



Reader's guide

Data underlying the figures

The data referred to in this volume are presented in Annex B and, in greater detail, including some additional tables, on the PISA website (www.pisa.oecd.org).

Five symbols are used to denote missing data:

- a The category does not apply in the country concerned. Data are therefore missing.
- c There are too few observations or no observation to provide reliable estimates (i.e. there are fewer than 30 students or fewer than 5 schools with valid data).
- m Data are not available. These data were not submitted by the country or were collected but subsequently removed from the publication for technical reasons.
- w Data have been withdrawn or have not been collected at the request of the country concerned.
- x Data included in another category or column of the table (e.g. x(2) means that data are included in Column 2 of the table).

Country coverage

This publication features data on 72 countries and economies, including all 35 OECD countries and 37 partner countries and economies (see Map of PISA countries and economies in “What is PISA”).

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Two notes were added to the statistical data related to Cyprus:

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.

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

FYROM refers to the Former Yugoslav Republic of Macedonia.

For the countries below, when results are based on students’ or school principals’ responses:

Argentina: Only data for the adjudicated region of Ciudad Autónoma de Buenos Aires (CABA) are reported in figures and in the text (see Annex A4).

Kazakhstan: Results for Kazakhstan are reported in a selection of figures (see Annex A4).

Malaysia: Results for Malaysia are reported in a selection of figures (see Annex A4).

International averages

The OECD average corresponds to the arithmetic mean of the respective country estimates. It was calculated for most indicators presented in this report.

The OECD total takes the OECD countries as a single entity, to which each country contributes in proportion to the number of 15-year-olds enrolled in its schools. It can be used to assess how a country compares with the OECD area as a whole.



The EU total takes the European Union Member States as a single entity, to which each member contributes in proportion to the number of 15-year-olds enrolled in its schools.

In this publication, the OECD average is generally used when the focus is on comparing performance across education systems. In the case of some countries, data may not be available for specific indicators, or specific categories may not apply. Readers should, therefore, keep in mind that the terms “OECD average” and “OECD total” refer to the OECD countries included in the respective comparisons. In cases where data are not available or do not apply for all sub-categories of a given population or indicator, the “OECD average” may be consistent within each column of a table but not necessarily across all columns of a table.

In analyses involving data from multiple years, the OECD average is reported on consistent sets of OECD countries, and several averages may be reported in the same table.

A number in the label used in figures and tables indicates the number of countries included in the average:

OECD average-35: Arithmetic mean across all OECD countries.

OECD average-34: Arithmetic mean across all OECD countries, excluding Austria.

OECD average-34-R: Arithmetic mean across all OECD countries, excluding the United States.

OECD average-30: Arithmetic mean across all OECD countries, excluding Chile, Estonia, Israel, Slovenia and the United Kingdom.

OECD average-28: Arithmetic mean across all OECD countries, excluding Estonia, Luxembourg, the Netherlands, the Slovak Republic, Slovenia, Turkey and the United Kingdom.

OECD average-24: Arithmetic mean across all OECD countries, excluding Austria, Chile, Estonia, Israel, Luxembourg, the Netherlands, the Slovak Republic, Slovenia, Turkey, the United Kingdom and the United States.

Rounding figures

Because of rounding, some figures in tables may not add up exactly to the totals. Totals, differences and averages are always calculated on the basis of exact numbers and are rounded only after calculation.

All standard errors in this publication have been rounded to one or two decimal places. Where the value 0.0 or 0.00 is shown, this does not imply that the standard error is zero, but that it is smaller than 0.05 or 0.005, respectively.

Reporting student data

The report uses “15-year-olds” as shorthand for the PISA target population. PISA covers students who are aged between 15 years 3 months and 16 years 2 months at the time of assessment and who are enrolled in school and have completed at least 6 years of formal schooling, regardless of the type of institution in which they are enrolled, and whether they are in full-time or part-time education, whether they attend academic or vocational programmes, and whether they attend public or private schools or foreign schools within the country.

Reporting school data

The principals of the schools in which students were assessed provided information on their schools’ characteristics by completing a school questionnaire. Where responses from school principals are presented in this publication, they are weighted so that they are proportionate to the number of 15-year-olds enrolled in the school.

