1

Programme for International Student Assessment: an overview

INTRODUCTION

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, focusing more on 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 8 and 3 countries and economies in 2001 and 2002, respectively), the second in 2003, the third in 2006, the fourth in 2009 (followed by a further 10 countries and economies in 2010), the fifth in 2012 and the sixth in 2015. The results of these surveys have been published in a series of reports (OECD, 2016a-b, 2014a-b-c, 2013a-b-c, 2011, 2010a-b-c-d-e, 2007, 2004, 2003, 2001; OECD/UNESCO Institute for Statistics (2003); and Walker (2011)) and a wide range of thematic and technical reports. The next survey will occur in 2018. For each assessment, reading, mathematics or science is chosen as the major domain and given greater emphasis than the remaining two minor domains. In 2000 and 2009 the major domain was reading; in 2003 and 2012 it was mathematics, and in 2006 and 2015 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, focusing 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 navigate everyday life; 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 2015 domains are fully defined in *PISA 2015 Assessment and Analytical Framework: Science, Reading, Mathematic and Financial Literacy* (OECD, 2016c).

PISA also conducts assessments 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 and in PISA 2009 a computer-delivered digital reading assessment (DRA) was included for the first time. In PISA 2012 a computer-delivered assessment of mathematics and problem solving was added, along with an assessment of financial literacy. The DRA was included again in 2012. In PISA 2015 financial literacy was assessed for a second time but for this cycle in computer-based form. A computer-based assessment of collaborative problem solving was also added.

In addition, PISA 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. There are also optional questionnaire modules for students asking about Familiarity with Information and Communications Technology (ICT) about aspects of their Educational Career (EC). In PISA 2015, 18 countries also administered a Parent Questionnaire to the parents of the students participating in PISA. A Teacher Questionnaire was also developed for the first time in PISA and this was administered in 19 countries. Chapter 17 provides information about participation in the optional questionnaires.

Using the data from questionnaires, analyses linking contextual information with student achievement can 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

- changes in any or all of these relationships over time by linking PISA 2000, PISA 2003, PISA 2006, PISA 2009 and PISA 2012.

By collecting such information at the student and school level on a cross-nationally comparable basis, PISA adds significantly to the knowledge base that is 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 2015 questionnaires is included in *PISA 2015 Assessment and Analytical Framework: Science, Reading, Mathematic and Financial Literacy* (OECD, 2016c).

PARTICIPATION

The first PISA survey was conducted in 2000 in 32 countries and economies (including 28 OECD member countries) using written tasks answered in schools under independently supervised test conditions. Another 11 countries and economies completed the same assessment in 2001 and 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 and economies.

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 and economies.

PISA 2015, the sixth PISA survey covered reading, mathematics, science, collaborative problem solving and financial literacy with a primary focus on science, and was conducted in 35 OECD countries and 37 partner countries and economies.

The participants in PISA 2015 are listed in Figure 1.1. The figure also indicates whether countries/economies participated in the computer-based mode (CBA) or paper-based mode (PBA), and shows the countries and economies that participated in the collaborative problem solving (CPS) and/or financial literacy assessments.

FEATURES OF PISA

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

- the design of the tests and questionnaires and the features incorporated in the instruments developed for PISA

- the sampling design, including both the school sampling and the student sampling requirements and procedures

- rules and procedures to guarantee the equivalence of the different language versions used within and between participating countries and economies, and taking into account the diverse cultural contexts of those countries and economies

- 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 economies

- the technical requirements and procedures for administering computer-based tests in schools

- scaling and analysis of the data and their subsequent reporting

- quality assurance procedures that enable PISA to provide high quality data to support policy formation and review.

This report describes the above-mentioned methodologies as they have been implemented in PISA 2015. Box 1.1 provides an overview of the central design elements of PISA 2015.

