



Annex A

TECHNICAL BACKGROUND

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ANNEX A1

CONSTRUCTION OF READING SCALES AND INDICES FROM THE STUDENT, SCHOOL AND PARENT CONTEXT QUESTIONNAIRES

How the PISA 2009 reading assessments were designed, analysed and scaled

The development of the PISA 2009 reading tasks was co-ordinated by an international consortium of educational research institutions contracted by the OECD, under the guidance of a group of reading experts from participating countries. Participating countries contributed stimulus material and questions, which were reviewed, tried out and refined iteratively over the three years leading up to the administration of the assessment in 2009. The development process involved provisions for several rounds of commentary from participating countries, as well as small-scale piloting and a formal field trial in which samples of 15-year-olds from all participating countries took part. The reading expert group recommended the final selection of tasks, which included material submitted by 21 of the participating countries. The selection was made with regard to both their technical quality, assessed on the basis of their performance in the field trial and their cultural appropriateness and interest level for 15-year-olds, as judged by the participating countries. Another essential criterion for selecting the set of material as a whole was its fit to the framework described in *Volume 1, What Students Know and Can Do*, to maintain the balance across various categories of text, aspect and situation. Finally, it was carefully ensured that the set of questions covered a range of difficulty, allowing good measurement and description of the reading literacy of all 15-year-old students, from the least proficient to the highly able.

More than 130 print reading questions were used in PISA 2009, but each student in the sample only saw a fraction of the total pool because different sets of questions were given to different students. The reading questions selected for inclusion in PISA 2009 were organised into half-hour clusters. These, along with clusters of mathematics and science questions, were assembled into booklets containing four clusters each. Each participating student was then given a two-hour assessment. As reading was the focus of the PISA 2009 assessment, every booklet included at least one cluster of reading material. The clusters were rotated so that each cluster appeared in each of the four possible positions in the booklets, and each pair of clusters appeared in at least one of the 13 booklets that were used.

This design, similar to those used in previous PISA assessments, makes it possible to construct a single scale of reading proficiency, in which each question is associated with a particular point on the scale that indicates its difficulty, whereby each student's performance is associated with a particular point on the same scale that indicates his or her estimated proficiency. A description of the modelling technique used to construct this scale can be found in the *PISA 2009 Technical Report* (OECD, forthcoming).

The relative difficulty of tasks in a test is estimated by considering the proportion of test takers who answer each question correctly. The relative proficiency of students taking a particular test can be estimated by considering the proportion of test questions they answer correctly. A single continuous scale shows the relationship between the difficulty of questions and the proficiency of students. By constructing a scale that shows the difficulty of each question, it is possible to locate the level of reading literacy that the question represents. By showing the proficiency of each student on the same scale, it is possible to describe the level of reading literacy that the student possesses.

The location of student proficiency on this scale is set in relation to the particular group of questions used in the assessment. However, just as the sample of students taking PISA in 2009 is drawn to represent all the 15-year-olds in the participating countries, so the individual questions used in the assessment are designed to represent the definition of reading literacy adequately. Estimates of student proficiency reflect the kinds of tasks they would be expected to perform successfully. This means that students are likely to be able to complete questions successfully at or below the difficulty level associated with their own position on the scale (but they may not always do so). Conversely, they are unlikely to be able to successfully complete questions above the difficulty level associated with their position on the scale (but they may sometimes do so).

The further a student's proficiency is located above a given question, the more likely he or she is to successfully complete the question (and other questions of similar difficulty); the further the student's proficiency is located below a given question, the lower the probability that the student will be able to successfully complete the question, and other questions of similar difficulty.

How reading proficiency levels are defined in PISA 2009

PISA 2009 provides an overall reading literacy scale for the reading texts, drawing on all the questions in the reading assessment, as well as scales for three aspects and two text formats. The metric for the overall reading scale is based on a mean for OECD countries set at 500 in PISA 2000, with a standard deviation of 100. To help interpret what students' scores mean in substantive terms, the scale is divided into levels, based on a set of statistical principles, and then descriptions are generated, based on the tasks that are located within each level, to describe the kinds of skills and knowledge needed to successfully complete those tasks.

For PISA 2009, the range of difficulty of tasks allows for the description of seven levels of reading proficiency: Level 1b is the lowest described level, then Level 1a, Level 2, Level 3 and so on up to Level 6.



Students with a proficiency within the range of Level 1b are likely to be able to successfully complete Level 1b tasks (and others like them), but are unlikely to be able to complete tasks at higher levels. Level 6 reflects tasks that present the greatest challenge in terms of reading skills and knowledge. Students with scores in this range are likely to be able to complete reading tasks located at that level successfully, as well as all the other reading tasks in PISA.

