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# Programme for International Student Assessment: an Overview

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The OECD Programme for International Student Assessment (PISA) is a collaborative effort among OECD member countries to measure how well 15-year-old students approaching the end of compulsory schooling are prepared to meet the challenges of today's knowledge societies. The assessment is forward-looking: rather than focusing on the extent to which these students have mastered a specific school curriculum, it looks at their ability to use their knowledge and skills to meet real-life challenges. This orientation reflects a change in curricular goals and objectives, which are increasingly concerned with what students can do with what they learn at school.

PISA surveys take place every three years. The first survey took place in 2000 (followed by a further 11 countries in 2002), the second in 2003, the third in 2006, the fourth in 2009 (followed by a further 10 countries and economies in 2010), and the fifth in 2012; the results of these surveys have been published in a series of reports (OECD, 2001, 2004, 2007, 2010, 2011, 2013, 2014) and a wide range of thematic and technical reports. The next survey will occur in 2015. For each assessment, one of reading, mathematics and science is chosen as the major domain and given greater emphasis. The remaining two areas, the minor domains, are assessed less thoroughly. In 2000 and 2009 the major domain was reading; in 2003 and 2012 it was mathematics and in 2006 it was science.

PISA is an age-based survey, assessing 15-year-old students in school in grade 7 or higher. These students are approaching the end of compulsory schooling in most participating countries, and school enrolment at this level is close to universal in almost all OECD countries.

The PISA assessments take a literacy perspective, which focuses on the extent to which students can apply the knowledge and skills they have learned and practised at school when confronted with situations and challenges for which that knowledge may be relevant. That is, PISA assesses the extent to which students can use their reading skills to understand and interpret the various kinds of written material that they are likely to meet as they negotiate their daily lives; the extent to which students can use their mathematical knowledge and skills to solve various kinds of numerical and spatial challenges and problems; and the extent to which students can use their scientific knowledge and skills to understand, interpret and resolve various kinds of scientific situations and challenges. The PISA 2012 domain definitions are fully articulated in *PISA 2012 Assessment and Analytical Framework: Mathematics, Reading, Science, Problem Solving and Financial Literacy* (OECD, 2013a).

PISA also allows for the assessment of additional cross-curricular competencies from time to time as participating countries see fit. For example, in PISA 2003, an assessment of general problem-solving competencies was included. A major addition for PISA 2009 was the inclusion of a computer-delivered assessment of digital reading which is also known as the digital reading assessment (DRA). For 2012 a computer-delivered assessment of mathematics and problem solving was added, along with an assessment of financial literacy.

PISA also uses Student Questionnaires to collect information from students on various aspects of their home, family and school background, and School Questionnaires to collect information from schools about various aspects of organisation and educational provision in schools. In PISA 2012, 11 countries also administered a Parent Questionnaire to the parents of the students participating in PISA.

Using the data from Student, Parent and School Questionnaires, analyses linking contextual information with student achievement could address:

- differences between countries in the relationships between student-level factors (such as gender and socio-economic background) and achievement;
- differences in the relationships between school-level factors and achievement across countries;
- differences in the proportion of variation in achievement between (rather than within) schools, and differences in this value across countries;
- differences between countries in the extent to which schools moderate or increase the effects of individual-level student factors and student achievement;
- differences in education systems and national context that are related to differences in student achievement across countries; and
- through links to PISA 2000, PISA 2003, PISA 2006 and PISA 2009, changes in any or all of these relationships over time.

Through the collection of such information at the student and school level on a cross-nationally comparable basis, PISA adds significantly to the knowledge base that was previously available from national official statistics, such as aggregate national statistics on the educational programmes completed and the qualifications obtained by individuals.



The framework for the PISA 2012 questionnaires is included in *PISA 2012 Assessment and Analytical Framework: Mathematics, Reading, Science, Problem Solving and Financial Literacy* (OECD, 2013a).

## PARTICIPATION

The first PISA survey was conducted in 2000 in 32 countries (including 28 OECD member countries) using written tasks answered in schools under independently supervised test conditions. Another 11 countries completed the same assessment in 2002. PISA 2000 surveyed reading, mathematics and science, with a primary focus on reading.

