



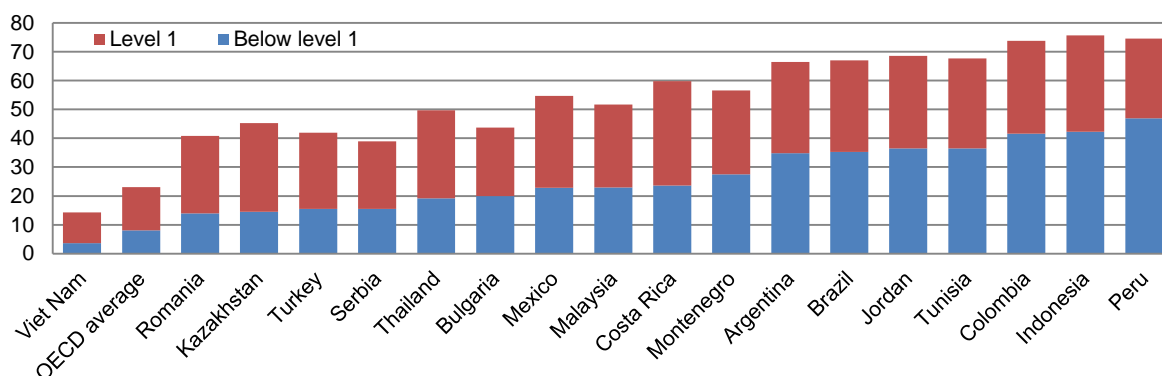
How does PISA for Development measure mathematical literacy?

- The term “mathematical literacy” as used in PISA is an individual’s capacity to formulate, employ and interpret mathematics in a variety of contexts.
- Building on the OECD’s experience with measuring mathematical literacy in middle-income countries, PISA for Development (PISA-D) extends PISA’s mathematical literacy framework to better measure basic processes.
- In particular, the PISA-D mathematics test measures skills, such as performing a simple calculation and drawing a simple conclusion, thus allowing countries to know more about the kinds of tasks 15-year-olds with poor mathematics proficiency can perform.

PISA defines mathematical literacy as: formulating, employing and interpreting mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena. It assesses the capacity of individuals to recognise the role that mathematics plays in the world and to make the well-founded judgements and decisions needed to be constructive, engaged and reflective citizens. PISA also establishes a baseline level – proficiency Level 2, on a scale with 6 as the highest level and 1 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 show that for more than half of the participating middle- and low-income countries, mathematics scores are concentrated below Level 2 (see figure). PISA-D therefore extends the PISA mathematics framework to lower levels of performance to gather precise data on the mathematical skills of the lowest performers. This information will help countries design effective plans to improve these students’ skills.

Percentage of students scoring at or below Level 1 in mathematics in 18 low- and middle-income countries 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 PISA’s assessment of basic mathematical literacy processes to better capture the abilities of low performers.

In light of the OECD’s analyses of mathematics scores in middle- and low- income countries, the conceptual framework for the mathematics assessment in PISA-D expands 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 using more straightforward, simply formulated items at these levels; and, third, by incorporating a careful analysis of students’ attempts to solve problems by describing their ability to choose an appropriate mathematical model from a list and select a strategy or an explanation for completing a given task. These enhancements to the PISA mathematics framework in PISA-D focus on three aspects of the assessment in particular:

1. *Proficiencies*: PISA-D differentiates performance at the lowest level by breaking down Level 1 into three sub-levels: 1a, 1b and 1c.
2. *Processes*: To better describe students’ attempts to apply mathematical processes, PISA-D extends the descriptions of the processes to include:
 - “Selecting an appropriate model from a list” to the PISA mathematical process “formulate situations mathematically”
 - “Performing a simple calculation”, “drawing a simple conclusion” and “selecting an appropriate strategy from a list” to the PISA mathematical process “employ mathematical concepts, facts, procedures and reasoning”
 - “Evaluating a mathematical outcome in terms of the context” to the PISA mathematical process “interpret, apply and evaluate mathematical outcomes”.
3. *Skills*: PISA-D adds and assesses 15-year-olds’ ability to “select a model appropriate to the context of real-world problems”, “select a representation appropriate to the context”, “select an appropriate justification” and “implement a given strategy” as some of the skills required to solve the problems presented in PISA-D.

With a clearer understanding of the mathematical 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 perform basic mathematical operations with greater ease and understanding, help teachers teach mathematics better, and help school systems promote mathematics 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>

For more information

Contact Michael.Ward@oecd.org, Catalina.Covacevich@oecd.org or Kelly.Makowiecki@oecd.org

<p>Visit</p> <p>www.oecd.org/pisa/aboutpisa/pisafordevelopment.htm</p>	<p>Coming next month</p> <p><i>How does PISA-D measure scientific literacy?</i></p>
---	--

Photo credits: © Curt Carnemark/World Bank © epicurean / iStockphoto

This paper is published under the responsibility of the Secretary-General of the OECD. The opinions expressed and the arguments employed herein do not necessarily reflect the official views of OECD member countries.

This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.