PISA applies a standard methodology for constructing proficiency scales. Based on a student's performance on the tasks in the test, his or her score is generated and located in a specific part of the scale, thus allowing the score to be associated with a defined proficiency level. The level at which the student's score is located is the highest level for which he or she would be expected to answer correctly, most of a random selection of questions within the same level. Thus, for example, in an assessment composed of tasks spread uniformly across Level 3, students with a score located within Level 3 would be expected to complete at least 50% of the tasks successfully. Because a level covers a range of difficulty and proficiency, success rates across the band vary. Students near the bottom of the level would be likely to succeed on just over 50% of the tasks spread uniformly across the level, while students at the top of the level would be likely to succeed on well over 70% of the same tasks.

Figure I.2.12 in Volume I provides details of the nature of reading skills, knowledge and understanding required at each level of the reading scale.

Explanation of indices

This section explains the indices derived from the student, school and parent context questionnaires used in PISA 2009. Parent questionnaire indices are only available for the 14 countries that chose to administer the optional parent questionnaire.

Several PISA measures reflect indices that summarise responses from students, their parents or school representatives (typically principals) to a series of related questions. The questions were selected from a larger pool of questions on the basis of theoretical considerations and previous research. Structural equation modelling was used to confirm the theoretically expected behaviour of the indices and to validate their comparability across countries. For this purpose, a model was estimated separately for each country and collectively for all OECD countries.

For a detailed description of other PISA indices and details on the methods, see *PISA 2009 Technical Report* (OECD, forthcoming).

There are two types of indices: simple indices and scale indices.

Simple indices are the variables that are constructed through the arithmetic transformation or recoding of one or more items, in exactly the same way across assessments. Here, item responses are used to calculate meaningful variables, such as the recoding of the four-digit ISCO-88 codes into "Highest parents' socio-economic index (HISEI)" or, teacher-student ratio based on information from the school questionnaire.

Scale indices are the variables constructed through the scaling of multiple items. Unless otherwise indicated, the index was scaled using a weighted maximum likelihood estimate (WLE) (Warm, 1985), using a one-parameter item response model (a partial credit model was used in the case of items with more than two categories).

The scaling was done in three stages:

- The item parameters were estimated from equal-sized subsamples of students from each OECD country.
- The estimates were computed for all students and all schools by anchoring the item parameters obtained in the preceding step.
- The indices were then standardised so that the mean of the index value for the OECD student population was 0 and the standard deviation was 1 (countries being given equal weight in the standardisation process).

Sequential codes were assigned to the different response categories of the questions in the sequence in which the latter appeared in the student, school or parent questionnaires. Where indicated in this section, these codes were inverted for the purpose of constructing indices or scales. It is important to note that negative values for an index do not necessarily imply that students responded negatively to the underlying questions. A negative value merely indicates that the respondents answered less positively than all respondents did on average across OECD countries. Likewise, a positive value on an index indicates that the respondents answered more favourably, or more positively, than respondents did, on average, in OECD countries. Terms enclosed in brackets < > in the following descriptions were replaced in the national versions of the student, school and parent questionnaires by the appropriate national equivalent. For example, the term <qualification at ISCED level 5A> was translated in the United States into "Bachelor's degree, post-graduate certificate program, Master's degree program or first professional degree program". Similarly the term <classes in the language of assessment> in Luxembourg was translated into "German classes" or "French classes" depending on whether students received the German or French version of the assessment instruments.

In addition to simple and scaled indices described in this annex, there are a number of variables from the questionnaires that correspond to single items not used to construct indices. These non-recoded variables have prefix of "ST" for the questionnaire items in the student questionnaire, "SC" for the items in the school questionnaire, and "PA" for the items in the parent questionnaire. All the context questionnaires as well as the PISA international database, including all variables, are available through www.pisa.oecd.org.

Student-level simple indices

Age

The variable AGE is calculated as the difference between the middle month and the year in which students were assessed and their month and year of birth, expressed in years and months.

Study programme

In PISA 2009, study programmes available to 15-year-old students in each country were collected both through the student tracking form and the student questionnaire (ST02). All study programmes were classified using ISCED (OECD, 1999). In the PISA international database, all national programmes are indicated in a variable (PROGN) where the first three digits are the ISO code for a country, the fourth digit the sub-national category and the last two digits the nationally specific programme code.

The following internationally comparable indices were derived from the data on study programmes:

- Programme level (ISCEDL) indicates whether students are (1) primary education level (ISCED 1); (2) lower-secondary education level; or (3) upper secondary education level.
- Programme designation (ISCEDD) indicates the designation of the study programme: (1) = "A" (general programmes designed to give access to the next programme level); (2) = "B" (programmes designed to give access to vocational studies at the next programme level); (3) = "C" (programmes designed to give direct access to the labour market); or (4) = "M" (modular programmes that combine any or all of these characteristics).
- Programme orientation (ISCEDO) indicates whether the programme's curricular content is (1) general; (2) pre-vocational; (3) vocational; or (4) modular programmes that combine any or all of these characteristics.