The second PISA survey, conducted in 2003 in 41 countries, assessed reading, mathematics and science, and problem solving with a primary focus on mathematics. The third survey covered reading, mathematics and science, with a primary focus on science, and was conducted in 2006 in 57 countries.

PISA 2009, the fourth PISA survey covered reading, mathematics and science, with a primary focus on reading, and was conducted in 65 countries and economies. Another 10 additional participants completed the PISA 2009 assessment in 2010.

PISA 2012, the fifth PISA survey covered reading, mathematics, science, problem solving and financial literacy with a primary focus on mathematics, and was conducted in 34 OECD countries and 31 partner countries/economies. The participants in PISA 2012 are listed in Figure 1.1. The figure also indicates the 44 countries/economies that participated in the computer-delivered assessment of problem solving, the 32 countries/economies who participated in the computer-based assessment of mathematics and reading, and the 18 countries/economies who participated in the assessment of financial literacy.

This report is concerned with the technical aspects of PISA 2012.

■ Figure 1.1 [Part 1/2] ■

### PISA 2012 participants

OECD countries	Computer-based assessment of mathematics and reading	Problem solving	Financial literacy
Australia	Yes	Yes	Yes
Austria	Yes	Yes	No
Belgium	Yes	Yes	Yes <sup>1</sup>
Canada	Yes	Yes	No
Chile	Yes	Yes	No
Czech Republic	No	Yes	Yes
Denmark	Yes	Yes	No
Estonia	Yes	Yes	Yes
Finland	No	Yes	No
France	Yes	Yes	Yes
Germany	Yes	Yes	No
Greece	No	No	No
Hungary	Yes	Yes	No
Iceland	No	No	No
Ireland	Yes	Yes	No
Israel	Yes	Yes	Yes
Italy	Yes	Yes	Yes
Japan	Yes	Yes	No
Korea	Yes	Yes	No
Luxembourg	No	No	No
Mexico	No	No	No
Netherlands	No	Yes	No
New Zealand	No	No	Yes
Norway	Yes	Yes	No
Poland	Yes	Yes	Yes
Portugal	Yes	Yes	No
Slovak Republic	Yes	Yes	Yes
Slovenia	Yes	Yes	Yes
Spain	Yes	Yes	Yes
Sweden	Yes	Yes	No
Switzerland	No	No	No
Turkey	No	Yes	No
United Kingdom	No	Yes <sup>2</sup>	No
United States	Yes	Yes	Yes

1. Only the Flemish Community of Belgium participated in the financial literacy assessment.

2. Only England participated in the problem-solving assessment.



■ Figure 1.1 [Part 2/2] ■  
**PISA 2012 participants**

Partner countries/economies	Computer-based assessment of mathematics and reading	Problem solving	Financial literacy
Albania	No	No	No
Argentina	No	No	No
Brazil	Yes	Yes	No
Bulgaria	No	Yes	No
Colombia	Yes	Yes	Yes
Costa Rica	No	No	No
Croatia	No	Yes	Yes
Cyprus*	No	Yes	No
Hong Kong-China	Yes	Yes	No
Indonesia	No	No	No
Jordan	No	No	No
Kazakhstan	No	No	No
Latvia	No	No	Yes
Liechtenstein	No	No	No
Lithuania	No	No	No
Macao-China	Yes	Yes	No
Malaysia	No	Yes	No
Montenegro	No	Yes	No
Peru	No	No	No
Qatar	No	No	No
Romania	No	No	No
Russian Federation	Yes	Yes	Yes
Serbia	No	Yes	No
Shanghai-China	Yes	Yes	Yes
Singapore	Yes	Yes	No
Chinese Taipei	Yes	Yes	No
Thailand	No	No	No
Tunisia	No	No	No
United Arab Emirates	Yes	Yes	No
Uruguay	No	Yes	No
Viet Nam	No	No	No
<b>Total</b>	<b>32</b>	<b>44</b>	<b>18</b>

1. Only the Flemish Community of Belgium participated in the financial literacy assessment.  
 2. Only England participated in the problem-solving assessment.

