%) and Israel (27.1%). In Jakarta (Indonesia), this proportion is even higher, with 69.3% of adults scoring at the two lowest proficiency levels in literacy. Japan (4.9%), Finland (10.6%), the Slovak Republic (11.6%), the Netherlands (11.7%),

New Zealand (11.8%) and the Czech Republic (11.8%) recorded the smallest proportions of adults who scored at or below Level 1. More information about the skills of readers with low literacy proficiency is provided through the reading components assessment (see below).

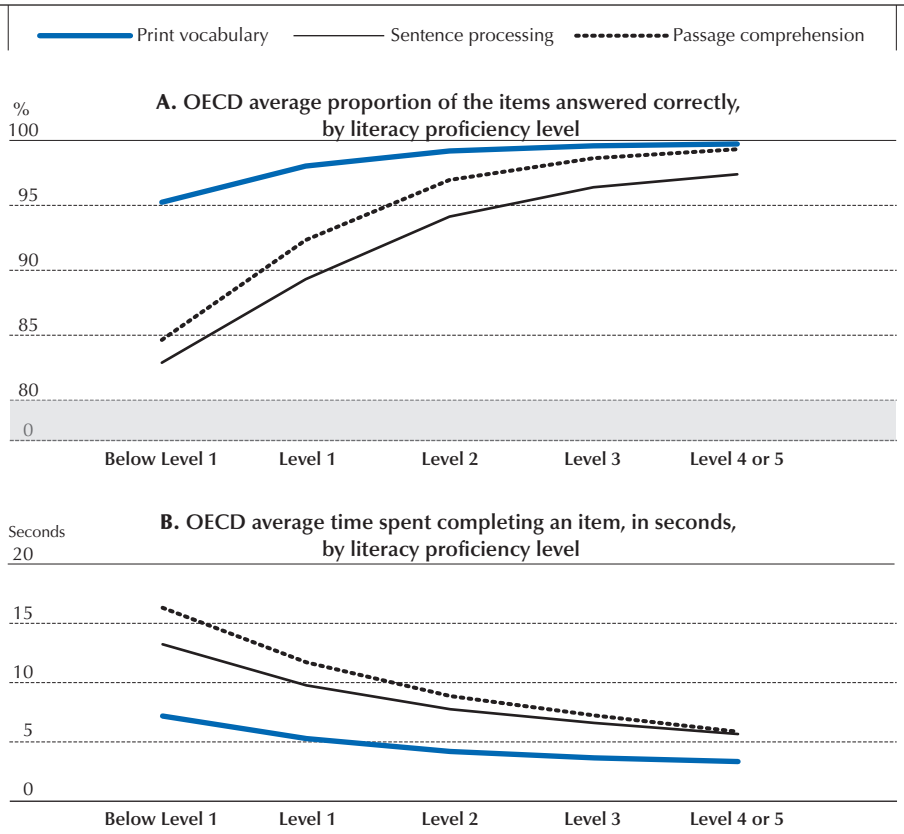
Literacy-related non-response

In all of the participating countries/economies, some adults were unable to complete the background questionnaire as they were unable to understand or read the language of the assessment, have difficulty reading or writing, or have learning or mental disabilities. In the case of the background questionnaire, there was no one present (either the interviewer or another person) to translate into the language of the respondent or answer on behalf of the respondent. In the case of these respondents, only their age, sex, and, in some cases, educational attainment is known. In most countries, non-respondents represented less than 5% of the total population. This category is identified separately in Figure 2.6 as a black bar in each country (categorised as "missing"). While the proficiency of this group is likely to vary among countries, in most cases, these persons are likely to have low levels of proficiency (Level 1 or below) in the test language(s) of the country concerned.

READING COMPONENTS

The Survey of Adult Skills included an assessment of reading components designed to provide information about adults with very low levels of proficiency in reading. This module was implemented in 29 of the 33 participating countries/economies (Finland, France, Japan and the Russian Federation did not participate in this assessment). The reading components assessment was designed to assess three skills considered as essential for understanding the meaning of written texts: knowledge of print vocabulary (word recognition), the ability to evaluate the logic of sentences (sentence processing), and fluency in reading passages of text (passage comprehension). Skilled readers are able to undertake these types of operations automatically.

Figure 2.7 ■ **Relationship between literacy proficiency and performance in reading components**



Notes: The results for each country/economy can be found in the table mentioned in the source below. Finland, France and Japan did not participate in the reading components assessment.

Source: Survey of Adult Skills (PIAAC) (2012, 2015), Table A2.2.

StatLink http://dx.doi.org/10.1787/888933365810

The print-vocabulary tasks required test takers to select the word corresponding to a picture of an object from a selection of four alternative words. The sentence-processing tasks required test takers to identify whether a sentence made logical sense in the properties of the real world. The passage-comprehension tasks entailed reading a prose text. At certain points in the text, test takers were given a choice of two words and required to select the word that made the most sense in the context of the passage. Chapter 1 in the Reader's Companion to this report presents samples of the reading-components tasks (OECD, 2016a).

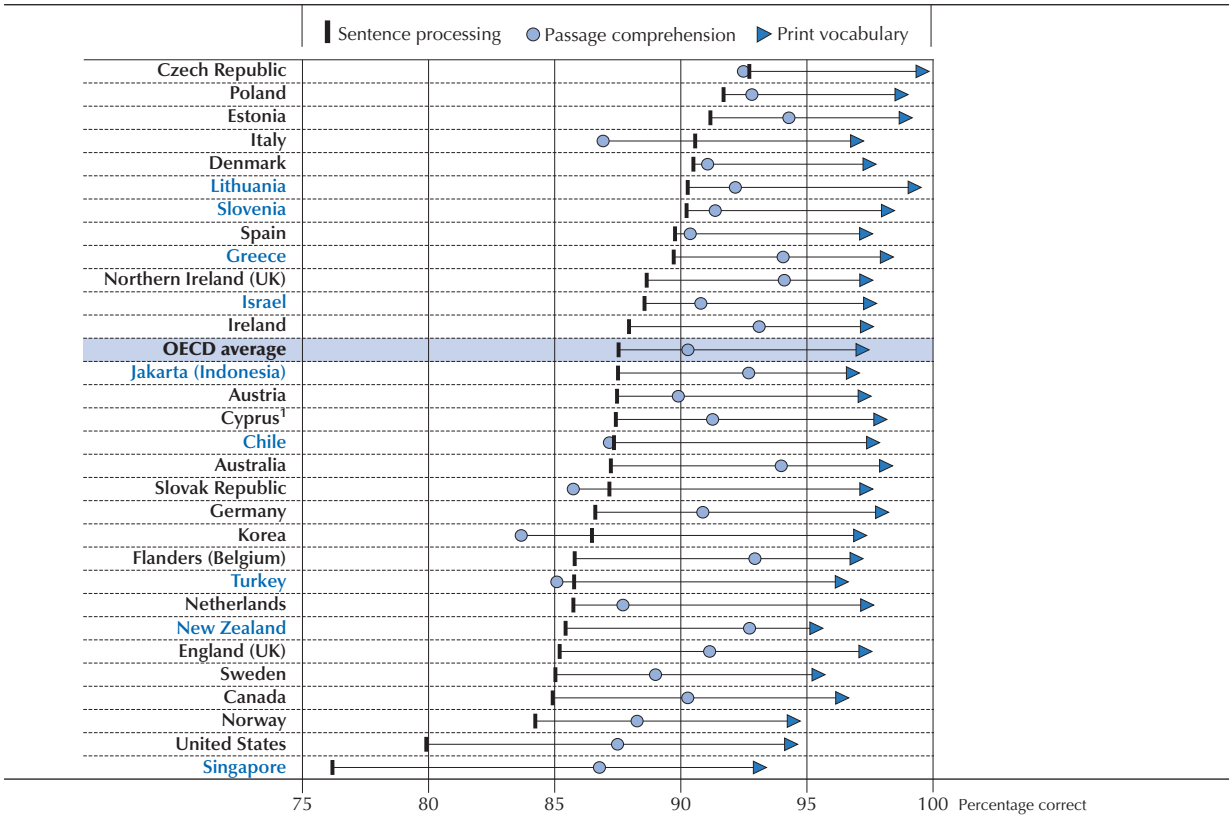
The assessment of reading components was completed by respondents who failed the literacy and numeracy core assessment in the computer-based version of the assessment, and by all respondents taking the paper version of the assessment in order to obtain comparative results (Box 2.2, Figure 2.5).

Figure 2.7 shows the relationship between literacy proficiency and the average performance in the three components of this assessment across the OECD countries/economies that participated in the reading components assessment. Information is available about two dimensions of performance in reading components: the proportion of items that were correctly answered by respondents and the time taken to complete the assessment. Figure 2.7a shows the relationship between literacy proficiency and the percentage of items answered correctly (accuracy); Figure 2.7b shows the relationship between literacy proficiency and the time taken (in seconds) to complete an item (speed). Both accuracy and speed increase with higher proficiency in all three of the components, with the gains in both accuracy and speed tapering off markedly among adults who are proficient at Level 2 or higher.

Figure 2.8 presents the average proportions of correctly answered items across countries/economies and in each of the three reading components. Since adults with higher literacy proficiency (Level 2 or above) correctly perform almost all tasks, results are presented only for adults proficient at or below Level 1 in literacy. Their scores in the reading components assessment vary much more.

Figure 2.8 ▪ **Performance in reading components**

Average proportion of items answered correctly, adults who score at or below Level 1 in literacy proficiency



Note: Finland, France, Japan and the Russian Federation did not participate in the reading components assessment.
1. See note 1 under Figure 2.1.
Countries and economies are ranked in descending order of the mean proportion of items answered correctly in sentence processing.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), Table A2.2.
StatLink http://dx.doi.org/10.1787/888933365824

There is little difference across countries/economies in the average proportion of correct answers in the print-vocabulary component, with the proportion varying between 93% in Singapore and 99.6% in the Czech Republic. More variability is observed in the case of passage comprehension. The largest variation occurs in the sentence-processing component, where the proportion of correct answers varies between 76% in Singapore and 92.7% in the Czech Republic.

Although the passage-comprehension tasks took longer to complete, on average in the majority of countries/economies, adults with low literacy found the sentence-processing tasks to be the most difficult to answer correctly. Adults with low proficiency in Singapore and the United States struggled much more with tasks in all three reading components than their peers in other participating countries did. These results may be related to the language background of the immigrant population in the United States and, in the case of Singapore, to both the considerably lower levels of educational attainment and poorer English-language skills among older cohorts (see Figures 2.2 and 2.3 in Box 2.1).[3] A more detailed analysis of reading components results is presented in a newly published report on adults with low proficiency in literacy and numeracy (Grotlüschen et al., 2016).

DISTRIBUTION OF PROFICIENCY SCORES ACROSS COUNTRIES AND ECONOMIES

Mean proficiency scores in literacy

Mean literacy scores among adults in the countries/economies participating in the Survey of Adult Skills are presented in Figure 2.9. Countries with mean scores that are not statistically different from those of other countries are identified (Box 2.3). For example, the mean score of adults in Israel (255 points) is similar to that of adults in Slovenia (256 points) and Greece (254 points), but is lower than that of adults in Singapore (258 points) and France (262 points), and higher than that of adults in Spain (252 points) and the countries whose mean scores are lower than that of Spain. For each country, a list of countries whose adults' average score is statistically similar is also shown.

Box 2.3 Comparing results among countries/economies and population subgroups

The statistics in this report are estimates of national performance based on samples of adults from each country, rather than values that would be obtained if every person in the target population in every country had answered every question. Consequently, in the Survey of Adult Skills, each estimate has an associated degree of uncertainty, which is expressed through a standard error. The use of confidence intervals provides a way to make inferences about the population means and proportions in a manner that reflects the uncertainty associated with the sample estimates. From an observed sample statistic, and assuming a normal distribution, it can be inferred that the result for the corresponding population would lie within the confidence interval in 95 out of 100 replications of the measurement on different samples drawn from the same population.

In many cases, readers are primarily interested in whether a given value in a particular country is different from a second value in the same or another country, e.g. whether women in a country perform better than men in the same country or whether adults in one country have higher average scores than adults in another country. In the tables and figures used in this report, differences are labelled as statistically significant when there is less than a 5% chance that an observed difference between two representative samples reflects random sample variation, rather than actual differences between these populations.

In addition to error associated with sampling, there is a range of other possible sources of error in sample surveys such as the Survey of Adult Skills, including error associated with survey non-response (see Chapter 3 of the Reader's Companion to this report for a discussion of response rates and non-response bias [OECD, 2016a]). While the likely level of bias associated with non-response is assessed as minimal to low for most countries/economies that participated in the study, the possibility of biases associated with non-response cannot be ruled out. Readers should, therefore, exercise caution in drawing conclusions from small score-point differences between countries or population groups, even if the differences concerned are statistically significant.