Occupational status of parents

Occupational data for both a student's father and a student's mother were obtained by asking open-ended questions in the student questionnaire (ST9a, ST9b, ST12, ST13a, ST13b and ST16). The responses were coded to four-digit ISCO codes (ILO, 1990) and then mapped to Ganzeboom *et al.*'s SEI index (1992). Higher scores of SEI indicate higher levels of occupational status. The following three indices are obtained:

- Mother's occupational status (BMMJ).
- Father's occupational status (BFMJ).
- The highest occupational level of parents (HISEI) corresponds to the higher SEI score of either parent or to the only available parent's SEI score.

Educational level of parents

The educational level of parents is classified using ISCED (OECD, 1999) based on students' responses in the student questionnaire (ST10, ST11, ST14 and ST15). Please note that the question format for school education in PISA 2009 differs from the one used in PISA 2000, 2003 and 2006 but the method used to compute parental education is the same.

As in PISA 2000, 2003 and 2006, indices were constructed by selecting the highest level for each parent and then assigning them to the following categories: (0) None, (1) ISCED 1 (primary education), (2) ISCED 2 (lower secondary), (3) ISCED Level 3B or 3C (vocational/pre-vocational upper secondary), (4) ISCED 3A (upper secondary) and/or ISCED 4 (non-tertiary post-secondary), (5) ISCED 5B (vocational tertiary), (6) ISCED 5A, 6 (theoretically oriented tertiary and post-graduate). The following three indices with these categories are developed:

- Mother's educational level (MISCED).
- Father's educational level (FISCED).
- Highest educational level of parents (HISCED) corresponds to the higher ISCED level of either parent.

Highest educational level of parents was also converted into the number of years of schooling (PARED). For the conversion of level of education into years of schooling, see Table A1.1.

Immigration and language background

Information on the country of birth of students and their parents (ST17) is collected in a similar manner as in PISA 2000, PISA 2003 and PISA 2006 by using nationally specific ISO coded variables. The ISO codes of the country of birth for students and their parents are available in the PISA international database (COBN_S, COBN_M, and COBN_F).

The index on immigrant background (IMMIG) has the following categories: (1) native students (those students born in the country of assessment, or those with at least one parent born in that country; students who were born abroad with at least one parent born in the country of assessment are also classified as 'native' students), (2) second-generation students (those born in the country of assessment but whose parents were born in another country) and (3) first-generation students (those born outside the country of assessment and whose parents were also born in another country). Students with missing responses for either the student or for both parents, or for all three questions have been given missing values for this variable.

Students indicate the language they usually speak at home. The data are captured in nationally-specific language codes, which were recoded into variable ST19Q01 with the following two values: (1) language at home is the same as the language of assessment, and (2) language at home is a different language than the language of assessment.



[Part 1/1]
Table A1.1 Levels of parental education converted into years of schooling

