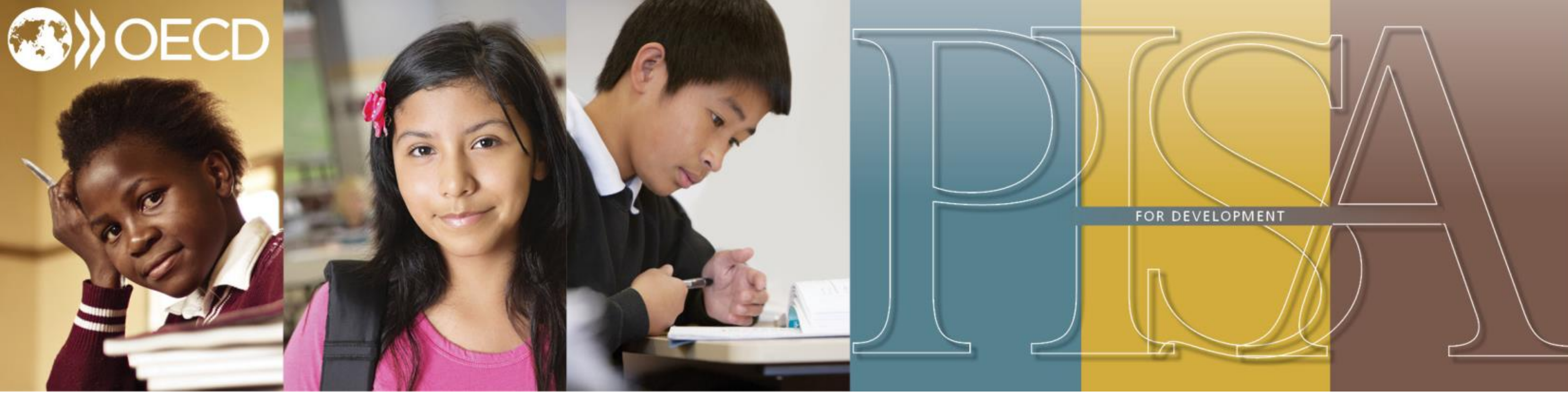


PISA for Development Brief 10

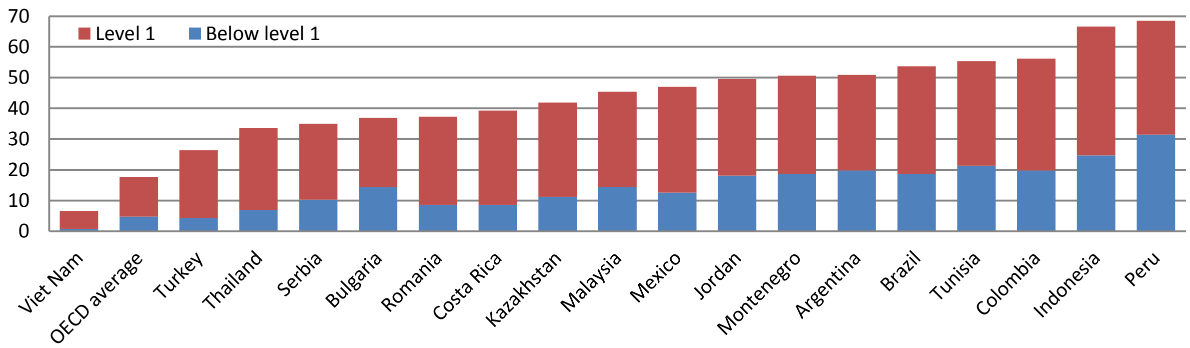
How does PISA for Development measure scientific literacy?

- The term “scientific literacy”, as used in PISA, is the ability to engage with science-related issues, and with the ideas of science, as a reflective citizen.
- Building on the OECD’s experience with measuring scientific literacy in middle-income countries, PISA for Development (PISA-D) extends and broadens PISA’s scientific literacy framework to better measure lower levels of knowledge and skills, particularly basic processes.
- The PISA-D science test measures basic skills, such as recognising an appropriate explanatory hypothesis, thus allowing countries to know more about the kinds of tasks 15-year-olds with lower levels of scientific literacy proficiency can and cannot perform.