■ Figure 1.1 ■

PISA 2012 participants

		Mode	CPS	Financial literacy
OECD countries	Australia	CBA	Yes	Yes
	Austria	CBA	Yes	No
	Belgium	CBA	Yes	Yes (Flemish community only)
	Bulgaria	CBA	Yes	No
	Canada	CBA	Yes	Yes (7 provinces)
	Czech Republic	CBA	Yes	No
	Denmark	CBA	Yes	No
	Estonia	CBA	Yes	No
	Finland	CBA	Yes	No
	France	CBA	Yes	No
	Germany	CBA	Yes	No
	Greece	CBA	Yes	No
	Hungary	CBA	Yes	No
	Iceland	CBA	Yes	No
	Ireland	CBA	No	No
	Israel	CBA	Yes	No
	Italy	CBA	Yes	Yes
	Japan	CBA	Yes	No
	Korea	CBA	Yes	No
	Latvia	CBA	Yes	No
	Luxembourg	CBA	Yes	No
	Mexico	CBA	Yes	No
	Netherlands	CBA	Yes	Yes
	New Zealand	CBA	Yes	No
	Norway	CBA	Yes	No
	Poland	CBA	No	Yes
	Portugal	CBA	Yes	No
	Slovak Republic	CBA	Yes	Yes
	Slovenia	CBA	Yes	No
	Spain	CBA	Yes	Yes
	Sweden	CBA	Yes	No
	Switzerland	CBA	No	No
	Turkey	CBA	Yes	No
	United Kingdom	CBA	Yes	No
	United States	CBA	Yes	Yes
Partner countries/economies	Albania	PBA	No	No
	Algeria	PBA	No	No
	Argentina	PBA	No	No
	Brazil	CBA	Yes	Yes
	B-S-J-G (China)[1]	CBA	Yes	Yes
	Chile	CBA	Yes	Yes
	Chinese Taipei	CBA	Yes	No
	Colombia	CBA	Yes	No
	Costa Rica	CBA	Yes	No
	Croatia	CBA	Yes	No
	Cyprus[2]	CBA	Yes	No
	Dominican Republic	CBA	No	No
	FYROM	PBA	No	No
	Georgia	PBA	No	No
	Hong Kong (China)	CBA	Yes	No
	Indonesia	PBA	No	No
	Jordan	PBA	No	No
	Kazakhstan	PBA	No	No
	Kosovo	PBA	No	No
	Lebanon	PBA	No	No
	Lithuania	CBA	Yes	Yes
	Macao (China)	CBA	Yes	No
	Malaysia	CBA	Yes	No
	Malta	PBA	No	No
	Moldova	PBA	No	No
	Montenegro	CBA	Yes	No
	Peru	CBA	Yes	Yes
	Qatar	CBA	No	No
	Romania	PBA	No	No
	Russia	CBA	Yes	Yes
	Singapore	CBA	Yes	No
	Thailand	CBA	Yes	No
	Trinidad and Tobago	PBA	No	No
	Tunisia	CBA	Yes	No
	United Arab Emirates	CBA	Yes	No
	Uruguay	CBA	Yes	No
	Viet Nam	PBA	No	No

1. B-S-J-G (China) refers to the four PISA-participating China provinces: Beijing, Shanghai, Jiangsu and Guangdong.

2. 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.

<div style="text-align:center">
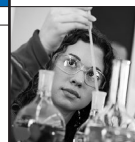
Box 1.1. **Key features of PISA 2015**

</div>

The content

The PISA 2015 survey focused on science, with reading and mathematics as minor areas of assessment. PISA 015 also included the assessment of an innovative domain, collaborative problem solving and the assessment of financial literacy 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

Approximately 540 000 students completed the assessment in 2015, representing about 29 million 15-year-olds in the schools of the 72 participating countries and economies.

The assessment

For the first time in PISA 2015, computer-based tests were the main mode of assessment. Paper-based alternatives were used in 15 countries and economies that did not have the resources available for computer-based testing in schools. The tests lasted a total of two hours for each student and covered reading, science, mathematics and collaborative problem solving in the majority of computer-based countries and economies[1] and reading, science and mathematics in paper-based countries and economies. An additional 60 minutes were devoted to the computer-based assessment of financial literacy in countries and economies that chose to implement this option.