	Did not go to school	Completed ISCED Level 1 (primary education)	Completed ISCED Level 2 (lower secondary education)	Completed ISCED Levels 3B or 3C (upper secondary education providing direct access to the labor market or to ISCED 5B programmes)	Completed ISCED Level 3A (upper secondary education providing access to ISCED 5A and 5B programmes) and/or ISCED Level 4 (non-tertiary post-secondary)	Completed ISCED Level 5A (university level tertiary education) or ISCED Level 6 (advanced research programmes)	Completed ISCED Level 5B (non-university tertiary education)
OECD							
Australia	0.0	6.0	10.0	11.0	12.0	15.0	14.0
Austria	0.0	4.0	9.0	12.0	12.5	17.0	15.0
Belgium	0.0	6.0	9.0	12.0	12.0	17.0	14.5
Canada	0.0	6.0	9.0	12.0	12.0	17.0	15.0
Chile	0.0	6.0	8.0	12.0	12.0	17.0	16.0
Czech Republic	0.0	5.0	9.0	11.0	13.0	16.0	16.0
Denmark	0.0	6.0	9.0	12.0	12.0	17.0	15.0
Estonia	0.0	4.0	9.0	12.0	12.0	16.0	15.0
Finland	0.0	6.0	9.0	12.0	12.0	16.5	14.5
France	0.0	5.0	9.0	12.0	12.0	15.0	14.0
Germany	0.0	4.0	10.0	13.0	13.0	18.0	15.0
Greece	0.0	6.0	9.0	11.5	12.0	17.0	15.0
Hungary	0.0	4.0	8.0	10.5	12.0	16.5	13.5
Iceland	0.0	7.0	10.0	13.0	14.0	18.0	16.0
Ireland	0.0	6.0	9.0	12.0	12.0	16.0	14.0
Israel	0.0	6.0	9.0	12.0	12.0	15.0	15.0
Italy	0.0	5.0	8.0	12.0	13.0	17.0	16.0
Japan	0.0	6.0	9.0	12.0	12.0	16.0	14.0
Korea	0.0	6.0	9.0	12.0	12.0	16.0	14.0
Luxembourg	0.0	6.0	9.0	12.0	13.0	17.0	16.0
Mexico	0.0	6.0	9.0	12.0	12.0	16.0	14.0
Netherlands	0.0	6.0	10.0	a	12.0	16.0	a
New Zealand	0.0	5.5	10.0	11.0	12.0	15.0	14.0
Norway	0.0	6.0	9.0	12.0	12.0	16.0	14.0
Poland	0.0	a	8.0	11.0	12.0	16.0	15.0
Portugal	0.0	6.0	9.0	12.0	12.0	17.0	15.0
Scotland	0.0	7.0	11.0	13.0	13.0	16.0	16.0
Slovak Republic	0.0	4.5	8.5	12.0	12.0	17.5	13.5
Slovenia	0.0	4.0	8.0	11.0	12.0	16.0	15.0
Spain	0.0	5.0	8.0	10.0	12.0	16.5	13.0
Sweden	0.0	6.0	9.0	11.5	12.0	15.5	14.0
Switzerland	0.0	6.0	9.0	12.5	12.5	17.5	14.5
Turkey	0.0	5.0	8.0	11.0	11.0	15.0	13.0
United Kingdom	0.0	6.0	9.0	12.0	13.0	16.0	15.0
United States	0.0	6.0	9.0	a	12.0	16.0	14.0
Partners							
Albania	0.0	6.0	9.0	12.0	12.0	16.0	16.0
Argentina	0.0	6.0	10.0	12.0	12.0	17.0	14.5
Azerbaijan	0.0	4.0	9.0	11.0	11.0	17.0	14.0
Brazil	0.0	4.0	8.0	11.0	11.0	16.0	14.5
Bulgaria	0.0	4.0	8.0	12.0	12.0	17.5	15.0
Colombia	0.0	5.0	9.0	11.0	11.0	15.5	14.0
Croatia	0.0	4.0	8.0	11.0	12.0	17.0	15.0
Dubai (UAE)	0.0	5.0	9.0	12.0	12.0	16.0	15.0
Hong Kong- China	0.0	6.0	9.0	11.0	13.0	16.0	14.0
Indonesia	0.0	6.0	9.0	12.0	12.0	15.0	14.0
Jordan	0.0	6.0	10.0	12.0	12.0	16.0	14.5
Kazakhstan	0.0	4.0	9.0	11.5	12.5	15.0	14.0
Kyrgyzstan	0.0	4.0	8.0	11.0	10.0	15.0	13.0
Latvia	0.0	3.0	8.0	11.0	11.0	16.0	16.0
Liechtenstein	0.0	5.0	9.0	11.0	13.0	17.0	14.0
Lithuania	0.0	3.0	8.0	11.0	11.0	16.0	15.0
Macao-China	0.0	6.0	9.0	11.0	12.0	16.0	15.0
Montenegro	0.0	4.0	8.0	11.0	12.0	16.0	15.0
Panama	0.0	6.0	9.0	12.0	12.0	16.0	a
Peru	0.0	6.0	9.0	11.0	11.0	17.0	14.0
Qatar	0.0	6.0	9.0	12.0	12.0	16.0	15.0
Romania	0.0	4.0	8.0	11.5	12.5	16.0	14.0
Russian Federation	0.0	4.0	9.0	11.5	12.0	15.0	a
Serbia	0.0	4.0	8.0	11.0	12.0	17.0	14.5
Shanghai-China	0.0	6.0	9.0	12.0	12.0	16.0	15.0
Singapore	0.0	6.0	8.0	10.5	10.5	12.5	12.5
Chinese Taipei	0.0	6.0	9.0	12.0	12.0	16.0	14.0
Thailand	0.0	6.0	9.0	12.0	12.0	16.0	14.0
Trinidad and Tobago	0.0	5.0	9.0	12.0	12.0	16.0	15.0
Tunisia	0.0	6.0	9.0	12.0	13.0	17.0	16.0
Uruguay	0.0	6.0	9.0	12.0	12.0	17.0	15.0

Relative grade

Data on the student's grade are obtained both from the student questionnaire (ST01) and from the student tracking form. As with all variables that are on both the tracking form and the questionnaire, inconsistencies between the two sources are reviewed and resolved during data-cleaning. In order to capture between-country variation, the relative grade index (GRADE) indicates whether students are at the modal grade in a country (value of 0), or whether they are below or above the modal grade level (+x grades, -x grades).