The average literacy score across the OECD countries/economies that participated in the assessment is 268 points. Japan had the highest average level of proficiency in literacy (296 points) followed by Finland (288 points) and the Netherlands (284 points). Chile (220 points) and Turkey (227 points) recorded the lowest average scores among countries. Jakarta (Indonesia) had an even lower average score (200 points). Given that Level 2 ranges between 226 and 275 points and Level 3 ranges between 276 and 325 points, adults in the eight best-performing countries scored, on average, towards the lower end of Level 3. This implies that an average adult in these countries could successfully complete almost all of the tasks at Level 2 difficulty and below, and more than half of the tasks at Level 3 difficulty.

Figure 2.9 ▪ **Comparison of average literacy proficiency**

Mean literacy proficiency scores of 16-65 year-olds

Significantly **above** the average
Not significantly different from the average
Significantly **below** the average

Mean	Comparison country/economy	Countries/economies whose mean score is NOT significantly different from the comparison country/economy
296	**Japan**	
288	**Finland**	
284	**Netherlands**	
281	**New Zealand**	Australia, Sweden, Russian Federation[1]
280	**Australia**	New Zealand, Norway, Sweden, Russian Federation[1]
279	**Sweden**	Australia, New Zealand, Norway, Russian Federation[1]
278	**Norway**	Australia, Sweden, Russian Federation[1]
276	**Estonia**	Czech Republic, Flanders (Belgium), Russian Federation[1]
275	**Flanders (Belgium)**	Czech Republic, Estonia, Slovak Republic, Russian Federation[1]
275	**Russian Federation[1]**	Australia, Canada, Czech Republic, Denmark, England (UK), Estonia, Flanders (Belgium), Germany, Korea, New Zealand, Northern Ireland (UK), Norway, Slovak Republic, Sweden, United States
274	**Czech Republic**	Canada, England (UK), Estonia, Flanders (Belgium), Korea, Slovak Republic, Russian Federation[1]
274	**Slovak Republic**	Canada, Czech Republic, England (UK), Flanders (Belgium), Korea, Russian Federation[1]
273	**Canada**	Czech Republic, England (UK), Korea, Slovak Republic, Russian Federation[1]
273	**England (UK)**	Canada, Czech Republic, Denmark, Korea, Northern Ireland (UK), Slovak Republic, United States, Russian Federation[1]
273	**Korea**	Canada, Czech Republic, England (UK), Northern Ireland (UK), Slovak Republic, Russian Federation[1]
271	**Denmark**	Austria, England (UK), Germany, Northern Ireland (UK), United States, Russian Federation[1]
270	**Germany**	Austria, Denmark, Northern Ireland (UK), United States, Cyprus,[2] Russian Federation[1]
270	**United States**	Austria, Denmark, England (UK), Germany, Northern Ireland (UK), Cyprus,[2] Russian Federation[1]
269	**Austria**	Denmark, Germany, Northern Ireland (UK), United States, Cyprus[2]
269	**Cyprus[2]**	Austria, Germany, Ireland, Northern Ireland (UK), United States, Lithuania
269	**Northern Ireland (UK)**	Austria, Denmark, England (UK), Germany, Ireland, Korea, Poland, United States, Cyprus,[2] Lithuania, Russian Federation[1]
268	**OECD average**	**Ireland, Northern Ireland (UK), Poland, Cyprus,[2] Lithuania**
267	**Poland**	Ireland, Northern Ireland (UK), Lithuania
267	**Lithuania**	Ireland, Northern Ireland (UK), Poland, Cyprus[2]
267	**Ireland**	Northern Ireland (UK), Poland, Cyprus,[2] Lithuania
262	**France**	
258	**Singapore**	Slovenia
256	**Slovenia**	Greece, Israel, Singapore
255	**Israel**	Greece, Slovenia
254	**Greece**	Israel, Slovenia, Spain
252	**Spain**	Greece, Italy
250	**Italy**	Spain
227	**Turkey**	
220	**Chile**	
200	**Jakarta (Indonesia)**	

Notes: Statistical significance is at the 5% level. Literacy-related non-response (missing) is excluded from the calculation of mean scores.
1. See note at the end of this chapter.
2. See note 1 under Figure 2.1.
Countries and economies are ranked in descending order of the mean score.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), Table A2.3.
StatLink http://dx.doi.org/10.1787/888933365839

The average proficiency of most countries, and the international average, rests at the upper part of Level 2. An average adult in these countries could successfully complete almost all of the tasks at Level 2 difficulty and some tasks at Level 3. By contrast, the average score in Chile is below Level 2 (the upper part of Level 1), indicating that the average adult in Chile could complete almost all tasks at Level 1 difficulty but only a few tasks at Level 2. The average adult in Jakarta (Indonesia) can complete even fewer tasks at Level 1 (around two-thirds), and very few if any at Level 2.

Overall, the variation in literacy proficiency among participating countries/economies is considerable. Some 76 score points separate the countries/economies with the highest and lowest mean score (96 points when Jakarta [Indonesia] is included). However, around two-third of countries/economies (22 of 33) differ by 21 points or less (they have mean scores within the range of 267 to 288 points) and around half of countries/economies (16) differ by 9 score points or less (they have mean scores within the range of 267 to 276 points). By way of comparison, the average score-point gap between the highest- and lowest-performing 25% of adults (first and third quartiles) in literacy is 62 score points across all countries/economies (see Table A2.3 in Annex A).

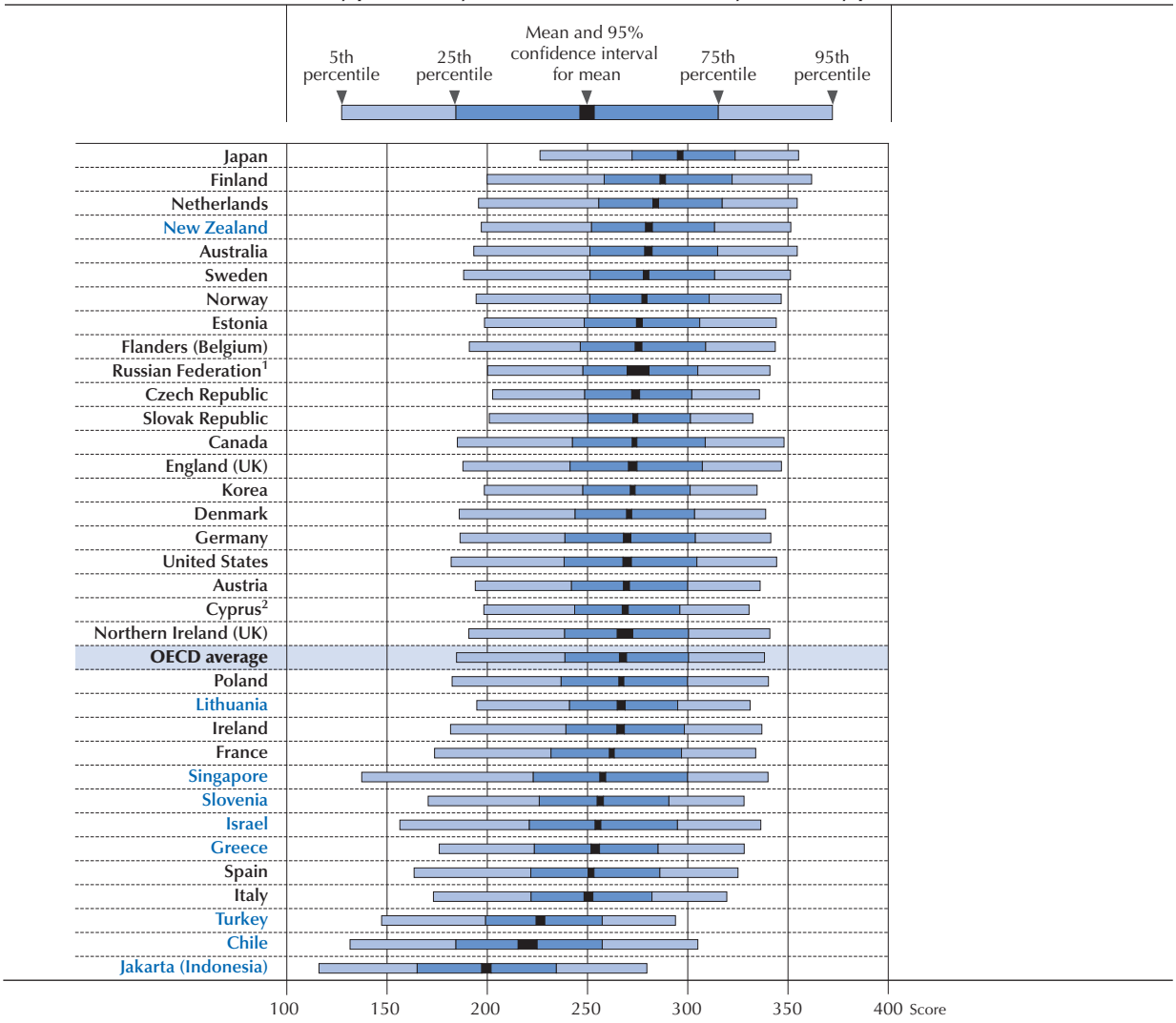
Variation of proficiency scores within countries/economies

In addition to examining differences in national averages in literacy proficiency, it is also useful to explore the distribution of proficiency scores within each country/economy. This can be done by identifying the score below which 5%, 25%, 75% and 95% of adults perform. Comparing score-point differences among adults at different points in the distribution of proficiency measures the extent of variation in that distribution in each participating country or economy. Figure 2.10 presents the distribution of scores within countries/economies in addition to the mean score. A longer bar indicates greater variations in literacy proficiency within a country; a shorter bar indicates smaller variations.

On average, 62 score points separate the 25% of adults who attained the highest and lowest scores in literacy (a measure known as the interquartile range). In a number of countries, comparatively small variations in literacy proficiency are observed. These include Japan (51 score points), the Slovak Republic (51 points), Cyprus[4] (52 points) and the Czech Republic (53 points). Countries with comparatively large variations in scores between the top- and bottom-performing 25% of adults include Singapore (77 points), Israel (74 points) and Chile (73 points).

Figure 2.10 ■ **Distribution of literacy proficiency scores**

Mean literacy proficiency and distribution of literacy scores, by percentile

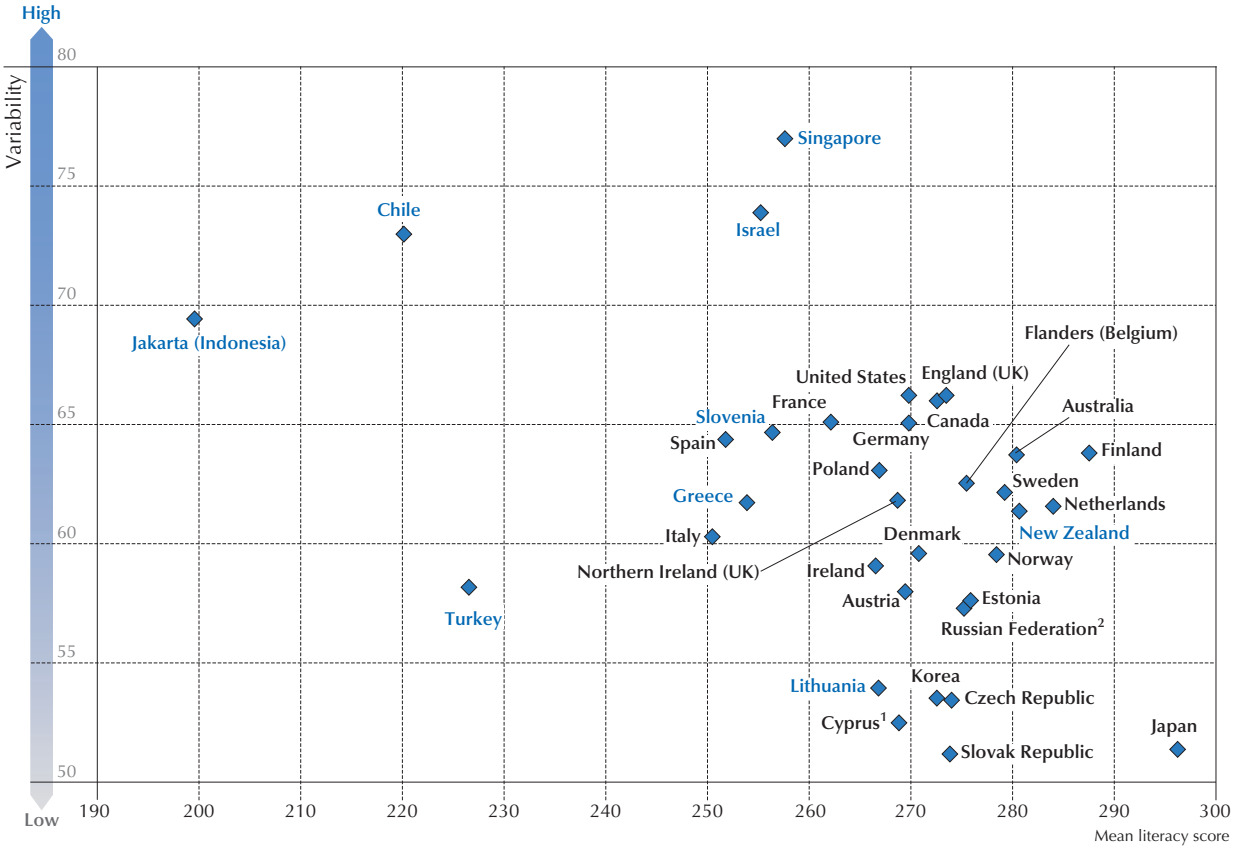


Notes: Mean scores are shown with a 95% confidence interval. Literacy-related non-response (missing) is excluded from the calculation of mean scores.
1. See note at the end of this chapter.
2. See note 1 under Figure 2.1.
Countries and economies are ranked in descending order of the mean score.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), Table A2.3.
StatLink http://dx.doi.org/10.1787/888933365842

Interestingly, there is a moderate inverse relationship (r=-0.44) between the overall level of adults' proficiency in literacy and the variation in scores: the higher the average level of proficiency, the smaller the variation in scores. Figure 2.11 presents this relationship between average scores and variation in scores, expressed through the interquartile range, across countries/economies. This suggests that there might not be a trade-off between achieving higher average skills proficiency and less inequality in skills distribution. Nevertheless, it is important to be cautious when interpreting this correlation as it is relatively weak and overwhelmingly relies on few (outlier) countries/economies.