Focusing on statistically significant differences

This volume discusses only statistically significant differences or changes. These are denoted in darker colours in figures and in bold font in tables. See Annex A3 for further information.



Changes in the PISA methodology

Several changes were made to the PISA methodology in 2015:

- **Change in assessment mode** from paper-based to computer. Over the past 20 years, digital technologies have fundamentally transformed the ways in which we read and manage information. To better reflect how students and societies access, use and communicate information, starting with the 2015 round, the assessment was delivered mainly on computers, although countries had the option to use a paper-based version. In order to ensure comparability of results between paper-based tasks that were used in previous PISA assessments and the computer-delivered tasks used in 2015, the 2015 assessment was anchored to previous assessments through a set of items that showed, across countries, the same characteristics in paper- and computer-delivered form. The statistical models used to facilitate the mode change are based on an approach that examines measurement invariance for each item in both modes. In effect, this both accounts for and corrects the potential effect of mode differences by assigning the same parameters only for item-response variables that are comparable on paper and computer. It is conceivable, however, that country differences in familiarity with computers, or in student motivation to take the test on computer or on paper could influence differences in country performance. Box I.5.1 examines the country-level correlation between students' exposure to computers and changes in mean mathematics performance between 2012 and 2015. The results show that countries where students have greater familiarity with ICT tools are roughly as likely to show positive and negative performance trends, as are countries where students have less familiarity with ICT. For more information, see Box I.5.1 and Annex A5.
- **Change in the framework and set of PISA science items.** New science items were developed for PISA 2015 to reflect advances in science and other changes that countries had prioritised for the PISA 2015 assessment. Among other goals, the revision of the science framework included the aim to more fully use the capabilities of the new technology-based delivery mode. To verify that the new science assessment allowed for the establishment of reliable trends with previous PISA assessments, an evaluation of dimensionality was conducted. When new and existing science items were treated as related to distinct latent dimensions, the median correlation (across countries/language groups) between these dimensions was 0.92, a very high value (similar to the correlation observed among subscales from the same domain). Model-fit statistics confirmed that a unidimensional model fits the new science assessment, supporting the conclusion that new and existing science items form a coherent unidimensional scale with good reliability. For more information, see Annex A5.
- **Changes in scaling procedures include:**
 - Change from a one-parameter model to a hybrid model that applies both a one- and two-parameter model, as appropriate. The one-parameter (Rasch) model is retained for all items where the model is statistically appropriate; a more general 2-parameter model is used instead if the fit of the one-parameter model could not be established. This approach improves the fit of the model to the observed student responses and reduces model and measurement errors.
 - Change in treatment of non-reached items to ensure that the treatment is consistent between the estimation of item parameters and the estimation of the population model to generate proficiency estimates in the form of plausible values. This avoids introducing systematic errors when generating performance estimates.
 - Change from cycle-specific scaling to multiple-cycle scaling in order to combine data, and retain and aggregate information about trend items used in previous cycles. This change results in consistent item parameters across cycles, which strengthen and support the inferences made about proficiencies on each scale.
 - Change from including only a subsample for item calibration to including the total sample with weights, in order to fully use the available data and reduce the error in item-parameter estimates by increasing the sample size. This reduces the variability of item-parameter estimation due to the random selection of small calibration samples.
 - Change from assigning internationally fixed item parameters and dropping a few dodgy items per country, to assigning a few nationally unique item parameters for those items that show significant deviation from the international parameters. This retains a maximum set of internationally equivalent items without dropping data and, as a result, reduces overall measurement errors.



The overall impact of these changes on trend comparisons is quantified by the link errors. As in previous cycles, a major part of the linking error is due to re-estimated item parameters. While the magnitude of link errors is comparable to those estimated in previous rounds, the changes in scaling procedures will result in reduced link errors in future assessment rounds. For more information on the calculation of this quantity and how to use it in analyses, see Annex A5 and the *PISA 2015 Technical Report* (OECD, forthcoming).