The relationship between the grade and student performance was estimated through a multilevel model accounting for the following background variables: *i*) the **PISA index of economic, social and cultural status**; *ii*) the **PISA index of economic, social and cultural status** squared; *iii*) the school mean of the **PISA index of economic, social and cultural status**; *iv*) an indicator as to whether students were foreign born first-generation students; *v*) the percentage of first-generation students in the school; and *vi*) students' gender.

Table A1.2 presents the results of the multilevel model. Column 1 in Table A1.2 estimates the score point difference that is associated with one grade level (or school year). This difference can be estimated for the 32 OECD countries in which a sizeable number of 15-year-olds in the PISA samples were enrolled in at least two different grades. The average score point difference between two grades is about 39 score points on the PISA reading scale. This implies that one school year corresponds to an average of 39 score points. Since 15-year-olds cannot be assumed to be distributed at random across the grade levels, adjustments had to be made for the above-mentioned contextual factors that may relate to the assignment of students to the different grade levels. These adjustments are documented in columns 2 to 7 of the table. While it is possible to estimate the typical performance difference among students in two adjacent grades net of the effects of selection and contextual factors, this difference cannot automatically be equated with the progress that students have made over the last school year but should be interpreted as a lower boundary of the progress achieved. This is not only because different students were assessed but also because the content of the PISA assessment was not expressly designed to match what students had learned in the preceding school year but more broadly to assess the cumulative outcome of learning in school up to age 15. For example, if the curriculum of the grades in which 15-year-olds are enrolled mainly includes material other than that assessed by PISA (which, in turn, may have been included in earlier school years) then the observed performance difference will underestimate student progress.

Learning time

Learning time in test language (LMINS) was computed by multiplying students' responses on the number of minutes on average in the test language class by number of test language class periods per week (ST28 and ST29). Comparable indices are computed for mathematics (MMINS) and science (SMINS).

Student-level scale indices

Family wealth

The *index of family wealth* (WEALTH) is based on the students' responses on whether they had the following at home: a room of their own, a link to the Internet, a dishwasher (treated as a country-specific item), a DVD player, and three other country-specific items (some items in ST20); and their responses on the number of cellular phones, televisions, computers, cars and the rooms with a bath or shower (ST21).

Home educational resources

The *index of home educational resources* (HEDRES) is based on the items measuring the existence of educational resources at home including a desk and a quiet place to study, a computer that students can use for schoolwork, educational software, books to help with students' school work, technical reference books and a dictionary (some items in ST20).

Cultural possessions

The *index of cultural possessions* (CULTPOSS) is based on the students' responses to whether they had the following at home: classic literature, books of poetry and works of art (some items in ST20).

Economic, social and cultural status

The *PISA index of economic, social and cultural status* (ESCS) was derived from the following three indices: highest occupational status of parents (HISEI), highest educational level of parents in years of education according to ISCED (PARED), and home possessions (HOMEPOS). The *index of home possessions* (HOMEPOS) comprises all items on the indices of WEALTH, CULTPOSS and HEDRES, as well as books in the home recoded into a four-level categorical variable (0-10 books, 11-25 or 26-100 books, 101-200 or 201-500 books, more than 500 books).

The *PISA index of economic, social and cultural status* (ESCS) was derived from a principal component analysis of standardised variables (each variable has an OECD mean of 0 and a standard deviation of 1), taking the factor scores for the first principal component as measures of the index of economic, social and cultural status.



[Part 1/1]

Table A1.2 A multilevel model to estimate grade effects in reading, accounting for some background variables