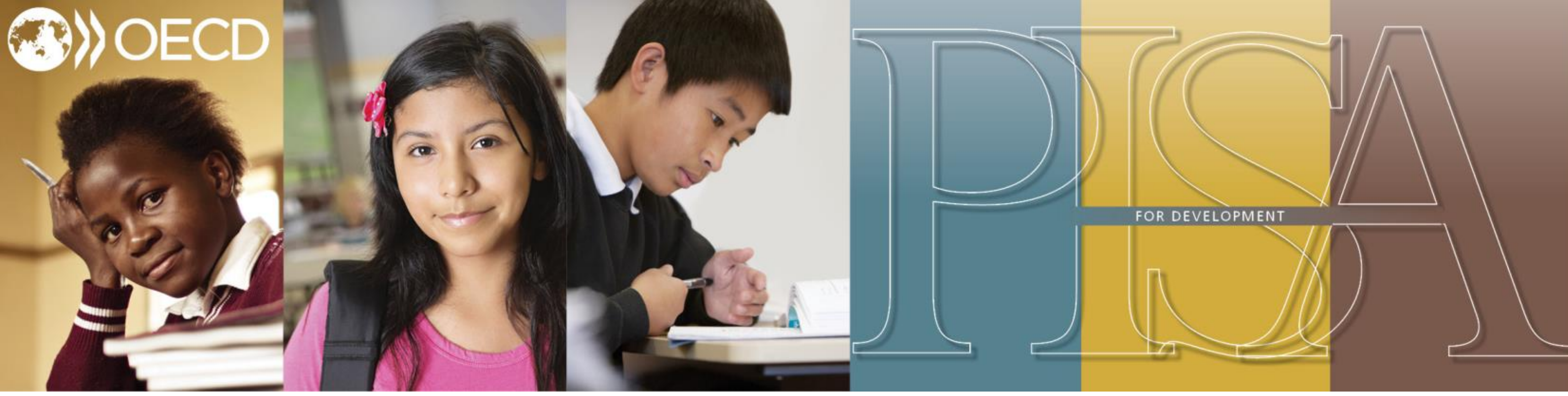
PISA defines scientific literacy as the ability to engage with science-related issues, and with the ideas of science, as a reflective citizen. PISA’s definition includes being able to explain phenomena scientifically, evaluate and design scientific enquiry, and interpret data and evidence scientifically. It emphasises the importance of being able to apply scientific knowledge in the context of real-life situations. PISA also establishes a baseline level – proficiency Level 2, on a scale with 6 as the highest level and 1b the lowest – at which individuals begin to demonstrate the competencies that will enable them to participate effectively and productively in life as students, workers and citizens.

The OECD analyses reported in PISA 2012 (the PISA-D project design was mainly informed by analysis of PISA 2012 data) show that for many of the participating middle- and low-income countries, mean average science scores are concentrated below Level 2 (see figure) – the baseline proficiency level. In PISA 2012, the lowest level of the science proficiency scale was Level 1. PISA 2015 differentiated performance at the lowest level by breaking Level 1 into two sub-levels: 1a and 1b. PISA-D builds on the PISA 2015 science framework, extending it to yet a lower level of performance (1c) to gather precise data on the science skills of the lowest performers. This information will help countries design effective policies to improve students’ skills in the future.

Percentage of students scoring at or below Level 1 in science in 18 low- and middle-income countries, PISA 2012



Source: OECD (2014), *PISA 2012 Results: What Students Know and Can Do (Volume I, Revised edition, February 2014): Student Performance in Mathematics, Reading and Science*, PISA, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264208780-en.



PISA-D is extending and broadening PISA's assessment of basic scientific literacy processes to better capture the abilities of low performers.

The conceptual framework for the science assessment in PISA-D extends and broadens the measurement at the lower end of the performance spectrum in three ways: first, by including more items at and below Level 2 difficulty; second, by including items at the lowest possible proficiency level and formulating these in the simplest possible language to reduce the cognitive demands on students; and, third, whenever possible, by ensuring that new items at the lowest proficiency level draw on phenomena that are familiar to students' everyday lives or on ideas that are pervasive in contemporary culture. These enhancements to the PISA science framework in PISA-D focus on three aspects of science literacy in particular:

1. *Proficiencies* – PISA-D creates Level 1c as the new lowest level on the science proficiency scale, and includes new test items to measure performance on tasks at this level.

2. *Competencies* – PISA-D creates a more limited definition for each of the three PISA science competencies at Level 1c so as to make fewer demands on students' knowledge and to require less cognitive processing. For example:

   - "Explain phenomena scientifically" requires students to recall appropriate scientific knowledge but not apply such knowledge; or make a simple prediction but not justify it.
   - "Evaluate and design scientific enquiry" requires students to identify a simple flaw in an experimental design, e.g. measuring the wrong factor.
   - "Interpret data and evidence scientifically" requires students to identify whether the conclusion drawn from a table of results, a graph or another form of data is justified.

3. *Skills* – To perform at proficiency Level 1c, a student must be able to read and comprehend simple sentences; use numeracy and basic computation; understand the basic components of tables and graphs; apply the basic procedures of scientific enquiry; and interpret simple data sets.

With a clearer understanding of the scientific skills of low-performing 15-year-olds, policy makers in middle- and low-income countries will be able to design more effective and targeted policies to help students improve their ability to engage with science-related issues, help teachers teach science better, and help school systems promote science as a fundamental skill.

References

OECD (forthcoming), *PISA for Development Assessment and Analytical Framework*, PISA, OECD Publishing, Paris.

OECD (2016), *PISA 2015 Assessment and Analytical Framework: Science, Reading, Mathematic and Financial Literacy*, PISA, OECD Publishing, Paris, DOI: http://dx.doi.org/10.1787/9789264255425-en

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