- **Changes in population coverage and response rates.** Even though PISA has consistently used the same standardised methods to collect comparable and representative samples, and population coverage and response rates were carefully reviewed during the adjudication process, slight changes in population coverage and response rates can affect point estimates of proficiency. The uncertainty around the point estimates due to sampling is quantified in sampling errors, which are the major part of standard errors reported for country mean estimates. For more information, see Annexes A2 and A4.
- **Change in test design** from 13 booklets in the paper-based design to 396 booklet instances. Despite the significant increase in the number of booklet types and instances from previous cycles, it is important to bear in mind that all items belonging to the same domain were delivered in consecutive clusters. No student had more than one hour of test questions related to one domain only. This is an improvement over the existing design, which was made possible by computer delivery. It strengthens the overall measurement of each domain and each respondent's proficiency.
- **Changes in test administration.** As in PISA 2000 (but different from other cycles up to 2012), students in 2015 had to take their break before starting to work on test clusters 3 and 4, and could not work for more than one hour on clusters 1 and 2. This reduces cluster position effects. Another change in test administration is that students who took the test on computers had to solve test questions in a fixed, sequential order, and could not go back to previous questions and revise their answers after reaching the end of the test booklets. This change prepares the ground for introducing adaptive testing in future rounds of PISA.

In sum, changes to the assessment design, the mode of delivery, the framework and the set of science items were carefully examined in order to ensure that the 2015 results can be presented as trend measures at the international level. The data show no consistent association between students' familiarity with ICT and with performance shifts between 2012 and 2015 across countries. Changes in scaling procedures are part of the link error, as they were in the past, where the link error quantified the changes introduced by re-estimating item parameters on a subset of countries and students who participated in each cycle. Changes due to sampling variability are quantified in the sampling error. The remaining changes (changes in test design and administration) are not fully reflected in estimates of the uncertainty of trend comparisons. These changes are a common feature of past PISA rounds as well, and are most likely of secondary importance when analysing trends.

The factors below are examples of potential effects that are relevant for the changes seen from one PISA round to the next. While these can be quantified and related to, for example, census data if available, these are outside of the control of the assessment programme:

- **Change in coverage of PISA target population.** PISA's target population is 15-year-old students enrolled in grade 7 or above. Some education systems saw a rapid expansion of 15-year-olds' access to school because of a reduction in dropout rates or in grade repetition. This is explained in detail, and countries' performance adjusted for this change is presented in Chapters 2, 4 and 5 in Volume I.
- **Change in demographic characteristics.** In some countries, there might be changes in the composition of the population of 15-year-old students. For example, there might be more students with an immigrant background. Chapters 2, 4 and 5 in Volume I present performance (country mean and distribution) adjusted for changes in the composition of the student population, including students' immigrant background, gender and age.
- **Change in student competency.** The average proficiency of 15-year-old students in 2015 might be higher or lower than that in 2012 or earlier rounds.



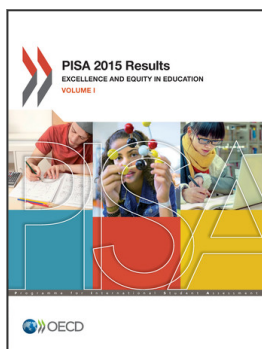
Abbreviations used in this report

ESCS	PISA index of economic, social and cultural status	PPP	Purchasing power parity
GDP	Gross domestic product	S.D.	Standard deviation
ISCED	International Standard Classification of Education	S.E.	Standard error
ISCO	International Standard Classification of Occupations	STEM	Science, Technology, Engineering and Mathematics
% dif.	Percentage-point difference	Score dif.	Score-point difference
ICT	Information and Communications Technology		

Further documentation

For further information on the PISA assessment instruments and the methods used in PISA, see the *PISA 2015 Technical Report* (OECD, forthcoming).

This report uses the OECD StatLinks service. Below each table and chart is a URL leading to a corresponding Excel™ workbook containing the underlying data. These URLs are stable and will remain unchanged over time. In addition, readers of the e-books will be able to click directly on these links and the workbook will open in a separate window, if their Internet browser is open and running.



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