	Grade		Index of economic, social and cultural status		Index of economic, social and cultural status squared		School mean index of economic, social and cultural status		First Generation students		School percentage of first generation students		Gender – student is a girl		Intercept	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
OECD	Australia	33.2 (1.95)	30.0 (1.36)	-3.8 (1.05)	66.4 (1.87)	-7.4 (2.82)	0.1 (0.07)	32.9 (1.91)	466.0 (1.39)							
	Austria	35.3 (2.18)	11.4 (1.66)	-0.5 (1.00)	89.7 (3.86)	-33.1 (6.11)	1.4 (0.13)	19.9 (2.67)	467.9 (2.45)							
	Belgium	48.9 (1.98)	10.0 (1.12)	-0.1 (0.63)	79.9 (1.73)	-3.2 (5.18)	0.3 (0.11)	11.3 (1.81)	507.0 (1.70)							
	Canada	45.0 (2.14)	19.4 (1.52)	1.5 (0.91)	33.9 (2.28)	-13.7 (3.18)	0.3 (0.04)	30.4 (1.60)	483.4 (1.76)							
	Chile	35.5 (1.55)	8.6 (1.52)	0.3 (0.63)	37.4 (1.61)	c c	c c	13.8 (2.33)	478.6 (1.60)							
	Czech Republic	44.6 (3.39)	13.4 (1.89)	-2.3 (1.47)	111.5 (3.12)	-8.9 (12.29)	0.4 (0.33)	32.3 (2.84)	460.7 (2.39)							
	Denmark	36.1 (3.02)	27.9 (1.51)	-2.8 (1.10)	35.1 (2.91)	-37.5 (5.97)	0.0 (0.14)	25.5 (2.59)	474.0 (1.95)							
	Estonia	44.4 (2.74)	14.1 (1.80)	1.6 (1.43)	52.1 (4.52)	-18.7 (14.08)	-3.3 (0.44)	36.7 (2.45)	485.8 (2.02)							
	Finland	37.3 (3.60)	27.7 (1.66)	-2.5 (1.30)	10.4 (3.28)	-56.0 (13.09)	-0.1 (0.29)	51.5 (2.26)	500.6 (2.02)							
	France	47.1 (5.14)	12.5 (1.70)	-1.9 (1.12)	81.6 (4.04)	-11.6 (9.24)	0.2 (0.15)	25.9 (2.67)	516.5 (2.35)							
	Germany	34.4 (1.74)	9.2 (1.23)	-1.6 (0.74)	109.1 (2.16)	-13.2 (4.80)	0.2 (0.12)	27.2 (1.92)	458.0 (1.46)							
	Greece	22.6 (10.86)	15.9 (1.46)	1.5 (1.07)	41.2 (2.84)	-15.0 (7.82)	0.0 (0.18)	36.2 (2.55)	469.0 (2.04)							
	Hungary	25.6 (2.19)	8.3 (1.39)	0.9 (0.87)	74.8 (2.09)	2.8 (7.92)	0.0 (0.27)	21.4 (2.22)	494.1 (1.65)							
	Iceland	c c	29.8 (2.56)	-5.1 (1.56)	-3.8 (5.12)	-52.2 (11.45)	-1.3 (0.40)	44.9 (2.59)	469.1 (4.23)							
	Ireland	18.2 (1.99)	29.7 (1.78)	-3.5 (1.44)	43.6 (2.68)	-32.8 (6.52)	-0.1 (0.20)	33.9 (3.62)	474.8 (2.77)							
	Israel	36.6 (3.85)	19.9 (1.90)	3.4 (1.04)	104.7 (2.10)	-11.0 (6.13)	1.5 (0.08)	29.4 (2.81)	460.1 (2.13)							
	Italy	36.1 (1.67)	4.5 (0.69)	-1.4 (0.42)	76.4 (1.07)	-29.7 (3.36)	0.2 (0.08)	24.0 (1.29)	491.4 (0.85)							
	Japan	a a	4.1 (1.51)	0.1 (1.47)	144.2 (2.40)	c c	c c	27.9 (2.43)	508.6 (1.58)							
	Korea	31.2 (9.77)	12.9 (1.42)	1.9 (1.18)	64.9 (2.24)	a a	a a	30.6 (3.21)	537.7 (2.08)							
	Luxembourg	45.3 (1.95)	16.6 (1.31)	-2.6 (1.08)	62.0 (2.89)	-10.4 (5.11)	-0.2 (0.10)	33.0 (2.22)	435.7 (2.40)							
	Mexico	32.6 (1.59)	7.5 (0.92)	0.8 (0.34)	27.8 (0.80)	-41.9 (6.36)	-1.8 (0.15)	17.9 (1.03)	473.7 (1.02)							
	Netherlands	26.6 (2.04)	6.0 (1.52)	-1.2 (1.02)	106.7 (2.32)	-11.6 (5.72)	1.7 (0.14)	15.3 (1.85)	484.5 (2.33)							
	New Zealand	44.2 (4.15)	38.9 (1.82)	-1.7 (1.44)	56.3 (3.35)	-12.2 (3.84)	0.0 (0.10)	44.8 (2.62)	496.5 (2.44)							
	Norway	37.6 (18.19)	34.2 (2.00)	-3.4 (1.62)	31.1 (4.32)	-33.4 (7.52)	0.4 (0.25)	48.3 (2.56)	453.2 (2.87)							