Figure 2.11 ■ **Average and distribution of literacy scores**

Relationship between mean literacy proficiency score and variability



Note: The measure of variability used is the interquartile range (difference between the third quartile and the first quartile).
1. See note 1 under Figure 2.1.
2. See note at the end of this chapter.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), Table A2.3.
StatLink http://dx.doi.org/10.1787/888933365856

Small variations in scores are found in countries/economies with high (Japan) or middle (the Slovak Republic and the Czech Republic) levels of literacy proficiency among adults, while large variations are found in countries/economies with low proficiency in literacy (Chile, Israel and Singapore). Relatively large variation is observed in Jakarta (Indonesia) as well. One exception to this trend is Turkey, which shows low overall literacy proficiency among adults, but smaller variations in scores. This might be because few adults score at the high end of the literacy proficiency scale.

The reasons underlying the differences in the distribution of scores are undoubtedly complex and likely to be affected by such factors as the historical patterns of participation in education, support for adult learning and practicing skills at and outside the workplace, and patterns of immigration. In Singapore, for example, a wide gap in average performance between different age cohorts contributed to both a wider dispersion of scores and a lower average proficiency level (see Chapter 3).

PROFICIENCY IN NUMERACY

The Survey of Adult Skills defines numeracy as the ability to access, use, interpret and communicate mathematical information and ideas in order to engage in and manage the mathematical demands of a range of situations in adult life. A numerate adult is one who responds appropriately to mathematical content, information and ideas represented in various ways in order to manage situations and solve problems in a real-life context. While performance on numeracy tasks is, in part, dependent on the ability to read and understand text, numeracy involves more than applying arithmetical skills to information embedded in text.

Levels of numeracy proficiency across countries/economies

Like the literacy scale, the numeracy proficiency scale is divided into six proficiency levels: Levels 1 through 5 and below Level 1. The features of the tasks located at these levels are described in detail in Table 2.2 (examples of numeracy items are available in OECD, 2013c).

Table 2.2 Description of proficiency levels in numeracy

Level	Score range	Percentage of adults scoring at each level (average)	The types of tasks completed successfully at each level of proficiency
Below Level 1	Below 176 points	6.7%	Tasks at this level require the respondents to carry out simple processes, such as counting, sorting, performing basic arithmetic operations with whole numbers or money, or recognising common spatial representations in concrete, familiar contexts where the mathematics content is explicit with little or no text or distractors.
1	176 to less than 226 points	16.0%	Tasks at this level require the respondent to carry out basic mathematical processes in common, concrete contexts where the mathematical content is explicit, with little text and minimal distractors. Tasks usually require one-step or simple processes involving counting, sorting, performing basic arithmetic operations, understanding simple percentages, such as 50%, and locating and identifying elements of simple or common graphical or spatial representations.
2	226 to less than 276 points	33.0%	Tasks at this level require the respondent to identify and act on mathematical information and ideas embedded in a range of common contexts where the mathematics content is fairly explicit or visual with relatively few distractors. Tasks tend to require the application of two or more steps or processes involving calculation with whole numbers and common decimals, percentages and fractions; simple measurement and spatial representation; estimation; and interpretation of relatively simple data and statistics in texts, tables and graphs.
3	276 to less than 326 points	31.8%	Tasks at this level require the respondent to understand mathematical information that may be less explicit, embedded in contexts that are not always familiar and represented in more complex ways. Tasks require several steps and may involve the choice of problem-solving strategies and relevant processes. Tasks tend to require the application of number sense and spatial sense; recognising and working with mathematical relationships, patterns and proportions expressed in verbal or numerical form; and interpretation and basic analysis of data and statistics in texts, tables and graphs.
4	326 to less than 376 points	10.2%	Tasks at this level require the respondent to understand a broad range of mathematical information that may be complex, abstract or embedded in unfamiliar contexts. These tasks involve undertaking multiple steps and choosing relevant problem-solving strategies and processes. Tasks tend to require analysis and more complex reasoning about quantities and data; statistics and chance; spatial relationships; and change, proportions and formulas. Tasks at this level may also require understanding arguments or communicating well-reasoned explanations for answers or choices.
5	Equal or higher than 376 points	1.0%	Tasks at this level require the respondent to understand complex representations and abstract and formal mathematical and statistical ideas, possibly embedded in complex texts. Respondents may have to integrate multiple types of mathematical information where considerable translation or interpretation is required; draw inferences; develop or work with mathematical arguments or models; and justify, evaluate and critically reflect upon solutions or choices.

Note: The proportion of adults scoring at different levels of proficiency adds up to 100% when the 1.4% of numeracy-related non-respondents across countries/economies are taken into account. Adults in the missing category were not able to provide enough background information to impute proficiency scores because of language difficulties, or learning or mental disabilities (see section on literacy-related non-response above).

Figure 2.12 presents the percentage of adults who scored at each of the six levels of proficiency on the numeracy scale in each participating country.

On average across participating OECD countries/economies, only 1.0% of adults scored at Level 5 and an additional 10.2% of adults scored at Level 4 in numeracy (see Table A2.4 in Annex A). Finland (19.4%), Japan (18.8%) and Sweden (18.6%) had the largest proportions of adults scoring at the two highest numeracy levels (Level 4 or 5). In contrast, Jakarta (Indonesia) (1.4%), Turkey (1.5%) and Chile (1.9%) had the smallest proportions of adults scoring at Level 4 or higher.

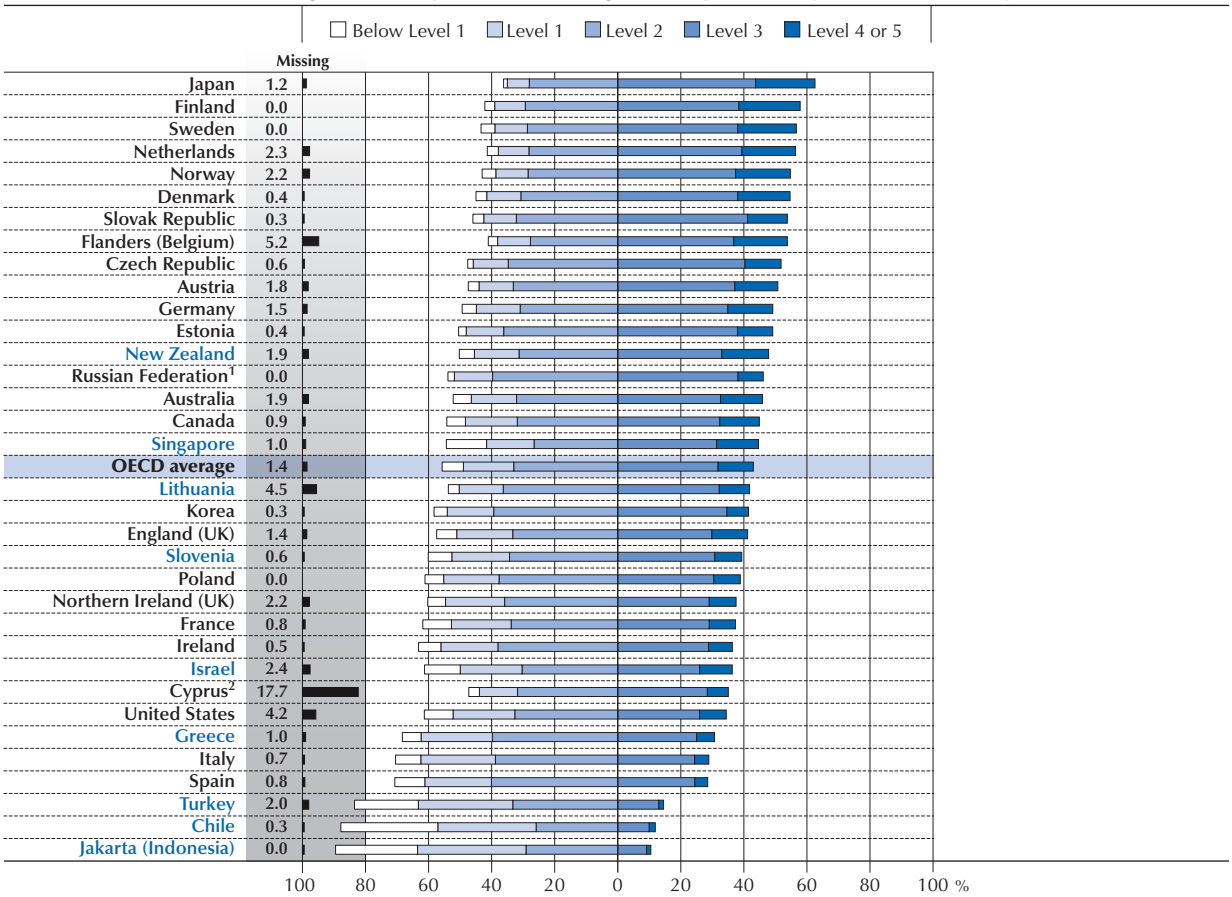
On average, around one in three adults scored at Level 3 (31.8%) and another one in three scored at Level 2 (33.0%). Japan had the largest proportion of adults scoring at Level 3 (43.7%), while the smallest proportions of adults at this level were observed in Jakarta (Indonesia) and Chile, where only around one in ten adults scored at Level 3 (9.1% and 10.0%, respectively), followed by Turkey (13.0%).

Around four in ten adults in Spain (40.1%), Greece (39.8%), the Russian Federation (39.7%), Korea (39.4%) and Italy (38.8%) scored at Level 2, while Chile (25.9%), Singapore (26.6%) and Flanders (Belgium) (27.7%) had the smallest proportions of adults who scored at this level.

Around one in four adults (22.7%) across OECD countries/economies scored at the two lowest levels of numeracy proficiency (16% at Level 1 and 6.7% below Level 1). Almost two in three adults in Chile (61.9%) and around half of adults in Turkey (50.2%) scored at these two levels. By contrast, only around one in ten adults in Japan (8.1%), Finland (12.8%) and the Czech Republic (12.9%) scored at or below Level 1.

Figure 2.12 ■ **Numeracy proficiency among adults**

Percentage of 16-65 year-olds scoring at each proficiency level in numeracy



Note: Adults in the missing category were not able to provide enough background information to impute proficiency scores because of language difficulties, or learning or mental disabilities (referred to as literacy-related non-response).

1. See note at the end of this chapter.

2. See note 1 under Figure 2.1.

Countries and economies are ranked in descending order of the combined percentage of adults scoring at Level 3 and at Level 4 or 5.

Source: Survey of Adult Skills (PIAAC) (2012, 2015), Table A2.4.

StatLink http://dx.doi.org/10.1787/888933365863

Literacy-related non-response

As noted above, in all countries/economies some adults were unable to complete the background questionnaire as they are unable to understand or read the language of the assessment, have difficulty reading or writing, or have a learning or mental disability. This category is identified separately in Figure 2.12 as a black bar in each country (categorised as "missing"). In most cases, these persons will have low proficiency (Level 1 or below) in numeracy when assessed in the test language(s) of the country concerned.