\* 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”.

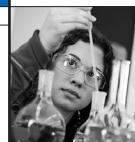
Note by all the European Union Member States of the OECD and the European Union: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of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

## FEATURES OF PISA

The technical characteristics of the PISA survey involve a number of different aspects:

- the design of the test and the features incorporated into the test developed for PISA are critical;
- the sampling design, including both the school sampling and the student sampling requirements and procedures;
- because of the multilingual nature of the test, rules and procedures are required to guarantee the equivalence of the different language versions used within and between participating countries, and to take into account the diverse cultural contexts of those countries;
- various operational procedures, including test administration arrangements, data capture and processing and quality assurance mechanisms designed to ensure the generation of comparable data from all countries; and
- scaling and analysis of the data and their subsequent reporting: PISA employs scaling models based on Item Response Theory (IRT) methodologies. The described proficiency scales, which are the basic tool in reporting PISA outcomes, are derived using IRT analysis.

This report describes the above-mentioned methodologies as they have been implemented in PISA 2012. It also describes the quality assurance procedures that have enabled PISA to provide high quality data to support policy formation and review. Box 1.1 provides an overview of the central design elements of PISA 2012.



The ambitious goals of PISA come at a cost: PISA is both resources intensive and methodologically complex, requiring intensive collaboration among many stakeholders. The successful implementation of PISA depends on the use, and sometimes further development, of state-of-the-art methodologies.

Quality within each of these areas is defined, monitored and assured through the use of a set of technical standards. These standards have been endorsed by the PISA Governing Board, and they form the backbone of implementation in each participating country and of quality assurance across the project (see Annex F for the PISA 2012 Technical Standards).

### Box 1.1. **Key features of PISA 2012**

#### *The content*

The PISA 2012 survey focused on mathematics, with reading, science and problem-solving as minor areas of assessment. For the first time, PISA 2012 also included an assessment of the financial literacy of young people, which was optional for countries and economies.

PISA assesses not only whether students can reproduce knowledge, but also whether they can extrapolate from what they have learned and apply their knowledge in new situations. It emphasises the mastery of processes, the understanding of concepts, and the ability to function in various types of situations.

#### *The students*

Around 510 000 students completed the assessment in 2012, representing about 28 million 15-year-olds in the schools of the 65 participating countries and economies.

#### *The assessment*

Paper-based tests were used, with assessments lasting a total of two hours for each student. In a range of countries and economies, an additional 40 minutes were devoted to the computer-based assessment of mathematics, reading and problem solving.

Test items were a mixture of multiple-choice items and questions requiring students to construct their own responses. The items were organised in groups based on a text or graphic setting out a real-life situation. A total of about 390 minutes of test items was included, with different students taking different combinations of test items.

Students answered a background questionnaire, which took 30 minutes to complete, that sought information about themselves, their homes and their school and learning experiences. School principals were given a questionnaire, to complete, that covered the school system and the learning environment. In some countries and economies, optional questionnaires were distributed to parents, who were asked to provide information on their perceptions of and involvement in their child's school, their support for learning in the home, and their child's career expectations, particularly in mathematics-based occupations. Countries could choose two other optional questionnaires for students: one asked students about their familiarity with and use of information and communication technologies, and the second sought information about their education to date, including any interruptions in their schooling and whether and how they are preparing for a future career.

## **MANAGING AND IMPLEMENTING PISA**

The design and implementation of PISA for the 2000, 2003, 2006, 2009 and 2012 data collections was the responsibility of an international consortium led by the Australian Council for Educational Research (ACER) with Ray Adams as International Project Director. Achieve (United States) was contracted by the OECD to develop the mathematics framework with ACER.

For PISA 2012 the Consortium partners were:

- cApStAn Linguistic Quality Control (Belgium)
- Deutsches Institut für Internationale Pädagogische Forschung (DIPF, Germany)



- Educational Testing Service (ETS, United States)
- Institutt for Lærerutdanning og Skoleutvikling (ILS, Norway)
- Leibniz - Institute for Science and Mathematics Education (IPN, Germany)
- National Institute for Educational Policy Research (NIER, Japan)
- The Tao Initiative: CRP - Henri Tudor and Université de Luxembourg - EMACS (Luxembourg)
- Unité d'analyse des systèmes et des pratiques d'enseignement (aSPe, Belgium)
- Westat (United States)

Annex G lists the Consortia staff and consultants who have made significant contributions to the development and implementation of the project.