	Poland	73.8 (4.44)	29.4 (1.59)	-1.8 (1.21)	19.4 (2.99)	c c	c c	44.2 (2.41)	498.9 (1.89)							
	Portugal	48.9 (1.71)	12.0 (0.94)	1.0 (0.64)	21.3 (1.33)	-5.3 (5.75)	0.0 (0.23)	22.9 (1.84)	518.6 (1.92)							
	Slovak Republic	34.2 (3.85)	14.7 (1.44)	-3.2 (0.98)	64.3 (6.30)	c c	c c	39.1 (2.58)	483.2 (2.33)							
	Slovenia	22.8 (3.41)	4.8 (1.28)	0.0 (1.25)	100.2 (2.74)	-23.4 (7.48)	-0.2 (0.24)	27.7 (2.16)	452.4 (1.63)							
	Spain	61.7 (1.22)	9.8 (0.83)	0.4 (0.64)	22.7 (1.25)	-29.7 (2.86)	0.4 (0.04)	18.0 (1.42)	511.3 (1.07)							
	Sweden	63.8 (6.69)	31.4 (1.82)	-1.3 (1.04)	49.0 (6.55)	-38.8 (8.53)	0.3 (0.34)	43.2 (2.41)	454.4 (3.62)							
	Switzerland	45.5 (2.75)	18.2 (1.27)	-1.0 (1.23)	59.5 (2.95)	-25.1 (3.99)	-0.7 (0.11)	27.0 (2.00)	488.8 (1.50)							
Turkey	33.7 (1.96)	7.7 (1.50)	0.3 (0.61)	46.3 (1.70)	c c	c c	27.9 (1.74)	524.0 (1.59)								
United Kingdom	35.9 (6.21)	27.7 (2.01)	-0.3 (1.51)	65.7 (2.49)	-13.6 (8.49)	-0.3 (0.13)	23.1 (2.48)	468.7 (1.73)								
United States	36.3 (2.17)	23.5 (1.70)	4.4 (1.15)	50.4 (2.56)	-5.6 (5.57)	0.8 (0.14)	25.4 (2.36)	463.5 (2.01)								
Partners	Albania	11.9 (5.07)	20.8 (3.04)	3.2 (1.35)	43.0 (2.47)	c c	c c	56.5 (3.40)	421.5 (3.44)							
	Argentina	33.6 (2.50)	11.2 (1.96)	0.9 (0.87)	52.6 (2.03)	-27.0 (10.55)	0.5 (0.20)	24.0 (2.38)	439.7 (2.32)							
	Azerbaijan	13.2 (1.78)	10.5 (1.67)	1.3 (0.90)	36.4 (2.00)	-9.8 (12.34)	-0.3 (0.49)	22.6 (2.16)	390.9 (2.12)							
	Brazil	36.1 (1.23)	7.7 (1.54)	1.3 (0.57)	38.3 (1.25)	-71.7 (17.16)	-0.9 (0.47)	20.2 (1.63)	445.5 (1.33)							
	Bulgaria	27.8 (5.08)	15.7 (1.93)	0.2 (1.29)	75.7 (3.99)	c c	c c	42.1 (3.51)	423.7 (2.61)							
	Colombia	33.2 (1.12)	6.9 (2.01)	0.9 (0.72)	39.4 (1.53)	c c	c c	3.2 (2.17)	477.7 (1.83)							
	Croatia	31.8 (2.33)	10.3 (1.36)	-4.0 (0.99)	75.3 (2.01)	-13.0 (5.71)	-0.1 (0.22)	31.4 (2.56)	472.8 (1.69)							
	Dubai (UAE)	34.6 (1.56)	15.2 (1.52)	3.2 (1.03)	25.9 (3.13)	21.5 (3.25)	1.1 (0.05)	28.2 (3.94)	362.4 (2.92)							
	Hong Kong-China	33.6 (2.03)	-0.9 (1.70)	-1.0 (0.76)	41.9 (1.64)	23.4 (3.70)	-0.4 (0.06)	21.9 (2.42)	575.8 (1.83)							
	Indonesia	14.4 (2.00)	4.7 (2.44)	0.9 (0.62)	29.1 (1.83)	c c	c c	28.0 (1.48)	430.8 (2.46)							
	Jordan	47.6 (6.38)	17.7 (1.52)	0.7 (0.81)	26.9 (1.55)	-11.5 (7.50)	-0.2 (0.20)	48.1 (2.73)	415.5 (2.04)							
	Kazakhstan	22.2 (2.42)	16.2 (2.12)	-1.7 (1.31)	55.7 (2.70)	-12.2 (6.78)	0.0 (0.10)	38.1 (2.23)	411.1 (1.57)							
	Kyrgyzstan	20.8 (2.92)	18.3 (2.23)	1.7 (1.10)	75.2 (2.03)	-23.4 (21.78)	3.3 (0.50)	46.0 (2.45)	345.7 (1.83)							
	Latvia	43.8 (3.07)	16.2 (1.89)	-0.8 (1.35)	37.0 (2.77)	c c	c c	38.9 (2.36)	479.6 (1.77)							
	Liechtenstein	23.8 (7.40)	2.1 (4.18)	-5.3 (3.07)	112.5 (12.17)	-12.6 (10.22)	-0.7 (0.44)	20.3 (6.86)	499.8 (8.42)							
	Lithuania	27.4 (2.87)	18.1 (1.56)	0.2 (1.04)	44.0 (2.45)	c c	c c	51.1 (2.34)	447.6 (1.87)							
