# PISA 2003: Introduction

*The present study affords an opportunity to view 15-year-old students' capabilities internationally through the lens of* mathematical literacy *as defined by the PISA 2003 mathematics framework and the resulting assessment. The framework (Chapter 2), the focus on the actual items (Chapter 3), students' performance by mathematical subtopic areas and competency clusters (Chapter 4), the influence of item format and reading level on item difficulty (Chapter 5), and the assessment and interpretation of student problem solving (Chapter 6) present an interesting view of* mathematical literacy *and instruction in an international context.*



## INTRODUCTION

This chapter provides an overview of the purposes and goals of this report. It links the important findings of the PISA 2003 mathematics assessment with ways in which they can be put to practical use by teachers in classrooms and by policy makers involved with matters related to instructional practices in mathematics classrooms. In doing so, the report highlights the importance of a focus on *mathematical literacy*, as defined by the PISA programme, to educational programmes worldwide.

## PURPOSE

*How is mathematical literacy related to curriculum and instruction across countries?*

The objective of this report is to provide information that relates the results of the PISA 2003 assessment of *mathematical literacy* to mathematics instruction. Specific focus is given to the exploration of connections between the results obtained, on the one hand, and instructional practices, curriculum, assessment practices, students' problem solving methods, and mathematical thinking on the other hand.

By using the term "literacy", the PISA framework[1] emphasises that mathematical knowledge and skills that have been defined within traditional school mathematics curricula are not the primary focus of the study. Instead, PISA focuses on students' mathematical knowledge as it is put to functional use in varied contexts and in reflective ways which may require insight and some creativity. However, such uses of mathematics are based on knowledge and skills learned in and practised through the kinds of problems that appear in school textbooks and classrooms. Internationally, educational systems have different curricula that result in different emphases placed on applications, different expectations for the use of mathematical rigor and language and different teaching and assessment practices.

The examination of the results related to *mathematical literacy* from PISA 2003 across participating countries makes it possible to identify some associations between the related levels of achievement and instructional practices found within these countries. Such information will be of direct interest to a wide community of educators including teachers, curriculum developers, assessment specialists, researchers, and policy makers.

## BACKGROUND

The Programme for International Student Assessment (PISA) is a project of the Organisation for Economic Co-operation and Development (OECD). PISA is a collaborative activity among the 30 member countries of the OECD and some partner countries and economies, bringing together scientific expertise from the participating countries and steered jointly by their governments through a Board, on the basis of shared, policy-driven interests. The project is implemented by a consortium of international researchers led by the Australian Council for Educational Research (ACER).

1. The PISA 2003 Assessment Framework (OECD, 2003) is described in detail in Chapter 2.



PISA involves testing of literacy in reading, mathematics, and science in samples of 15-year-olds draw from each participating country. The aim in focusing on students of this age is the generation of a summative, comparative, international report on *mathematical literacy* for students nearing the end of their period of compulsory schooling. The tests are designed to generate measures of the extent to which students can make effective use of what they have learned in school to deal with various problems and challenges they are likely to experience in everyday life. The tests, common across all countries, are translated into the local instructional languages used in each country. Testing first took place in 2000, when reading in the language of instruction was the major test domain. The second cycle of testing occurred in 2003, with *mathematical literacy* the major test domain. The third cycle of testing occurred in 2006, with *scientific literacy* as the major domain focus. PISA collects assessment data every three years with the three domains rotating as the major focus of interest and smaller portions of the assessments being focused on the two other domains. As a result, this OECD programme provides trend data focused on the domains for the participating countries.

*PISA seeks to assess how well 15-year-olds are prepared for life's challenges…*

*… and assesses students in three different domains: reading, mathematics and science.*

A typical test cycle has a number of phases – establishment or refinement of the domain frameworks and sample indicators upon which the assessment will focus, development of assessment instruments linked to these frameworks, field trials of all resulting test instruments in all of the participating countries, careful refinement of the assessments and school and student sampling based on these field trials, implementation of the main study in sampled schools from the participating nations, careful cleaning and analysis of the resulting data, and, finally, interpretation and reporting of the results. The PISA assessments for 2000, 2003, and 2006 have resulted in various publications, including the frameworks (OECD, 1999, 2003), initial reports (OECD, 2001, 2004a, 2004b), associated technical reports (OECD, 2002, 2005, 2009a), a number of thematic reports like this one (OECD, 2009b, 2009c, and 2009d) and a wide variety of national level reports (see *www.pisa.oecd.org* for many examples).

## ORGANISATION OF THE REPORT

This report concentrates on in-depth analysis of PISA 2003 mathematics performance data at the level of individual tasks and test items.

Chapter 2 provides a detailed description of PISA 2003 assessment framework (OECD, 2003). It explains in detail the constructs of the mathematics assessment in PISA and lays out the context for the examples and further analysis presented in subsequent chapters.

Chapter 3 illustrates this framework with released assessment items and links them to different levels of *mathematical literacy* proficiency. The reader can find the actual items in this chapter along with a discussion of students' performance on each of them.

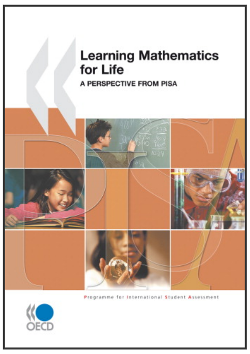


Chapter 4 focuses on differences in the patterns of performance by aspects of mathematical content contained within the items' expectations. In participating countries, by the age of 15 students have been taught different subtopics from the broad mathematics curriculum and these subtopics have been presented to them differently depending on the instructional traditions of the country.

Chapter 5 focuses on factors other than the three Cs (mathematical content, competencies and context) which influence students' performances. Just as countries differ, students' experiences differ by their individual capabilities, the instructional practices they have experienced, and their everyday lives.

For example, item format, wording, reading demand, the amount of information as well as the use of graphics and formulae in items, can all affect students' performance. Chapter 5 examines some of these differences in the patterns of performance by focusing on three factors accessible through data from PISA 2003: language structure within items, item format, and student omission rates related to items.

The final chapter, Chapter 6, concentrates on problem solving methods and differences in students' mathematical thinking. The PISA 2003 assessment framework (OECD, 2003) gives rise to further possibilities for investigating fundamentally important mathematical problem solving methods and approaches. In particular, the framework discusses processes involved with what is referred to as the "mathematisation" cycle. This incorporates both horizontal mathematisation, where students must link phenomena in the real world with the mathematical world (the emphasis is on creating mathematical models, and on interpretation of real situations in relation to their mathematical elements, or interpreting mathematical representations in relation to their real-world implications), and perform vertical mathematisation, where students are required to apply their mathematical skills to link and process information and produce mathematical solutions. The chapter provides two case studies, explaining how the elements required in the different stages of mathematisation are implemented in PISA items.




**From:**

# Learning Mathematics for Life

## A Perspective from PISA

**Access the complete publication at:**

https://doi.org/10.1787/9789264075009-en

**Please cite this chapter as:**

OECD (2010), “Introduction”, in *Learning Mathematics for Life: A Perspective from PISA*, OECD Publishing, Paris.

DOI: https://doi.org/10.1787/9789264075009-2-en



OECD