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. Some science tasks presented students with an interactive scenario (e.g. a science experiment) which required manipulation of elements within the scenario, while collaborative problem solving was assessed via interactive chat-based tasks with branching based on student responses. A total of 810 minutes of test items in reading, science, mathematics and collaborative problem solving were included, with different students taking different combinations of test items.

Students answered a background questionnaire, which took around 30 minutes to complete. The questionnaire sought information about themselves, their homes and their school and learning experiences. School principals completed a questionnaire 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 science-based occupations. Countries and economies 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. For the first time in PISA 2015 countries and economies could also opt to distribute a questionnaire to teachers.

1. The test of collaborative problem solving was not available in paper-based format and a small number of computer-based countries (Ireland, Poland, Qatar, Dominican Republic and Switzerland) also chose not to administer this part of the assessment.

TECHNICAL INNOVATIONS IN PISA 2015

A major innovation in PISA 2015 was the move from a primarily paper-based survey that included optional computer-based modules to a fully computer-delivered survey. A paper-based version of the assessment that included only trend units was developed for the small number of countries and economies that did not implement the computer-based survey (see Figure 1.1). The computer-based delivery mode made it possible to measure new and expanded aspects of the domain constructs. In particular, the addition of interactive tasks in science allowed students to manipulate variables in simulated scientific enquiries, and the collaborative problem solving assessment applied interactive chat-based tasks with branching based on student responses. Chapter 2 describes these tasks in more detail and Chapter 18 describes the technical aspects of the computer delivery platform. Chapter 17 describes the platform used for the development and delivery of background questionnaires for students, school principals and teachers.

In addition to the development of computer-based delivery in schools,an interactive portal was set up to support survey implementation and enhance communication between national teams and the international contractors. Chapter 6

describes the use of this portal for a variety of tasks while Chapter 18 describes the technical aspects of the portal. Chapter 5 describes the use of the online portal for translation and adaptation procedures in more detail.

A further development of computer-based activities was onscreen marking of tests which was an option for national centres in previous PISA cycles but became the main medium for test marking in PISA 2018. This offered considerable advantages in monitoring marking activities and enabling real-time checks on marker reliability, thereby increasing the accuracy and reliability of marking open-ended responses. In addition, responses from closed items in test and questionnaires were captured automatically without the need for data entry, saving time and avoiding potential operator error. Chapter 13 describes the marking process while Chapter 18 describes technical details of the Open-Ended Coding System (OECS) and the direct capture of responses from closed items.

The move to computer-based delivery as the main mode of assessment also made it possible to collect more in depth information not just on student responses but also the process behind those responses, such as the amount of time it took to complete each task and the number of actions taken by the student. Chapter 18 describes the type of information which was collected.

There were also innovations in the scaling model used and in the measurement of trends across PISA cycles. The ability to establish and maintain trends over time is an important goal for PISA. In PISA 2015 the assessment design was enhanced to increase coverage of minor domains, with the aim of strengthening trend measurement. The integrated design for the assessment which is described in Chapter 2 increased the number of items for the minor domains to previous major domain levels, reducing the potential for introducing systematic measurement error across PISA cycles. The methodology incorporated all available data from previous cycles for scaling and analysis, thus providing a solid base for linking across cycles and between paper-based and computer-based administrations.

PISA, as with other large scale international studies, uses an Item Response Theory (IRT) approach in the analysis and scaling of the data and the measurement of trends across cycles. The IRT model used in PISA 2015 underwent some modifications compared with previous cycles which based the scaling entirely on a Rasch model. To increase the ability of the scaling to address the complexities of PISA data, PISA 2015 implemented a hybrid model which combined a Rasch approach with other IRT models, with a two-parameter-logistic model and a generalised partial credit model (GPCM) used where appropriate. Chapter 9 describes this innovative approach in detail and Chapter 12 presents scaling outcomes.

