

PISA 2018 Technical Report



Chapter 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 and non-Member partner 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/economies in 2001 and 2002, respectively), the second in 2003, the third in 2006, the fourth in 2009 (followed by a further 10 countries/economies in 2010), the fifth in 2012, the sixth in 2015, and the seventh in 2018. The results of these surveys have been published in a series of reports (OECD, 2020a-b-c, 2019a-b-c, 2017a-b-c, 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 (e.g. OECD, 2021a-b). The next survey will occur in 2022. 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, 2009, and 2018, the major domain was reading; in 2003 and 2012 it was mathematics, in 2006 and 2015 it was science.

PISA is an age-based survey, assessing 15-year-olds in school in grade 7 or higher. These students are approaching the end of compulsory schooling in most participating countries/economies, 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 2018 domains are fully defined in *PISA 2018 Assessment and Analytical Framework* (OECD, 2019d).

PISA also conducts assessments of additional cross-curricular competencies from time to time as participating countries/economies 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 2015 and administered for a second time in PISA 2018. In PISA 2018 financial literacy was assessed for the third time, also in computer-based form, which was administered to 21 countries/economies. A computer-based assessment of global competence was also added, and administered to 27 countries/economies.

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), aspects of their Educational Career (EC) and Well-being (WB). In PISA 2018, 17 countries/economies also administered a Parent Questionnaire to the parents of the students participating in PISA. A Teacher Questionnaire was implemented for the second time in PISA 2018 and was administered in 19 countries/economies. In PISA 2018, a Student Wellbeing Questionnaire was also developed for the first time, and was administered in 7 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/economies 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/economies;
- differences in the proportion of variation in achievement between (rather than within) schools, and differences in this value across countries/economies;
- differences between countries/economies 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/economies;
- changes in any or all of these relationships over time by linking PISA 2000, PISA 2003, PISA 2006, PISA 2009, PISA 2012 and PISA 2015 and PISA 2018.

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 2018 questionnaires is included in *PISA 2018 Assessment and Analytical Framework* (OECD, 2019d).

PARTICIPATION

The first PISA survey was implemented in 43 countries/economies (including 32 OECD Member countries). It was first conducted in 2000 in 32 countries/economies (including 28 OECD Member countries) using written tasks answered in schools under independently supervised test conditions.

Another 11 countries/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/economies, 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/economies.

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

PISA 2012, the fifth PISA survey covered reading, mathematics and science, with a primary focus on reading and was conducted in 34 OECD countries and 31 partner countries/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/economies.

PISA 2018, the seventh PISA survey covered reading, mathematics, science, global competence and financial literacy, with a primary focus on reading, and was conducted in 37 OECD countries and 42 partner countries/economies

The participants in PISA 2018 are listed in Table 1.1. The figure also indicates whether countries/economies participated in the computer-based (CBA) or paper-based mode (PBA), and shows the countries/economies that participated in the global competence (GC) and/or financial literacy assessment.

Table 1. PISA 2018 participants

	Participating countries/economies in PISA 2018	Mode	Global competence	Financial literacy	Educational career questionnaire	ICT questionnaire	Well-being questionnaire	Parent questionnaire	Teacher questionnaire
OECD countries	Australia	CBA	No	Yes	Yes	Yes	No	No	No
	Austria	CBA	No	No	Yes	Yes	No	No	No
	Belgium	CBA	No	No	Yes	Yes	No	Yes	No
	Canada	CBA	Yes	Yes	No	No	No	No	No
	Chile	CBA	Yes	Yes	No	Yes	No	Yes	Yes
	Colombia	CBA	Yes	No	No	No	No	No	No
	Czech Republic	CBA	No	No	No	Yes	No	No	No
	Denmark	CBA	No	No	Yes	Yes	No	No	No
	Estonia	CBA	No	Yes	No	Yes	No	No	No
	Finland	CBA	No	Yes	No	Yes	No	No	No
	France	CBA	No	No	No	Yes	No	No	No
	Germany	CBA	No	No	Yes	Yes	No	Yes	Yes
	Greece	CBA	Yes	No	Yes	Yes	No	No	No
	Hungary	CBA	No	No	Yes	Yes	No	No	No
	Iceland	CBA	No	No	Yes	Yes	No	No	No