DISTRIBUTION OF PROFICIENCY SCORES ACROSS COUNTRIES/ECONOMIES

Mean proficiency scores in numeracy

Mean numeracy scores among adults in the countries/economies participating in the Survey of Adult Skills are presented in Figure 2.13. Countries/economies with mean scores that are not statistically different from those of other countries/economies are identified. For example, the mean score among adults in France (254 points) is similar to that of adults in Ireland (256 points) and the United States (253 points), but is significantly different from that of adults in other countries/economies at the 95% confidence level (Box 2.3).

Figure 2.13 ■ **Comparison of average numeracy proficiency**

Mean numeracy proficiency scores of 16-65 year-olds

Significantly **above** the average
Not significantly different from the average
Significantly **below** the average

Mean	Comparison country/economy	Countries/economies whose mean score is NOT significantly different from the comparison country/economy
288	**Japan**	
282	**Finland**	Flanders (Belgium), Netherlands
280	**Flanders (Belgium)**	Denmark, Finland, Netherlands, Norway, Sweden
280	**Netherlands**	Finland, Flanders (Belgium), Norway, Sweden
279	**Sweden**	Denmark, Flanders (Belgium), Netherlands, Norway
278	**Norway**	Denmark, Flanders (Belgium), Netherlands, Sweden
278	**Denmark**	Flanders (Belgium), Norway, Sweden
276	**Slovak Republic**	Austria, Czech Republic
276	**Czech Republic**	Austria, Slovak Republic
275	**Austria**	Czech Republic, Estonia, Slovak Republic, Russian Federation[1]
273	**Estonia**	Austria, Germany, New Zealand, Russian Federation[1]
272	**Germany**	Estonia, New Zealand, Russian Federation[1]
271	**New Zealand**	Estonia, Germany, Russian Federation[1]
270	**Russian Federation[1]**	Australia, Austria, Canada, Estonia, Germany, New Zealand, Cyprus,[2] Lithuania
268	**Australia**	Canada, Lithuania, Russian Federation[1]
267	**Lithuania**	Australia, Canada, Cyprus,[2] Russian Federation[1]
265	**Canada**	Australia, Cyprus,[2] Lithuania, Russian Federation[1]
265	**Cyprus[2]**	Canada, Korea, Lithuania, Russian Federation[1]
263	**Korea**	England (UK), Cyprus[2]
263	**OECD average**	**England (UK), Korea, Cyprus[2]**
262	**England (UK)**	Korea, Northern Ireland (UK), Poland
260	**Poland**	England (UK), Northern Ireland (UK), Slovenia
259	**Northern Ireland (UK)**	England (UK), Ireland, Poland, Slovenia, Singapore
258	**Slovenia**	Ireland, Northern Ireland (UK), Poland, Singapore
257	**Singapore**	Ireland, Northern Ireland (UK), Slovenia
256	**Ireland**	France, Northern Ireland (UK), Slovenia, United States, Singapore
254	**France**	Ireland, United States
253	**United States**	France, Greece, Ireland, Israel
252	**Greece**	Israel, United States
251	**Israel**	Greece, United States
247	**Italy**	Spain
246	**Spain**	Italy
219	**Turkey**	
210	**Jakarta (Indonesia)**	Chile
206	**Chile**	Jakarta (Indonesia)

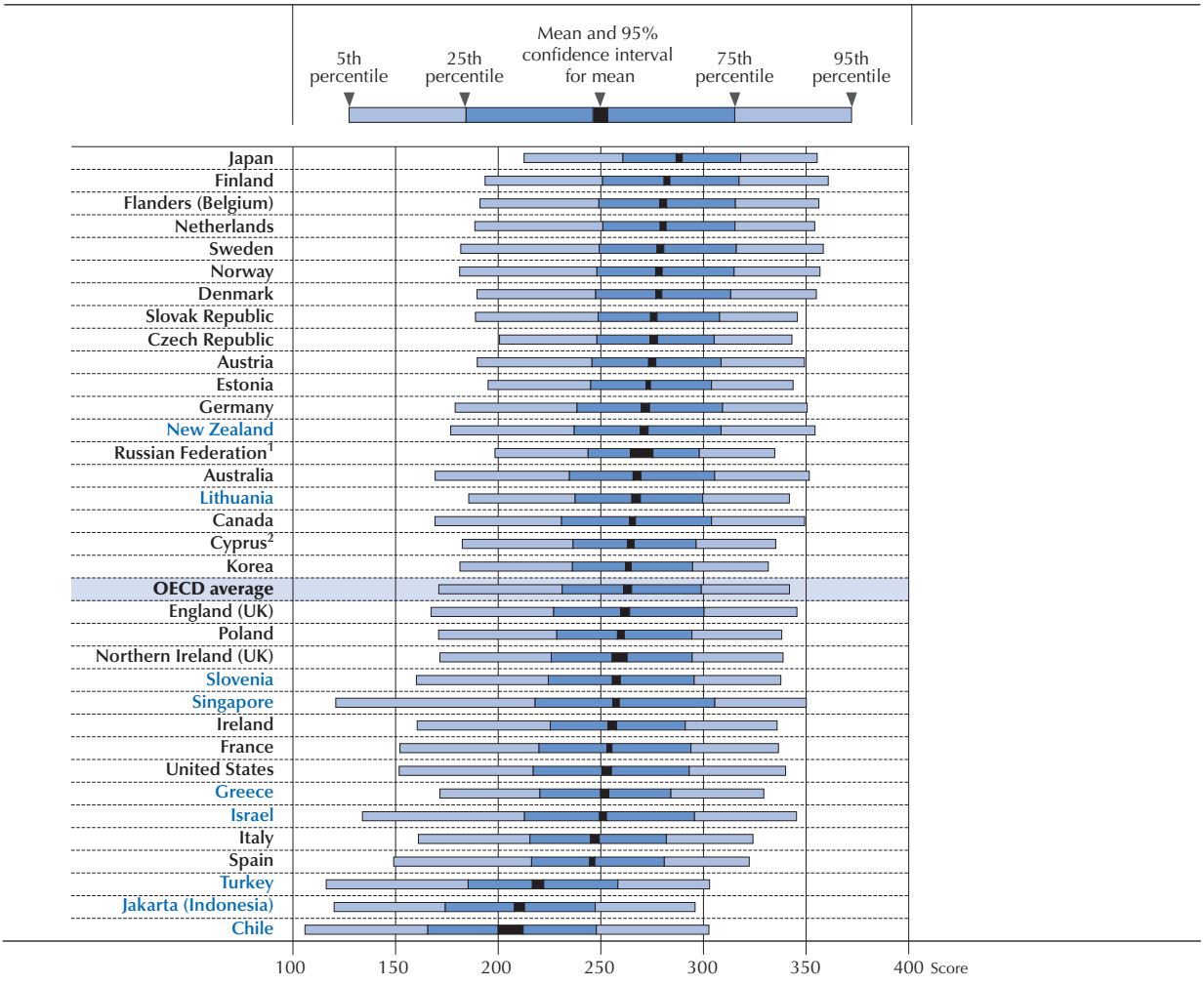
Note: Statistical significance is at the 5% level. Literacy-related non-response (missing) is excluded from the calculation of mean scores.
1. See note at the end of this chapter.
2. See note 1 under Figure 2.1.
Countries and economies are ranked in descending order of the mean score.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), Table A2.5.
StatLink http://dx.doi.org/10.1787/888933365873

The average numeracy score across the OECD countries/economies that participated in the assessment is 263 points. Japan had the highest average level of proficiency in numeracy (288 points), followed by Finland (282 points). Chile (206 points), Jakarta (Indonesia) (210 points) and Turkey (219 points) recorded the lowest average scores. An adult with a score equal to the national average in Israel (251 points) or Greece (252 points) could successfully complete around two-thirds of items at Level 2. By contrast, the average adult in Austria, the Czech Republic and the Slovak Republic scored at the upper limit of Level 2 and lower limit of Level 3, and as such could complete around 80% of items at Level 2 difficulty and around half of the items at Level 3 difficulty. The average adult in Chile, Jakarta (Indonesia) and Turkey could successfully complete most items at Level 1 difficulty, but only a few items at Level 2 difficulty and very few, if any, items at Level 3.

Overall, the variation in mean scores among countries/economies is relatively substantial. Some 82 points separate the mean scores of the highest- and lowest-performing countries/economies. However, the majority of countries/economies (26 out of 33) differ by 29 score points or less (mean scores within the range of 251 to 280 points). By way of comparison, the average score-point gap in numeracy between the highest- and lowest-performing 25% of adults (interquartile range) across all countries/economies is 68 score points (see Table A2.5 in Annex A).

Figure 2.14 ■ **Distribution of numeracy proficiency scores**

Mean numeracy proficiency and distribution of numeracy scores, by percentile



Notes: Mean scores are shown with a 95% confidence interval. Literacy-related non-response (missing) is excluded from the calculation of mean scores.
1. See note at the end of this chapter.
2. See note 1 under Figure 2.1.
Countries and economies are ranked in descending order of the mean score .
Source: Survey of Adult Skills (PIAAC) (2012, 2015), Table A2.5.
StatLink http://dx.doi.org/10.1787/888933365881

While adults' mean scores in literacy and numeracy are similar in most countries/economies, there are some notable exceptions. Adults in Korea and England (United Kingdom), for example, scored around the international average in numeracy, but above average in literacy. Adults in Ireland, Northern Ireland (United Kingdom) and Poland performed around the international average in literacy, but below average in numeracy. Adults in the United States performed better than the international average in literacy, but much worse in numeracy (see Figure 2.22 below).

Variation of proficiency scores within countries and economies

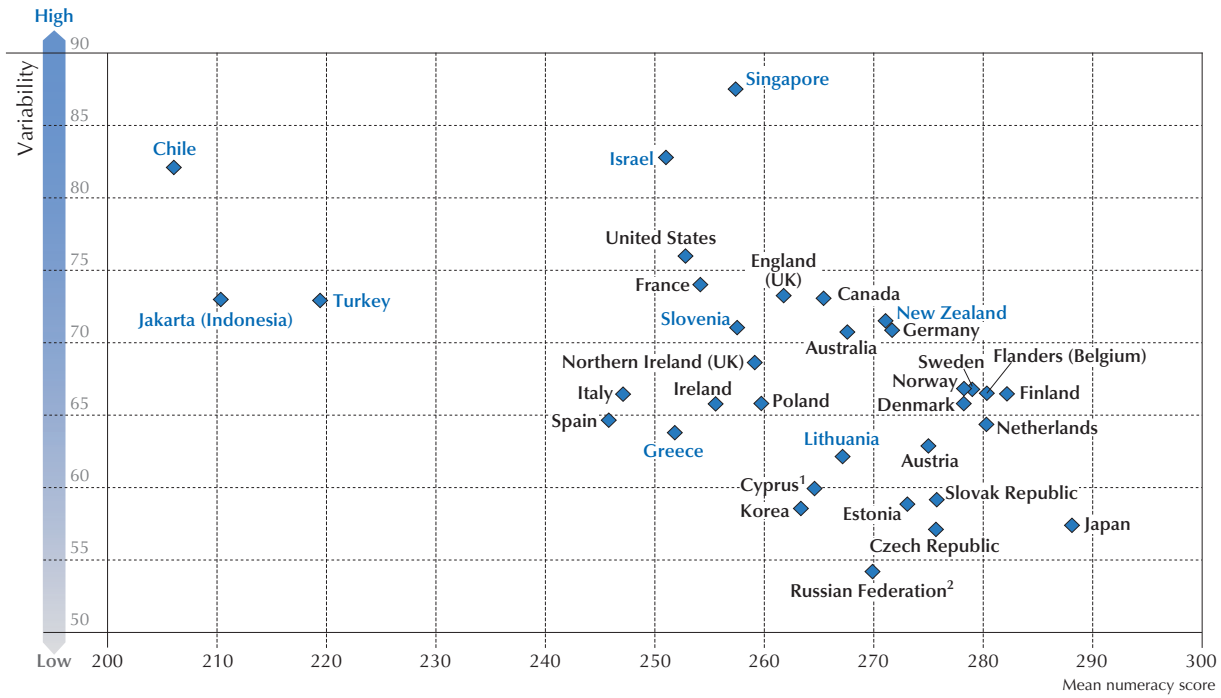
As with literacy proficiency, the variation in performance within a country is examined by identifying the score points below which 5%, 25%, 75%, and 95% of adults perform. Figure 2.14 presents the distribution of scores within countries/economies in addition to the mean score. A longer bar indicates greater variations in numeracy proficiency within a country/economy; a shorter bar indicates smaller variations.