MANAGING AND IMPLEMENTING PISA

PISA is implemented within a framework established by the PISA Governing Board (PGB) which includes representation from all participating countries and economies at senior policy levels. The PGB establishes policy priorities and standards for developing indicators, for establishing assessment instruments, and for reporting results. Annex G lists the members of the PISA Governing Board and the observers from partner countries and economies.

Experts from participating countries and economies served on working groups linking the programme policy objectives with the best internationally available technical expertise in the 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) and the Questionnaire Expert Group (QEG). By participating in these expert groups and regularly reviewing outcomes of the groups' meetings, countries and economies ensured that the instruments were internationally valid, that they took the cultural and educational contexts of participating countries and economies into account, that the assessment materials had strong measurement potential, and that the instruments emphasised authenticity and educational validity. See Annex G for the list of members of the expert groups.

Each of the participating countries and economies 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. Annex G also lists the PISA 2015 NPMs.

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 and economies involved, and served as the interlocutor between the PGB and the international contractors.

The design and implementation of the surveys, within the framework established by the PISA Governing Board, is the responsibility of external contractors. For PISA 2015, the overall management of contractors and implementation was carried out by the Educational Testing Service (ETS) in the United States as the **Core 7** contractor. The OECD Secretariat worked closely with the International Project Director, Irwin Kirsch of ETS, to co-ordinate all aspects of implementation.

The additional tasks related to the implementation of PISA 2015 were carried out by six additional contractors – Cores 1 to 6.

Pearson in the United Kingdom developed the assessment frameworks as the **Core 1** contractor.

Core 2 was led by ETS and focused on the development of the computer platform in co-operation with the Centre de Recherche Public Henri Tudor (CRP-HT) in Luxembourg.

Core 3 focused on the instrument development, scaling and analysis and was led by ETS, with co-operation from cApStAn Linguistic Quality Control in Belgium for linguistic quality control, the University of Luxembourg, University of Heidelberg, GESIS and the Center for Educational Technology in Israel for test development, the Unité d'analyse des systèmes et des pratiques d'enseignement (aSPe) at the University of Liège in Belgium for coding training for open-constructed items, the International Association for Evaluation of Educational Achievement (IEA) in the Netherlands for the data management software, and HallStat SPRL in Belgium for the translation referee.

Core 4 focused on Survey Operations and was implemented by Westat in the United States.

Core 5 focused on sampling and was implemented by Westat in the United States in co-operation with the Australian Council for Educational Research (ACER).

Core 6 focused on the questionnaire frameworks and questionnaire development and was carried out by the Deutsches Institut für Internationale Pädagogische Forschung (DIPF) in Germany, with the co-operation of Statistics Canada.

Annex G lists the staff and consultants associated with the core contractors who have made significant contributions to the development and implementation of the project.

PISA 2015 PUBLICATIONS

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 2015 which have been published in *PISA 2015 Results (Volume I): Excellence and Equity in Education* (OECD, 2016a) and *PISA 2015 Results (Volume II): Policies and Practices for Successful Schools* (OECD, 2016b). Further results are reported in Volume III (OECD, 2017a), which discusses Students' Well-Being, Volume IV (OECD, 2017b), which reports on Students' Financial Literacy and Volume V (forthcoming), which delves into Collaborative Problem Solving.

References

OECD (forthcoming), *PISA 2015 Results (Volume V): Collaborative Problem Solving*, OECD Publishing, Paris.

OECD (2017a), *PISA 2015 Results (Volume III): Students' Well-Being*, OECD Publishing, Paris, *http://dx.doi.org/10.1787/9789264273856-en*.

OECD (2017b), *PISA 2015 Results (Volume IV): Students' Financial Literacy*, OECD Publishing, Paris, *http://dx.doi.org/10.1787/9789264270282-en*.