Ireland	CBA	No	No	Yes	Yes	Yes	Yes	No
Israel	CBA	Yes	No	No	Yes	No	No	No
Italy	CBA	No	Yes	Yes	Yes	No	Yes	No
Japan	CBA	No	No	No	Yes	No	No	No
Korea	CBA	Yes	No	Yes	Yes	No	Yes	Yes
Latvia	CBA	Yes	Yes	No	Yes	No	No	No
Lithuania	CBA	Yes	Yes	Yes	Yes	No	No	No
Luxembourg	CBA	No	No	No	Yes	No	Yes	No
Mexico	CBA	No	No	No	Yes	Yes	Yes	No
Netherlands	CBA	No	Yes	No	No	No	No	No
New Zealand	CBA	No	No	Yes	Yes	No	No	No
Norway	CBA	No	No	No	No	No	No	No
Poland	CBA	No	Yes	Yes	Yes	No	No	No
Portugal	CBA	No	Yes	No	No	No	Yes	Yes
Slovak Republic	CBA	Yes	Yes	Yes	Yes	No	No	No
Slovenia	CBA	No	No	Yes	Yes	No	No	No
Spain	CBA	Yes	Yes	Yes	Yes	Yes	No	Yes
Sweden	CBA	No	No	No	Yes	No	No	No
Switzerland	CBA	No	No	No	Yes	No	No	No
Türkiye	CBA	No	No	No	Yes	No	No	No
United Kingdom (excl. Scotland)	CBA	No	No	Yes	Yes	No	No	No
United Kingdom (Scotland)	CBA	Yes	No	No	Yes	No	No	Yes
United States	CBA	No	Yes	No	Yes	No	No	Yes

Partner countries/economies

Albania	CBA	Yes	No	Yes	Yes	No	No	Yes
Argentina	PBA	NA	NA	NA	NA	NA	NA	NA
Baku (Azerbaijan)	CBA	No	No	No	No	No	No	Yes
Belarus	CBA	No	No	No	No	No	No	No
Bosnia and Herzegovina	CBA	No	No	No	No	No	No	No
Brazil	CBA	No	Yes	Yes	Yes	No	Yes	Yes
Brunei Darussalam	CBA	Yes	No	Yes	Yes	No	No	No
B-S-J-Z (China)*	CBA	No	No	No	No	No	No	No
Bulgaria	CBA	No	Yes	Yes	Yes	Yes	No	No
Costa Rica**	CBA	Yes	No	Yes	Yes	No	No	No
Croatia	CBA	Yes	No	Yes	Yes	No	Yes	No
Cyprus***	CBA	No	No	No	No	No	No	No
Dominican Republic	CBA	No	No	No	Yes	No	Yes	Yes
Georgia	CBA	No	Yes	No	Yes	Yes	Yes	No
Hong Kong (China)	CBA	Yes	No	Yes	Yes	Yes	Yes	Yes
Indonesia	CBA	Yes	Yes	No	No	No	No	No
Jordan	PBA	NA	NA	NA	NA	NA	NA	NA
Kazakhstan	CBA	Yes	No	Yes	Yes	No	No	No
Kosovo	CBA	No	No	No	No	No	No	No
Lebanon	PBA	NA	NA	NA	NA	NA	NA	NA
Macao (China)	CBA	No	No	No	Yes	No	Yes	Yes
Malaysia	CBA	No	No	No	No	No	No	Yes
Malta	CBA	Yes	No	Yes	Yes	No	Yes	No
Moldova	PBA	NA	NA	NA	NA	NA	NA	NA
Montenegro	CBA	No	No	No	No	No	No	No
Morocco	CBA	Yes	No	Yes	Yes	No	No	Yes
North Macedonia	PBA	NA	NA	NA	NA	NA	NA	NA
Panama	CBA	Yes	No	Yes	Yes	Yes	Yes	Yes