On average, 68 score points separate the highest and lowest 25% of performers in numeracy. The narrowest distribution of scores on the numeracy scale is observed among adults in the Russian Federation (54 score-point difference), the Czech Republic (57-point difference) and Japan (57-point difference). The widest gaps between the lowest- and the highest-performing adults are observed in Singapore (88 points), Israel (83 points) and Chile (82 points).

As observed with literacy proficiency, a moderately strong inverse relationship (r=-0.52) is found between the overall level of proficiency in numeracy and the degree of score variation (expressed in terms of interquartile range) (Figure 2.15). In general, countries/economies with higher average numeracy scores (e.g. the Czech Republic, Estonia, Japan and the Slovak Republic) have the smallest variations in proficiency, while countries/economies with the lowest average scores in numeracy (Chile, Jakarta [Indonesia], Turkey and Israel) show the largest variations in numeracy scores. Singapore is the only exception to this general trend: its mean score in numeracy is close to the OECD average, but it has the greatest variation in numeracy scores among adults. The wide gap in numeracy performance – as in literacy performance – among adults in Singapore could be partly due to older cohorts having lower educational attainment and more often having been educated in a language other than the test language than younger cohorts.

Figure 2.15 ■ **Average and distribution of numeracy scores**

Relationship between mean numeracy proficiency score and variability



Note: The measure of variability used is the interquartile range (difference between the third quartile and the first quartile).

1. See note 1 under Figure 2.1.

2. See note at the end of this chapter.

Source: Survey of Adult Skills (PIAAC) (2012, 2015), Table A2.5.

StatLink http://dx.doi.org/10.1787/888933365890

PROFICIENCY IN PROBLEM SOLVING IN TECHNOLOGY-RICH ENVIRONMENTS

The Survey of Adult Skills defines problem solving in technology-rich environments as "using digital technology, communication tools and networks to acquire and evaluate information, communicate with others and perform practical tasks". It focuses on "the abilities to solve problems for personal, work and civic purposes by setting up appropriate goals and plans, and accessing and making use of information through computers and computer networks" (OECD, 2012a).

Table 2.3 Description of proficiency levels in problem solving in technology-rich environments

Level	Score range	Percentage of adults able to perform tasks at each level (average)	The types of tasks completed successfully at each level of proficiency
No computer experience	Not applicable	10.0%	Adults in this category reported having no prior computer experience; therefore, they did not take part in the computer-based assessment but took the paper-based version of the assessment, which did not include the problem solving in technology-rich environment domain.
Failed ICT core	Not applicable	4.7%	Adults in this category had prior computer experience but failed the ICT core test, which assesses the basic ICT skills, such as the capacity to use a mouse or scroll through a web page, needed to take the computer-based assessment. Therefore, they did not take part in the computer-based assessment, but took the paper-based version of the assessment, which did not include the problem solving in technology-rich environment domain.
"Opted out" of taking computer-based assessment	Not applicable	9.6%	Adults in this category opted to take the paper-based assessment without first taking the ICT core assessment, even if they reported some prior experience with computers. They also did not take part in the computer-based assessment, but took the paper-based version of the assessment, which did not include the problem solving in technology-rich environment domain.
Below Level 1	Below 241 points	14.2%	Tasks are based on well-defined problems involving the use of only one function within a generic interface to meet one explicit criterion without any categorical or inferential reasoning, or transforming of information. Few steps are required and no sub-goal has to be generated.
1	241 to less than 291 points	28.7%	At this level, tasks typically require the use of widely available and familiar technology applications, such as e-mail software or a web browser. There is little or no navigation required to access the information or commands required to solve the problem. The problem may be solved regardless of the respondent's awareness and use of specific tools and functions (e.g. a sort function). The tasks involve few steps and a minimal number of operators. At the cognitive level, the respondent can readily infer the goal from the task statement; problem resolution requires the respondent to apply explicit criteria; and there are few monitoring demands (e.g. the respondent does not have to check whether he or she has used the appropriate procedure or made progress towards the solution). Identifying content and operators can be done through simple match. Only simple forms of reasoning, such as assigning items to categories, are required; there is no need to contrast or integrate information.
2	291 to less than 341 points	25.7%	At this level, tasks typically require the use of both generic and more specific technology applications. For instance, the respondent may have to make use of a novel online form. Some navigation across pages and applications is required to solve the problem. The use of tools (e.g. a sort function) can facilitate the resolution of the problem. The task may involve multiple steps and operators. The goal of the problem may have to be defined by the respondent, though the criteria to be met are explicit. There are higher monitoring demands. Some unexpected outcomes or impasses may appear. The task may require evaluating the relevance of a set of items to discard distractors. Some integration and inferential reasoning may be needed.
3	Equal to or higher than 341 points	5.4%	At this level, tasks typically require the use of both generic and more specific technology applications. Some navigation across pages and applications is required to solve the problem. The use of tools (e.g. a sort function) is required to make progress towards the solution. The task may involve multiple steps and operators. The goal of the problem may have to be defined by the respondent, and the criteria to be met may or may not be explicit. There are typically high monitoring demands. Unexpected outcomes and impasses are likely to occur. The task may require evaluating the relevance and reliability of information in order to discard distractors. Integration and inferential reasoning may be needed to a large extent.

Note: The proportion of adults scoring at different levels of proficiency adds up to 100% when 1.9% of literacy-related non-respondents across countries/economies are taken into account. Adults in the missing category were not able to provide enough background information to impute proficiency scores because of language difficulties, or learning or mental disabilities (see section on literacy-related non-response above).

Problem solving in technology-rich environments does not measure the cognitive skill required to solve problems in isolation. It measures both problem-solving and basic computer literacy skills (i.e. the capacity to use ICT tools and applications). This is done by assessing how well adults can use ICT tools and applications to assess, process, evaluate and analyse information in a goal-oriented way. For more details about the characteristics and some examples of problem solving tasks, see OECD, 2013c.

A prerequisite for displaying proficiency in problem solving in technology-rich environments is having some rudimentary skills in using computer tools and applications. Given the very different levels of familiarity with computer applications in the countries/economies participating in the Survey of Adult Skills, the proportions of the population to which the estimates of proficiency in this domain refer vary widely among countries/economies. For this reason, the presentation of results focuses on defining the proportions of the population by proficiency level rather than on comparing mean proficiency scores.[5]

The survey provides two different, albeit related, pieces of information regarding the capacity of adults to manage information in technology-rich environments. The first is the proportion of adults who have sufficient familiarity with computers to use them to perform information-processing tasks. The second is the proficiency of adults with at least some ICT skills in solving the types of problems commonly encountered in their roles as workers, citizens and consumers in a technology-rich world.

Levels of proficiency in problem solving in technology-rich environments across countries and economies

The scale of problem solving in technology-rich environments is divided into four levels of proficiency (Levels 1 through 3 plus below Level 1). The features of the tasks at these levels are described in detail in Table 2.3 (some examples of problem-solving items are available in OECD, 2013a and OECD, 2013c).

Figure 2.16 presents the proportion of adults across all participating countries/economies at the four proficiency levels of the problem solving in technology-rich environments scale.

Only 5.4% of adults in participating OECD countries/economies scored at Level 3, the highest proficiency level, while around one in four adults (25.7%) scored at Level 2. Taken together, on average, around one in three adults (31.1%) is proficient at the two highest levels of problem-solving proficiency (Level 2 or 3). The proportion varies from more than four in ten adults in New Zealand (44.2%), Sweden (44.0%), Finland (41.6%), the Netherlands (41.5%) and Norway (41.0%), to fewer than one in ten (7.8%) in Turkey and around one in seven in Greece (14.0%) and Chile (14.6%).

Across all countries/economies, the largest proportion of adults (28.7%) scored at Level 1 and around one in seven adults (14.2%) scored below Level 1. More than one in four adults in Chile (26.8%) and Lithuania (25.5%) scored below Level 1 on the problem-solving scale. By contrast, fewer than one in ten adults in Japan (7.6%), the Slovak Republic (8.9%), Australia (9.2%), Korea (9.8%) and Austria (9.9%) scored at this level.

The proportion of adults without basic ICT skills

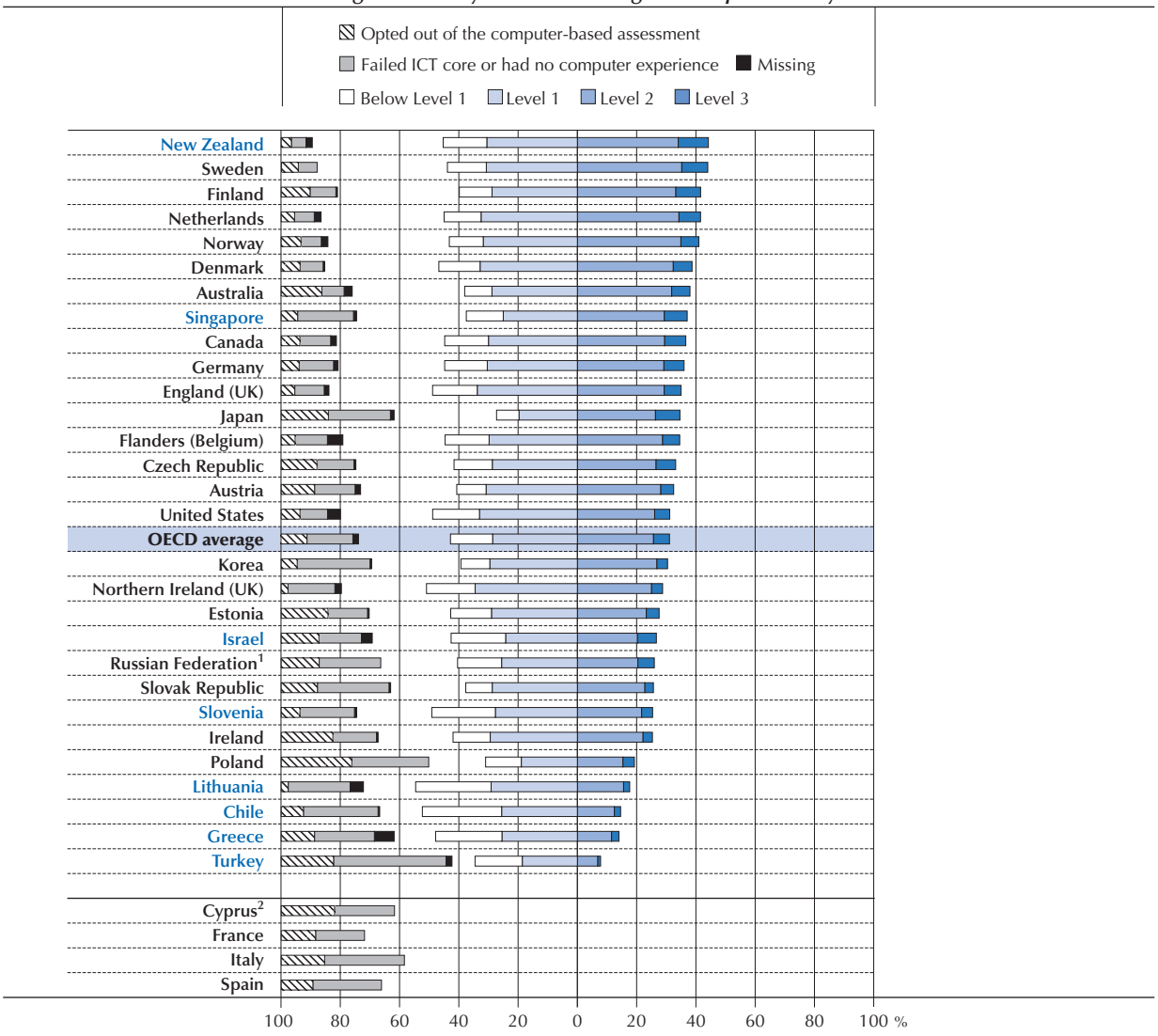
In each participating country/economy, a substantial proportion of adults was unable to display any proficiency in problem solving in technology-rich environments since they took the assessment in the paper-based format.[6] Three separate groups of adults fall in this category: adults with no computer experience, those who failed the "ICT core" test and thus did not have basic computer skills needed for the computer-based assessment, and adults who opted to take the paper-based version of the assessment even though they reported having previous computer experience.

Overall, around one in ten adults (10.0%) reported having no prior computer experience. This ranged from less than 2% in Sweden (1.6%) and Norway (1.6%) to more than one in three adults in Turkey (35.6%) and more than one in five adults in Italy (24.4%) and the Slovak Republic (22.0%).

A further 4.7% of adults did not have the basic ICT skills that were assessed by the ICT core test, such as the capacity to use a mouse or scroll through a web page (see Figure 2.5 in Box 2.2). This was true of around 2% of adults in Cyprus[4] (1.9%), the Czech Republic (2.2%) and the Slovak Republic (2.2%). Large proportions of adults in Japan (10.7%),[7] Korea (9.1%), Chile (7.8%) and Singapore (7.1%) did not pass the ICT core test (see Table A2.6 in Annex A).