OECD (2016a), *PISA 2015 Results (Volume I): Excellence and Equity in Education*, OECD Publishing, Paris, *http://dx.doi.org/10.1787/9789264266490-en*.

OECD (2016b), *PISA 2015 Results (Volume II): Policies and Practices for Successful Schools*, OECD Publishing, Paris, *http://dx.doi.org/10.1787/9789264267510-en*.

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

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

OECD (2014b), *PISA 2012 Results: Creative Problem Solving (Volume V): Students' Skills in Tackling Real-Life Problems*, PISA, OECD Publishing, Paris, *http://dx.doi.org/10.1787/9789264208070-en*.

OECD (2014c), *PISA 2012 Results: Students and Money (Volume VI): Financial Literacy Skills for the 21st Century*, PISA, OECD Publishing, Paris, *http://dx.doi.org/10.1787/9789264208094-en*.

OECD (2013a), *PISA 2012 Results: Excellence through Equity (Volume II): Giving Every Student the Chance to Succeed*, PISA, OECD Publishing, Paris, *http://dx.doi.org/10.1787/9789264201132-en*.

OECD (2013b), *PISA 2012 Results: Ready to Learn (Volume III): Students' Engagement, Drive and Self-beliefs*, PISA, OECD Publishing, Paris, *http://dx.doi.org/10.1787/9789264201170-en*.

OECD (2013c), *PISA 2012 Results: What Makes Schools Successful (Volume IV): Resources, Policies and Practices*, PISA, OECD Publishing, Paris, *http://dx.doi.org/10.1787/9789264201156-en*.

OECD (2011), *PISA 2009 Results: Students On Line: Digital Technologies and Performance (Volume VI)*, PISA, OECD Publishing, Paris, *http://dx.doi.org/10.1787/9789264112995-en*.

OECD (2010a), *PISA 2009 Results: What Students Know and Can Do: Student Performance in Reading, Mathematics and Science (Volume I)*, PISA, OECD Publishing, Paris, *http://dx.doi.org/10.1787/9789264091450-en*.

OECD (2010b), *PISA 2009 Results: Overcoming Social Background: Equity in Learning Opportunities and Outcomes (Volume II)*, PISA, OECD Publishing, Paris, *http://dx.doi.org/ 10.1787/9789264091504-en*.

OECD (2010c), *PISA 2009 Results: Learning to Learn: Student Engagement, Strategies and Practices (Volume III)*, PISA, OECD Publishing, Paris, *http://dx.doi.org/10.1787/9789264083943-en*.

OECD (2010d), *PISA 2009 Results: What Makes a School Successful?: Resources, Policies and Practices (Volume IV)*, PISA, OECD Publishing, Paris, *http://dx.doi.org/10.1787/9789264091559-en*.

OECD (2010e), *PISA 2009 Results: Learning Trends: Changes in Student Performance since 2000 (Volume V)*, PISA, OECD Publishing, Paris, *http://dx.doi.org/ 10.1787/9789264091580-en*.

OECD (2007), *PISA 2006: Science Competencies for Tomorrow's World*, PISA, OECD Publishing, Paris, *http://dx.doi.org/ 10.1787/9789264040014-en*.

OECD (2004), *Learning for Tomorrow's World: First Results from PISA 2003*, PISA, OECD Publishing, Paris, *http://dx.doi.org/ 10.1787/9789264006416-en*.

OECD (2001), *Knowledge and Skills for Life: First Results from PISA 2000*, PISA, OECD Publishing, Paris, *http://dx.doi.org/ 10.1787/9789264195905-en*.

OECD/UNESCO Institute for Statistics (2003), *Literacy Skills for the World of Tomorrow: Further Results from PISA 2000*, OECD Publishing, Paris, *http://dx.doi.org/10.1787/9789264102873-en*.

Walker, Maurice (2011), *PISA 2009 Plus Results: Performance of 15-year-olds in reading, mathematics and science for 10 additional participants*, ACER Press, Melbourne.