Peru	CBA	No	Yes	No	No	No	No	No	Yes
Philippines	CBA	Yes	No	No	No	No	No	No	No
Qatar	CBA	No	No	No	No	No	No	No	No
Romania	PBA	NA	NA	NA	NA	NA	NA	NA	NA
Russian Federation	CBA	Yes	Yes	No	Yes	No	No	No	No
Saudi Arabia	PBA	NA	NA	NA	NA	NA	NA	NA	NA
Serbia	CBA	Yes	Yes	Yes	Yes	Yes	No	No	No
Singapore	CBA	Yes	No	No	Yes	No	No	No	No
Chinese Taipei	CBA	Yes	No	Yes	Yes	No	No	Yes	Yes
Thailand	CBA	Yes	No	Yes	Yes	No	No	No	No
Ukraine	PBA	NA	NA	NA	NA	NA	NA	NA	NA
United Arab Emirates	CBA	No	No	No	No	Yes	No	Yes	Yes
Uruguay	CBA	No	No	No	Yes	No	No	No	No
Viet Nam	PBA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

* B-S-J-Z (China) refers to the four PISA-participating China provinces: Beijing, Shanghai, Jiangsu and Zhejiang.

** Costa Rica became an OECD Member on 25 May 2021.

*** Note by Republic of Türkiye: 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. Türkiye recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Türkiye 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 Türkiye. 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 several 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/economies, and taking into account the diverse cultural contexts of those countries/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/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 2018. Box 1 provides an overview of the central design elements of PISA 2018.

Box 1. KEY FEATURES OF PISA 2018

The content

The PISA 2018 survey focused on reading, with mathematics, science and global competence as minor areas of assessment. PISA 2018 also included an assessment of young people's financial literacy, which was optional for participating 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

Some 600 000 students completed the assessment in 2018, representing about 32 million 15-year-olds in the schools of the 79 participating countries/economies.

The assessment

Computer-based tests were used in most countries, with assessments lasting a total of two hours. In reading, a multi-stage adaptive approach was applied in computer-based tests whereby students were assigned a block of test items based on their performance in preceding blocks.

Test items were a mixture of multiple-choice questions and questions requiring students to construct their own responses. The items were organised into groups based on a passage of text describing a real-life situation. More than 15 hours of test items for reading, mathematics, science and global competence were covered, with different students taking different combinations of test items.

Students also answered a background questionnaire, which took about 35 minutes to complete. The questionnaire sought information about the students themselves, their attitudes, dispositions and beliefs, their homes, and their school and learning experiences. School principals completed a questionnaire that covered school management and organisation, and the learning environment.

Some countries/economies also distributed additional questionnaires to elicit more information. These included: in 19 countries/economies, a questionnaire for teachers asking about themselves and their teaching practices; and in 17 countries/economies, a questionnaire for parents asking them to provide information about their perceptions of and involvement in their child's school and learning.

Countries/economies could also choose to distribute three other optional questionnaires for students: 52 countries/economies distributed a questionnaire about students' familiarity with computers; 32 countries/economies distributed a questionnaire about students' expectations for further education; and 9 countries/economies distributed a questionnaire, developed for PISA 2018, about students' well-being.