Figure 2.16 ■ **Proficiency in problem solving in technology-rich environments among adults**

Percentage of 16-65 year-olds scoring at each proficiency level



Notes: Adults included in the missing category were not able to provide enough background information to impute proficiency scores because of language difficulties, or learning or mental disabilities (referred to as literacy-related non-response). The missing category also includes adults who could not complete the assessment of problem solving in technology-rich environments because of technical problems with the computer used for the survey. Cyprus,[2] France, Italy, Jakarta (Indonesia) and Spain did not participate in the problem solving in technology-rich environments assessment. Results for Jakarta (Indonesia) are not shown since the assessment was administered exclusively in paper and pencil format.

1. See note at the end of this chapter.

2. See note 1 under Figure 2.1.

Countries and economies are ranked in descending order of the combined percentages of adults scoring at Level 2 and at Level 3.

Source: Survey of Adult Skills (PIAAC) (2012, 2015), Table A2.6.

StatLink http://dx.doi.org/10.1787/888933365903

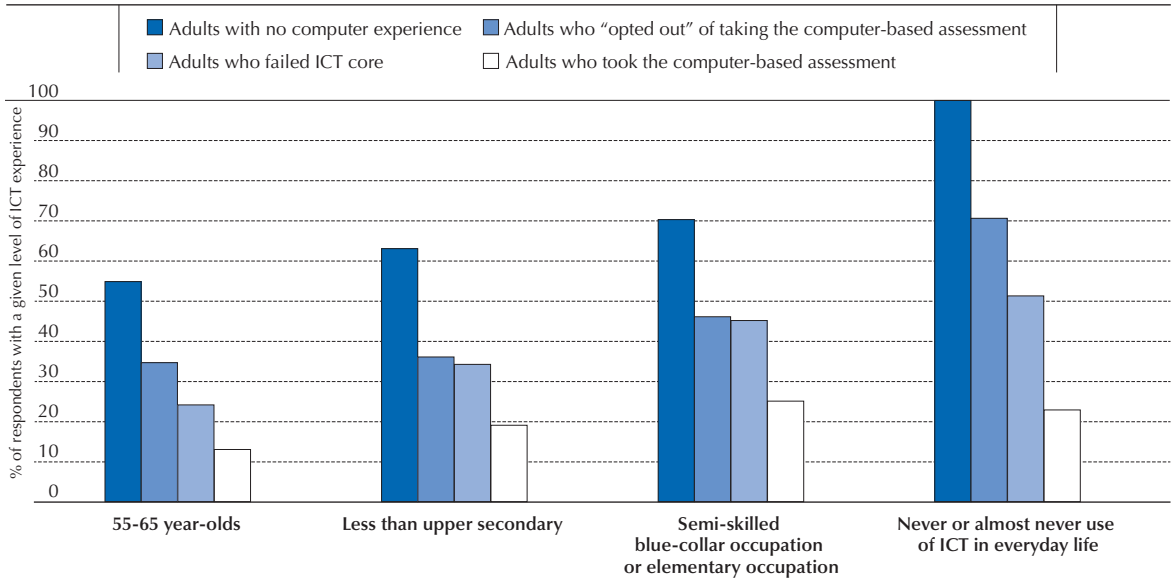
Some adults preferred not to use a computer in an assessment situation, even if they reported some prior experience with computers. On average, around one in ten adults (9.6%) opted to take the paper-based version of the assessment without first taking the ICT core test (Box 2.2). Large proportions of adults in Poland (23.8%), Cyprus[4] (18.0%), Turkey (17.7%) and Ireland (17.4%) "opted out" of the computer-based assessment, while relatively small proportions of adults in Northern Ireland (United Kingdom) (2.3%), Lithuania (2.3%) and New Zealand (3.4%) did so.

It is not known why these people chose to take the paper-based assessment.[8] However, information regarding the characteristics of these people and their patterns of ICT use is available and can be used to make inferences about their likely level of ICT skills and/or comfort with using a computer in a test situation. In short, the evidence suggests that many in the "opt out" group are likely to have relatively poor computer skills (Box 2.4).

Box 2.4 **Adults who "opted out" of taking the computer-based assessment**

Respondents who opted out of the computer-based assessment were much more similar in age, level of educational attainment and occupation to the respondents who failed the ICT core test than to those who passed and took the assessment in its computer-based format (Figure 2.17). Overall, respondents who opted out of taking the computer-based assessment were younger than those with no computer experience but older than those who failed and those who passed the ICT core test and took the computer-based assessment. For example, around 55% of adults who reported no computer experience were 55-65 year-olds, compared to 35% of those who "opted out", 24% of those who failed the ICT core test, and only 13% of those who took the computer-based assessment. Adults who "opted out" of the computer-based assessment had similar levels of education and occupational status as the respondents who failed the ICT core test, and lower levels of education and less likelihood of being employed in skilled occupations than those who passed the core test. The opt-out group reported less frequent use of ICTs in everyday life and at work compared to those who failed and those who passed the ICT core test. Adults who opted out had somewhat higher mean literacy and numeracy scores than those who failed the ICT core test, but they had lower scores than adults who passed the ICT core test (Figures 2.18 and 2.19).

Figure 2.17 ■ **Socio-demographic characteristics of adults with varying levels of ICT experience**



Notes: The bars shown in this figure are based on the OECD averages; the results for each country/economy can be found in the tables cited in the source. International average is computed for OECD participating countries/economies.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), Tables B2.4, B2.5, B2.6, B2.7, B2.8.
StatLink http://dx.doi.org/10.1787/888933365918

THE RELATIONSHIP AMONG THE THREE PROFICIENCIES

Proficiency in literacy is closely related to proficiency in numeracy, with a correlation of 0.86. The correlation varies between 0.93 in Singapore to 0.79 in the Russian Federation (for the full list of correlation coefficients across countries/economies, see Table A2.7 in Annex A). This level of correlation is in line with expectations. Similar levels of correlation (r=0.85) are found in PISA between 15-year-olds' reading literacy and mathematical literacy (OECD, 2012b, p. 194), and in the Adult Literacy and Lifeskills Survey between prose and document literacy and numeracy (r=0.83 and r=0.86 respectively). Even higher levels of correlation (r=0.93) between prose literacy and numeracy were found in the International Adult Literacy Survey.

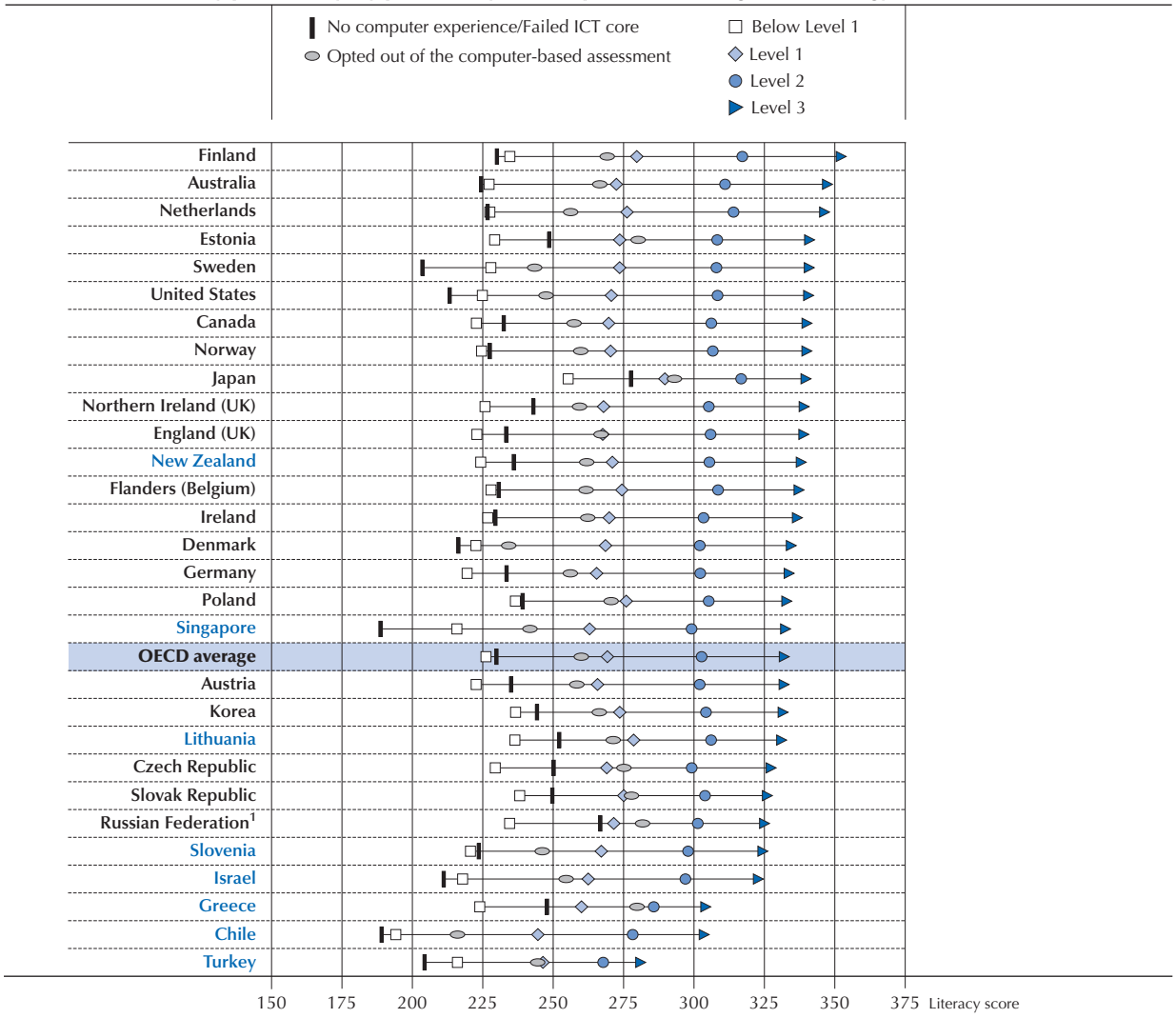
Given that adults use similar cognitive strategies in comparable work and life situations, those with a high level of proficiency in one skills domain will be more likely to have a higher level of skills in the other domain and vice versa. Nevertheless, literacy and numeracy represent distinct domains, each defined by its respective conceptual framework.

In particular, each is characterised by a different type of content (textual vs. mathematical) to which adults must respond, and also by different cognitive strategies required to engage with this content. As such, the strength of the relationship between proficiency and other outcomes, such as employment and wages, differs between literacy and numeracy. Proficiency in numeracy, for example, has a stronger relationship with wages than does literacy proficiency (Hanushek, et al., 2013). Likewise, countries' mean scores can vary substantially between the two domains, both in relation to those of other countries and to the OECD average (Figure 2.22).

In order to take a closer look at the relationship between proficiency in the two core domains and proficiency in problem solving in technology-rich environments, the mean literacy (Figure 2.18) and numeracy (Figure 2.19) scores are presented across the four proficiency levels of the problem solving in technology-rich environments scale. In addition, average literacy and numeracy scores are also shown for those adults with no or only basic ICT skills and for those who opted not to take the computer-based assessment.

Figure 2.18 ■ **Relationship between literacy and problem solving in technology-rich environments**

Mean literacy proficiency, by proficiency level in problem solving in technology-rich environments



Note: Cyprus,[2] France, Italy, Jakarta (Indonesia) and Spain did not participate in the problem solving in technology-rich environments assessment.

1. See note at the end of this chapter.

2. See note 1 under Figure 2.1.

Countries and economies are ranked in descending order of the mean literacy score of adults scoring at Level 3 on the problem solving in technology-rich environments scale.

Source: Survey of Adult Skills (PIAAC) (2012, 2015), Table A2.8.

StatLink http://dx.doi.org/10.1787/888933365924

Figure 2.19 ■ **Relationship between numeracy and problem solving in technology-rich environments**

Mean numeracy proficiency, by proficiency level in problem solving in technology-rich environments

Note: Cyprus,[2] France, Italy, Jakarta (Indonesia) and Spain did not participate in the problem solving in technology-rich environments assessment.

1. See note at the end of this chapter.

2. See note 1 under Figure 2.1.

Countries and economies are ranked in descending order of the mean numeracy score of adults scoring at Level 3 on the problem solving in technology-rich environments scale.

Source: Survey of Adult Skills (PIAAC) (2012, 2015), Table A2.9.