PISA is implemented within a framework established by the PISA Governing Board (PGB) which includes representation from all participating countries at senior policy levels. The PGB established policy priorities and standards for developing indicators, for establishing assessment instruments, and for reporting results. Experts from participating countries served on working groups linking the programme policy objectives with the best internationally available technical expertise in the three assessment areas and in the areas which were included in the context questionnaires.

These expert groups were referred to as Subject Matter Expert Groups (EGs) (see Annex G for the list of members) and the Questionnaire Expert Group (QEG). By participating in these expert groups and regularly reviewing outcomes of the groups' meetings, countries ensured that the instruments were internationally valid, that they took the cultural and educational contexts of the different OECD member countries into account, that the assessment materials had strong measurement potential, and that the instruments emphasised authenticity and educational validity.

Each of the participating countries appointed a National Project Manager (NPM), to implement PISA nationally. The NPMs ensured that internationally agreed common technical and administrative procedures were employed. These managers played a vital role in developing and validating the international assessment instruments and ensured that PISA implementation was of high quality. The NPMs also contributed to the verification and evaluation of the survey results, analyses and reports.

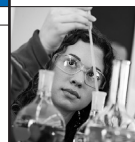
The OECD Secretariat was responsible for the overall management of the programme. It monitored its implementation on a day-to-day basis, served as the secretariat for the PGB, fostered consensus building between the countries involved, and served as the interlocutor between the PGB and the international Consortia.

## STRUCTURE OF THIS REPORT

This Technical Report is designed to describe the technical aspects of the project at a sufficient level of detail to enable review and, potentially, replication of the implemented procedures and technical solutions to problems. It therefore does not report the results of PISA 2012 which have been published in *PISA 2012 Results: What Students Know and Can Do - Student Performance in Mathematics, Reading and Science (Volume I – Revised Edition)* (OECD, 2014a), *Excellence through Equity: Giving Every Student the Chance to Succeed (Volume II)* (OECD, 2013b), *Ready to Learn: Students' Engagement, Drive and Self-Beliefs (Volume III)* (OECD, 2013c), *What Makes Schools Successful? Resources, Policies and Practices (Volume IV)* (OECD, 2013d), *Creative Problem Solving: Students' Skills in Tackling Real-Life Problems (Volume V)* (OECD, 2014b), *Students and Money: Financial Literacy Skills for the 21st century (Volume VI)* (OECD, 2014c). A bibliography of other PISA related reports is included in Annex H.

There are five sections in this report:

- *Section One – Instrument design*: describes the design and development of both the questionnaires and achievement tests (Chapters 2 and 3).
- *Section Two – Operations*: gives details of the operational procedures for the sampling and population definitions, test administration procedures, quality monitoring and assurance procedures for Test Administration and National Centre operations, and instrument translation (Chapters 4, 5, 6 and 7).
- *Section Three – Data processing*: covers the methods used in data cleaning and preparation, including the methods for weighting and variance estimation, scaling methods, methods for examining inter-rater variation and the data cleaning steps (Chapters 8, 9 and 10).



- *Section Four — Quality indicators and outcomes*: covers the results of the scaling and weighting, report response rates and related sampling outcomes and gives the outcomes of the inter-rater reliability studies. The last chapter in this section summarises the outcomes of the PISA 2012 data adjudication; that is, the overall analysis of data quality for each country (Chapters 11, 12, 13 and 14).
- *Section Five — Scale construction and data products*: describes the construction of the PISA 2012 described levels of proficiency and the construction and validation of questionnaire-related indices. The final chapter briefly describes the contents of the PISA 2012 database (Chapters 15, 16, 17, 18 and 19).

There are also detailed annexes of results pertaining to the chapters of the report that are provided.

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