TECHNICAL INNOVATIONS IN PISA 2018

PISA 2015 represented the first step of switching from a primarily paper-based survey that included optional computer-based modules to a fully computer-delivered survey, a process that continued into the 2018 cycle. The computer-based delivery mode allows PISA to measure new and expanded aspects of the domain constructs. In reading, new material included multiple sources and digital reading formats to better represent the kinds of reading that are becoming more prevalent in the 21st century. PISA 2018 also adopted the computer-based multi-stage adaptive testing for the reading literacy domain to further improve measurement accuracy and efficiency, especially at the extremes of the proficiency scale. In financial literacy, some interactive tasks were created that allowed students to manipulate variables and observe effects of financial

choices. In addition, PISA 2018 retained a paper-based version of the assessment that included only trend units. This paper-based assessment was administered to the small number of countries/economies that did not implement the computer-based survey (see Table 1). 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 implementation of PISA 2018 as a fully computer-based survey, a new interactive portal was developed 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 on-screen online marking of tests which was an option for national centres in previous PISA cycles but became the main medium for test marking in PISA 2015 (offline) and 2018 (online). 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.

The innovations in the scaling model implemented in 2015 continued in 2018 to improve the measurement of trends across PISA cycles. The ability to establish and maintain trends over time is an important goal for PISA. 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 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 and 2018 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 and 2018 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/economies at senior policy levels. The PGB establishes policy priorities and standards for developing indicators, for establishing assessment instruments, and for reporting results. Annex J lists the members of the PISA Governing Board and the observers from partner countries/economies.

Experts from participating countries/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 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/economies ensured that the instruments were internationally valid, that they took the cultural and educational contexts of participating countries/economies into account, that the assessment materials had strong measurement potential, and that the instruments emphasised authenticity and educational validity. See Annex J for the list of members of the expert groups.

Each of the participating country/economy appointed a National Project Manager (NPM) to implement PISA. 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/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 2018, the overall management of contractors and implementation was carried out by the Educational Testing Service (ETS) in the United States as part of its responsibility as the **Core A** contractor. The OECD Secretariat worked closely with the International Project Director and Project Manager, Irwin Kirsch and Claudia Tamassia, to co-ordinate all aspects of implementation. In addition to overall management, Core A was responsible for the computer-delivery platform, instrument development, scaling and analysis, and all data products. As the lead of Core A, ETS worked in co-operation with Westat in the United States for survey operations, the Leibniz Institute for Research and Information in Education (DIPF) in Germany for questionnaires in co-operation with Statistics Canada, the University of Luxembourg for test development, the Unité d'analyse des systèmes et des pratiques d'enseignement (aSPe) at the University of Liège in Belgium for test development and coder training for human-coded 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.

The additional tasks related to the implementation of PISA 2018 were carried out by three additional contractors – **Cores B, C and D**.

Pearson in the United Kingdom facilitated the development of the reading assessment framework and questionnaire frameworks as the **Core B** contractor¹. **Core C** focused on sampling and was implemented by Westat in the United States in co-operation with the Australian Council for Educational Research (ACER). **Core D** was managed by cApStAn Linguistic Quality Control in Belgium for linguistic quality control in co-operation with BranTra in Belgium.

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

PISA 2018 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 2018 which have been published in PISA 2018 Results (Volume I): What Students Know and Can Do (OECD, 2019a) and PISA 2018 Results (Volume II): Where all Students can Succeed (OECD, 2019b). Further results are reported in Volume III (OECD, 2019c), which discusses School Climate, Students' Well-Being and Growth Mindset, Volume IV (OECD, 2020a), which reports on Students' Financial Literacy, Volume V (OECD, 2020b), which analyses Schools and School Systems and their relationship with education outcomes. Volume VI (OECD, 2020c) reviews the results on Student's Global Competence.

Two thematic reports based on the results of PISA 2018 were also published by the end of 2021. Findings on Student's Growth Mindset were reported in *Sky's the Limit: Growth Mindset, students, and schools in PISA* (OECD, 2021a). Students' reading skills to navigate the technology-rich 21st century were examined in a second thematic report: *21st Century Readers: Developing Literacy Skills in a Digital World* (OECD 2021b).

¹ The framework for the Global Competence (GC) assessment was developed by the OECD and contracted experts. The full list of the individuals involved in the development of the GC framework is available in the *PISA 2018 Assessment and Analytical Framework* report (OECD, 2019d).

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