StatLink http://dx.doi.org/10.1787/888933365938

As expected, there is a strong positive relationship between problem-solving proficiency on the one hand and literacy and numeracy proficiency on the other. The higher the average literacy and numeracy scores, the higher the proficiency in problem solving. On average, individuals who scored at Level 3 on the problem solving in technology-rich environments scale scored at the lower range of Level 4 on the literacy and numeracy scales (average scores are 332 score points in literacy and 333 points in numeracy). Those who scored at Level 2 on the problem solving in technology-rich environments scale scored, on average, at the middle range of Level 3 on the literacy and numeracy scales (303 and 302 points, respectively). Those who scored at Level 1 on the problem solving in technology-rich environments scale, on average, scored at the top of Level 2 or at the lower end of Level 3 on the literacy and numeracy scales (269 and 268 points, respectively). Those who scored below Level 1 in problem solving scored, on average, at the bottom of Level 2 or the top of Level 1 on the literacy and numeracy scales (226 points in both cases).

There is relatively little variation across countries in this regard. One exception is Japan, where those who scored at or below Level 1 on the problem solving in technology-rich environments scale scored considerably higher in literacy and numeracy than adults in other participating countries with a similar level of proficiency in problem solving. Adults in Chile, Greece and Turkey who scored at the two highest levels on the problem-solving scale scored substantially lower in literacy and numeracy, on average, than adults in other countries who scored similarly in problem solving.

The literacy and numeracy proficiency of those who opted out of the computer-based assessment is slightly higher than that among people with no or only basic computer skills, both on average across participating countries and in each individual country. Adults who opted out of the computer-based assessment scored, on average, at the middle range of Level 2 in literacy and numeracy (260 and 244 points, respectively), while those with no or only basic ICT skills scored at the bottom of Level 2 or at the top of Level 1 on the literacy and numeracy scales.

High proficiency in literacy and numeracy goes hand-in-hand with high proficiency in problem solving in technology-rich environments and vice versa. Low proficiency in literacy and numeracy may, therefore, present significant barriers to using ICT applications to manage information and solve more complex problems.

As has been noted, another potential barrier to developing problem-solving skills in computer-rich environments is a lack of basic ICT skills. These skills, in themselves, require a minimum level of proficiency in literacy and numeracy. However, even if adults have some computer skills, it is difficult for those with low proficiency in literacy and numeracy to handle many of the information-management and information-processing tasks that they are likely to encounter in everyday life. In modern societies, it has become increasingly common – and, in some places, it has become the norm – to use information found via computers for such everyday tasks as informing oneself, communicating, shopping, managing services and interacting with authorities. Given that text-based and numeric information occupies a considerable portion of the digital world, access to that world depends not only on ICT skills but also on basic proficiency in literacy and numeracy. In other words, the digital divide may also reflect a literacy and numeracy divide.

COMPARISON OF THE RESULTS FROM THE SURVEY OF ADULT SKILLS WITH THOSE OF PREVIOUS SURVEYS

The Survey of Adult Skills was designed to provide valid comparisons with the results of the International Adult Literacy Survey (IALS), which was conducted in 21 countries between 1994 and 1998, and the Adult Literacy and Life Skills Survey (ALL), which was conducted in 13 countries between 2003 and 2007. In total, 19 countries/economies participating in the Survey of Adult Skills participated in IALS and seven participated in both IALS and ALL.

An overview of the relationship between the Survey of Adult Skills and IALS and ALL is provided in Chapter 5 of the Reader's Companion to this report (OECD, 2016a). A detailed comparative analysis of the IALS, ALL and PIAAC results and related issues can be found in a separate working paper on the topic (Paccagnella, forthcoming). As noted in the Reader's Companion, given the large gap in time between IALS and PIAAC (between 13 and 18 years), differences in the mode of delivery and in operational procedures, and low response rates in some countries/economies, a degree of caution is advised in interpreting the variations in proficiency observed between PIAAC and the previous surveys.

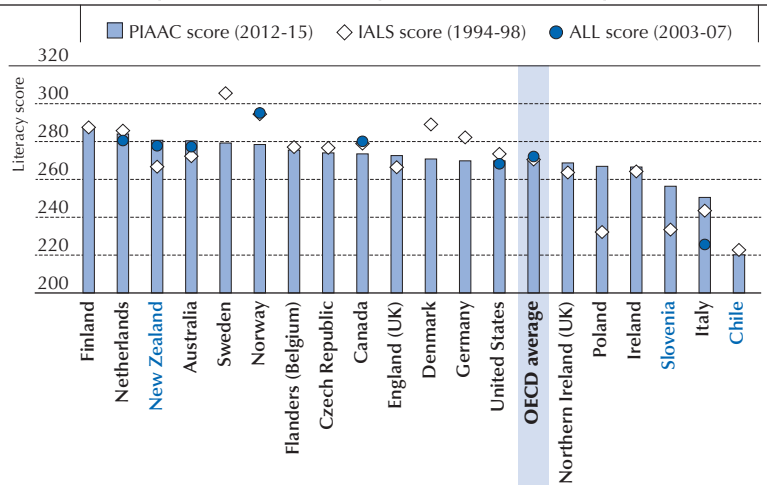
For example, the domains covered in the surveys are somewhat different (OECD and Statistics Canada, 2000 and 2011, Statistics Canada and OECD, 2005). The Survey of Adult Skills reports results for a single domain of literacy, which covers the reading of both prose and document texts as well as digital texts; IALS and ALL report literacy as two separate domains: prose literacy and document literacy. Similarly, even though the concept of numeracy has remained largely unchanged between ALL (in which the concept was introduced) and the Survey of Adult Skills, there is significantly more information available from the Survey of Adult Skills for constructing the numeracy scale.

To allow for comparisons of change over time, the results for prose and document literacy in IALS and ALL have been combined and re-estimated so that that they can be presented on a common scale with those from the Survey of Adult Skills. The results for numeracy in ALL have also been re-estimated for the countries that participated in both surveys. Comparisons between the results of the Survey of Adult Skills and those of previous surveys should, therefore, be made only on the basis of the revised data from IALS and ALL. These comparisons are presented in Figures 2.20 and 2.21 below.

In considering trends in literacy proficiency, three distinct groups of countries/economies can be identified. First, in most countries/economies (13 of 19), results have not changed substantially over the past two decades. For example, in Chile, the Czech Republic, Finland, Flanders (Belgium) and Ireland, average scores in literacy in IALS and the Survey of Adult Skills are almost identical. In the second group of countries, which includes Denmark, Germany, Norway and Sweden, mean scores substantially decreased between IALS and the Survey of Adult Skills, with an especially large decrease in Sweden. Finally, a sizeable increase in the national average is observed in Italy, Poland and Slovenia. Poland has seen by far the largest change in average scores in literacy: an increase of 35 score points.

Figure 2.20 ■ **Changes in literacy scores in IALS, ALL and PIAAC surveys**

Mean literacy proficiency in the International Adult Literacy Survey (IALS), the Adult Literacy and Lifeskills Survey (ALL) and the Survey of Adult Skills (PIAAC)



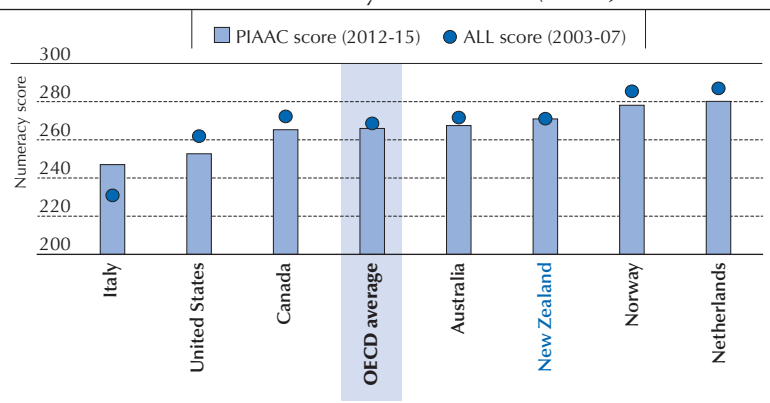
Countries and economies are ranked in descending order of the mean score on the Survey of Adult Skills (PIAAC).

Sources: Survey of Adult Skills (PIAAC) (2012, 2015), International Adult Literacy Survey (IALS) and Adult Literacy and Lifeskills Survey (ALL), see Table A2.10.

StatLink http://dx.doi.org/10.1787/888933365943

Figure 2.21 ■ **Changes in numeracy scores in PIAAC and ALL surveys**

Mean numeracy proficiency in the Adult Literacy and Lifeskills Survey (ALL) and the Survey of Adult Skills (PIAAC)



Countries are ranked in descending order of the mean score on the Survey of Adult Skills (PIAAC).

Sources: Survey of Adult Skills (PIAAC) (2012, 2015), and Adult Literacy and Lifeskills Survey (ALL), see Table A2.11.

StatLink http://dx.doi.org/10.1787/888933365958

Changes in numeracy scores between ALL and the Survey of Adult Skills are not as pronounced, except in Italy, where scores improved substantially over the period. A moderate decrease in numeracy scores was observed in Canada, the Netherlands, Norway and the United States.

The major trend observed is a considerable reduction in the gap between the lowest- and highest-performing countries, resulting in a more equal distribution of mean scores across countries/economies. Part of the reason for this trend may be differences in educational attainment across age groups. Younger adults have more similar levels of educational attainment across countries than older adults do (Figures 2.2, 2.3 and 2.4 Box 2.1). For example, the proportion of tertiary-educated adults doubled in Italy, Poland and Slovenia during the past three decades, while countries where national averages decreased saw no change (Germany) or only a slight rise in educational attainment among younger generations (in this latter group of countries, however, initial levels of educational attainment were substantially higher than in the former group). Interestingly, national wealth is not directly correlated with an increase in proficiency scores. In Poland, for example, both GDP and proficiency scores have increased substantially over the past two and a half decades, while in Chile and Ireland, sharp rises in GDP over the past 25 years were not matched by improvements in literacy and numeracy proficiency.

The decrease in literacy scores observed in Denmark, Norway and Sweden between IALS (and ALL in the case of Norway) and the Survey of Adult Skills may partly be the result of a number of demographic factors, such as population ageing and an increase in the proportion of immigrants in the population. However, it may also indicate somewhat lower academic standards among younger adults who are consequently not attaining as high levels of literacy and proficiency as their older compatriots did. For example, even though the number of students with tertiary degrees has increased over the years, younger adults may have poorer skills than older adults who have attained the same level of education (Paccagnella, 2016).

SUMMARISING PERFORMANCE ACROSS COUNTRIES AND ECONOMIES

Figure 2.22 summarises the proficiency of adults in participating countries/economies in each of the three domains assessed. It provides an overview of the average proficiency in each participating country/economy relative to the average in each domain.

Figure 2.22 ■ **Summary of proficiency in key information-processing skills**

Mean proficiency scores of 16-65 year-olds in literacy and numeracy, and the percentage of 16-65 year-olds scoring at Level 2 or 3 in problem solving in technology-rich environments

Significantly **above** the average
Not significantly different from the average
Significantly **below** the average

	Literacy	Numeracy	Problem solving in technology-rich environments
	Mean score	Mean score	% at Level 2 or 3
OECD countries and economies			
Australia	280	268	38
Austria	269	275	32
Canada	273	265	37
Chile	220	206	15
Czech Republic	274	276	33
Denmark	271	278	39
England (UK)	273	262	35
Estonia	276	273	28
Finland	288	282	42
Flanders (Belgium)	275	280	35
France	262	254	m
Germany	270	272	36
Greece	254	252	14
Ireland	267	256	25
Israel	255	251	27
Italy	250	247	m
Japan	296	288	35
Korea	273	263	30
Netherlands	284	280	42
New Zealand	281	271	44
Northern Ireland (UK)	269	259	29
Norway	278	278	41
Poland	267	260	19
Slovak Republic	274	276	26
Slovenia	256	258	25
Spain	252	246	m
Sweden	279	279	44
Turkey	227	219	8
United States	270	253	31
OECD average	**268**	**263**	**31**
Partners			
Cyprus[1]	269	265	m
Jakarta (Indonesia)	200	210	m
Lithuania	267	267	18
Russian Federation[2]	275	270	26
Singapore	258	257	37

Note: Cyprus,[1] France, Italy, Jakarta (Indonesia) and Spain did not participate in the problem solving in technology-rich environments assessment.
1. See note 1 under Figure 2.1.
2. See note at the end of this chapter.
Countries and economies are listed in alphabetical order.
Source: Survey of Adult Skills (PIAAC) (2012, 2015), Tables A2.3, A2.5 and A2.6.
StatLink http://dx.doi.org/10.1787/888933365964

It also indicates whether the country's/economy's mean score is statistically greater than, equal to, or less than the average across participating OECD countries/economies. In the case of problem solving in technology-rich environments, the average proficiency is not presented because of variations across countries/economies in the proportions of respondents who did not take the computer-based version and were not assessed in the problem-solving domain. Instead, the figure shows the proportion of the total population performing at Level 2 or 3 on this scale.

Adults in 11 of 33 countries/economies show above-average levels of proficiency in all three domains. Among these, adults in Japan had the highest average scores in literacy and numeracy, while New Zealand and Sweden had the largest proportion of adults scoring at Level 2 or 3 in problem solving in technology-rich environments.

In five countries – Chile, Greece, Israel, Slovenia and Turkey – adults' mean scores were statistically significantly below average in all three domains; and in four of the five countries/economies that did not participate in the assessment of problem solving – France, Italy, Jakarta (Indonesia) and Spain – mean scores in both literacy and numeracy were below average. Adults in Jakarta (Indonesia) and Chile had the lowest average score in literacy and numeracy, respectively, while Turkey had the smallest proportion of adults at Level 2 or 3 in problem solving in technology-rich environments. Adults in the remaining 14 countries/economies had mixed results. A closer look at the results of the countries/economies that participated in Round 2 is provided in Box 2.5.

Box 2.5 Skills proficiency among adults in the countries/economies that participated in Round 2 of the Survey of Adult Skills (PIAAC)

The proficiency of adults in the nine countries/economies that participated in Round 2 of the Survey of Adult Skills varies substantially, reflecting the diversity of the countries'/economies' current economic situation and their social, educational and economic development over the past five decades.

Among the adults in the nine Round-2 countries/economies, those in New Zealand averaged the highest scores, by far, in the three domains assessed. In fact, along with Sweden, New Zealand had the largest proportion of adults who scored at the two highest levels of proficiency in problem solving in technology-rich environments (Levels 2 and 3) of all countries/economies that participated in both rounds of the study, and had the fourth highest score in literacy. Adults in New Zealand did not score as high in numeracy as in literacy, but their mean numeracy score was still significantly above the international average.

Adults in Lithuania performed close to the international mean in literacy but showed better-than-average performance in numeracy. Somewhat surprisingly, their proficiency in problem solving in technology-rich environments was substantially lower than the international average, with only 18% of adults reaching one of the two highest levels. The relatively large proportion of adults who reported having no computer experience (16%) suggests that these results may reflect the low level of ICT skills in the country.

By contrast, the mean literacy and numeracy scores among adults in Singapore were somewhat below the international average, but scores in problem solving in technology-rich environments were much higher than average. There are large differences in levels of educational attainment among age cohorts in Singapore: younger adults have attained much higher levels of education than older adults. In fact, compared to their peers in other countries/economies, young adults in Singapore were among the most proficient in the three domains assessed. In addition, a sizable proportion of those in the older cohorts who were relatively better-educated were educated in a language other than the test language. These could be some of the reasons why Singapore shows the largest variations in literacy and numeracy scores.

Adults in Slovenia scored somewhat lower than average in all three domains. A comparison between Slovenia's performance in IALS and in the Survey of Adult Skills suggests that there has been substantial improvement in literacy proficiency among adults over the past 15 years. These results may reflect the outcome of some of the intense political and economic transformations that Slovenia underwent over the past few decades.

The mean scores of adults in Israel were also consistently somewhat below the international average in all three domains. After Singapore, Israel shows the second highest dispersion of individual scores, indicating a heterogeneous distribution of skills across the adult population.

...

Adults in Greece achieved mean scores in literacy and numeracy similar to those of adults in Slovenia and Israel, scoring around 12 points lower than the international average. However, they scored much lower in problem solving in technology-rich environments, with only 14% reaching one of the two highest levels of proficiency in this domain – the second smallest proportion among countries/economies that participated in the two rounds of the survey.

The mean literacy and numeracy scores among adults in Turkey were more than 40 points lower than the international average (around one standard deviation). This means that the average literacy and numeracy proficiency of adults in Turkey (which is between the upper end of Level 1 and the lower end of Level 2) was almost one proficiency level lower than the international average (the upper end of Level 2). In addition, a majority of adults in Turkey showed no or very low levels of proficiency in problem solving in technology-rich environments. Only 8% of adults attained one of the two highest proficiency levels in this domain. Given that almost 40% of adults reported no computer experience or failed the ICT core test, the lack of the basic ICT skills among a large proportion of adults may be chiefly responsible for the poor performance of Turkish adults in this domain.

Adults in Chile had the lowest mean scores in numeracy and the second lowest in literacy among all countries in both rounds of the survey. The mean literacy score of adults in Chile was 48 score points lower than the international average. In numeracy, the mean score was 57 score points lower than the international average. In relative terms, adults in Chile performed better in problem solving in technology-rich environments, where a slightly larger proportion of adults scored at one of the two highest proficiency levels compared to the proportion of adults in Turkey and Greece who scored at that level. Together with Singapore and Israel, Chile is also one of the countries with the greatest variations in both literacy and numeracy proficiency. The average literacy proficiency among Chilean adults seems to have changed little in the 15 years that separate the IALS from the Survey of Adult Skills.

The average scores of adults in Jakarta (Indonesia) are the lowest among participating countries/economies in literacy and the second lowest in numeracy. Furthermore, there is a relatively high level of individual variation in scores, in spite of the fact that few adults scored at the two highest proficiency levels. Since only the paper-based assessment module was used in Jakarta (Indonesia), there is no information in the domain of problem-solving in technology rich environments.

SUMMARY

The Survey of Adult Skills measures proficiency in literacy, numeracy and problem solving in technology-rich environments among 16 to 65 year-olds. It finds that the variation in average scores in the three domains, across countries, is substantial, although many countries score within relatively close range of each other. However, even relatively small differences in national averages (e.g. 10 score points) are significant since average scores at the national level represent the proficiency of a country's entire working-age population. Thus substantial effort and cost is associated with improving the proficiency scores of each person.

Variations in scores among adults in individual countries are even larger than those across countries. Countries/economies with higher mean scores tend to have less variation in scores among their adults. On the one hand, this relationship could be seen as an encouraging sign for all countries/economies, given that it implies that higher levels of literacy proficiency go hand-in-hand with – or at least do not hinder – a more equal and homogeneous distribution of skills proficiency across the adult population. On the other hand, it could also be seen as an indication of the urgency for the countries with low proficiency and large variations in scores, such as Chile, to act, both to improve general levels of proficiency and to reduce inequalities.

Among the Round-2 countries/economies, New Zealand performed the best, scoring significantly above average in all three domains. Adults in Lithuania and Singapore performed better than average in some domains (numeracy and problem solving, respectively) and at or slightly below average in others. Adults in Greece, Israel and Slovenia performed below average in all three domains but, with the exception of problem solving in technology-rich environments in Greece, scored relatively close to the OECD average. Mean scores in all three domains in Chile and Turkey were substantially below the OECD average, presenting significant policy challenges. In addition, Chile, Israel and Singapore showed the widest dispersion of scores among adults, indicating the need for policies to focus specifically on adults with low proficiency.

As expected, literacy and numeracy proficiency are closely related: adults who are highly proficient in one domain are likely to be highly proficient in the other. Nevertheless, literacy and numeracy require different cognitive strategies and constitute distinct abilities. There is also a strong positive relationship between literacy and numeracy, on the one hand, and problem solving in technology-rich environments on the other.

Low-skilled adults are numerous in all countries/economies, with the proportion ranging from one in ten to one in two adults who are proficient at or below Level 1 in the domain of literacy or numeracy. At these levels, adults can usually complete simple reading and numeracy tasks, such as locating information in a short text or performing simple one-step arithmetic operations; but they have trouble extracting information from longer and more complex texts or performing numerical tasks involving several steps and mathematical information represented in different ways.

In all countries/economies that participated in the Survey of Adult Skills, a considerable proportion of adults has no or very limited ICT skills. In addition, nearly half of adults have low proficiency in problem solving in technology-rich environments. This means that they are able to use only familiar applications to solve problems that involve few steps and explicit criteria, such as sorting e-mails into pre-existing folders. Given these findings, governments may need to rethink the way they conceive and implement policies relating to the digital economy, particularly concerning e-government and online access to public services.

Notes

1. The lower number of proficiency levels for the domain of problem solving in technology rich-environments indicates a less precise scale due to the far smaller number of items that are used in the assessment of problem solving (16 items) compared to literacy (58 items) and numeracy (56 items).

2. The common denomination of the levels (e.g. Level 1, 2 or 3) does not imply any underlying similarity of the factors affecting the difficulty of tasks at any given level in each of the domains. The descriptors for each of the levels in each of the domains reflect the features of the relevant framework and the specific factors determining difficulty in each domain.

3. English was the only test language in Singapore.

4. See notes regarding Cyprus under Figure 2.1.

5. For this reason, the presentation of results focuses on the proportions of the population by proficiency level rather than the comparison of mean proficiency scores.

6. Proficiency in problem solving in technology-rich environments was assessed only in computer-based formats; numeracy and literacy were assessed in both paper- and computer-based formats.

7. This may represent an overestimate of the proportion of Japanese adults with poor ICT skills. In particular, literacy and numeracy proficiency among these adults was far higher compared to that of adults in other countries who reported no prior computer use. At the same time, the majority of those in Japan who failed the core test reported limited use of ICTs in everyday life.

8. Presumably they regarded themselves as having poor ICT skills, or felt more comfortable with or believed that they would perform better on the paper-based version of the assessment than on the computer-based assessment.

A note regarding the Russian Federation

The sample for the Russian Federation does not include the population of the Moscow municipal area. The data published, therefore, do not represent the entire resident population aged 16-65 in the Russian Federation but rather the population of the Russian Federation *excluding* the population residing in the Moscow municipal area.

More detailed information regarding the data from the Russian Federation as well as that of other countries can be found in the *Technical Report of the Survey of Adult Skills, Second Edition* (OECD, forthcoming).

References and further reading

Autor, D., F. Levy and **R.J. Murnane** (2003), "The skill content of recent technological change: An empirical exploration", *Quarterly Journal of Economics*, No. 118/4, pp. 1279-1334.

Grotlüschen, A. et al. (2016), "Adults with low proficiency in literacy or numeracy", *OECD Education Working Papers*, No. 131, OECD Publishing, Paris, http://dx.doi.org/10.1787/5jm0v44bnmnx-en.

Hanushek, E.A. et al. (2013), "Returns to skills around the world: Evidence from PIAAC", *OECD Education Working Papers*, No. 101, OECD Publishing, Paris, http://dx.doi.org/10.1787/5k3tsjqmvtq2-en.

Levy, F. and **R.J. Murnane** (2006), "Why the changing American economy calls for twenty-first century learning: Answers to educators' questions", *New Directions for Youth Development*, No. 110, pp. 53-62.

OECD (forthcoming), *Technical Report of the Survey of Adult Skills, Second Edition*.

OECD (2016a), *The Survey of Adult Skills: Reader's Companion, Second Edition,* OECD Skills Studies, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264258075-en.

OECD (2016b), *Survey of Adult Skills (PIAAC)* (Database 2012, 2015), www.oecd.org/site/piaac/publicdataandanalysis.htm.

OECD (2015), *Country Statistical Profiles* (database), http://stats.oecd.org (accessed on 2 May 2016).

OECD (2013a), *The Survey of Adult Skills: Reader's Companion,* OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264204027-en.

OECD (2013b), *Technical Report of the Survey of Adult Skills*, www.oecd.org/site/piaac/_Technical%20Report_17OCT13.pdf.

OECD (2013c), *OECD Skills Outlook 2013: First Results from the Survey of Adult Skills*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264204256-en.

OECD (2012a), *Literacy, Numeracy and Problem Solving in Technology-Rich Environments: Framework for the OECD Survey of Adult Skills*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264128859-en.

OECD (2012b), *PISA 2009 Technical Report, PISA*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264167872-en.

OECD and **Statistics Canada** (2011), *Literacy for Life: Further Results from the Adult Literacy and Life Skills Survey*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264091269-en.

OECD and **Statistics Canada** (2005), *Learning a Living: First Results of the Adult Literacy and Life Skills Survey*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264010390-en.

OECD and **Statistics Canada** (2000), *Literacy in the Information Age: Final Report of the International Adult Literacy Survey*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264181762-en.

Paccagnella, M. (forthcoming), "Literacy and numeracy proficiency in IALS, ALL, and PIAAC", *OECD Education Working Papers*, OECD Publishing, Paris.

Paccagnella, M. (2016), "Age, ageing and skills: Results from the Survey of Adult Skills", *OECD Education Working Papers*, No. 132, OECD Publishing, Paris, http://dx.doi.org/10.1787/5jm0q1n38lvc-en.

World Bank (2015), "GDP per capita (constant 2005 US$)", http://data.worldbank.org/indicator/NY.GDP.PCAP.KD (accessed 2 May, 2016).