	Macao-China	36.7 (1.01)	1.8 (1.61)	-1.1 (0.78)	1.0 (4.75)	16.7 (2.17)	-0.1 (0.23)	14.1 (1.51)	511.0 (3.47)							
	Montenegro	22.9 (3.44)	12.1 (1.38)	-0.3 (1.05)	64.2 (6.54)	-1.8 (6.69)	-1.2 (0.32)	39.3 (2.63)	409.5 (2.58)							
	Panama	32.6 (3.41)	7.9 (2.42)	1.2 (0.79)	45.8 (2.60)	-3.4 (10.77)	-1.4 (0.16)	15.8 (4.48)	431.3 (3.22)							
	Peru	27.5 (1.23)	10.5 (2.05)	0.9 (0.64)	47.2 (1.46)	c c	c c	8.3 (2.17)	445.6 (1.59)							
	Qatar	30.7 (1.70)	5.3 (0.98)	0.4 (0.85)	12.7 (2.91)	31.5 (2.98)	1.7 (0.07)	31.4 (3.71)	302.5 (2.94)							
	Romania	19.6 (4.19)	10.7 (1.63)	-0.3 (0.79)	63.9 (2.34)	c c	c c	13.7 (2.56)	446.4 (1.70)							
	Russian Federation	31.0 (2.01)	18.2 (1.93)	-1.6 (1.40)	38.8 (3.32)	-9.1 (5.88)	-0.4 (0.22)	38.7 (2.28)	452.9 (1.89)							
	Serbia	21.3 (4.48)	9.2 (1.25)	-0.8 (0.74)	55.1 (3.42)	1.2 (5.65)	0.3 (0.13)	27.1 (2.22)	425.1 (1.60)							
	Shanghai-China	21.8 (3.34)	4.6 (1.41)	0.1 (0.85)	57.3 (1.48)	c c	c c	29.3 (1.98)	583.5 (2.04)							
	Singapore	28.9 (2.09)	22.2 (2.19)	-2.8 (1.14)	104.7 (2.86)	0.4 (4.21)	-1.0 (0.13)	24.6 (2.57)	590.2 (2.76)							
	Chinese Taipei	15.4 (4.12)	15.5 (1.50)	-1.2 (1.05)	82.8 (3.06)	c c	c c	36.8 (2.25)	515.6 (2.03)							
Thailand	22.1 (2.05)	10.4 (1.54)	2.4 (0.66)	28.8 (1.31)	a a	a a	31.3 (1.78)	454.6 (1.67)								
Trinidad and Tobago	35.3 (1.60)	-0.6 (2.00)	-0.2 (0.91)	123.2 (3.42)	-9.2 (13.59)	-0.7 (0.28)	40.4 (2.90)	484.9 (2.77)								
Tunisia	49.7 (1.57)	3.7 (1.76)	0.7 (0.56)	17.8 (1.25)	c c	c c	14.4 (1.84)	449.6 (1.63)								
Uruguay	41.4 (1.49)	12.4 (1.58)	0.5 (0.75)	29.7 (1.58)	c c	c c	30.1 (2.48)	464.2 (2.29)								

Principal component analysis was also performed for each participating country to determine to what extent the components of the index operate in similar ways across countries. The analysis revealed that patterns of factor loading were very similar across countries, with all three components contributing to a similar extent to the index. For the occupational component, the average factor loading was 0.80, ranging from 0.66 to 0.87 across countries. For the educational component, the average factor loading was 0.79, ranging from 0.69 to 0.87 across countries. For the home possession component, the average factor loading was 0.73, ranging from 0.60 to 0.84 across countries. The reliability of the index ranged from 0.41 to 0.81. These results support the cross-national validity of the *PISA index of economic, social and cultural status*.

The imputation of components for students missing data on one component was done on the basis of a regression on the other two variables, with an additional random error component. The final values on the *PISA index of economic, social and cultural status* (ESCS) have an OECD mean of 0 and a standard deviation of 1.

Enjoyment of reading activities

The *index of enjoyment of reading activities* (ENJOY) was derived from students' level of agreement with the following statements (ST24): *i*) I read only if I have to; *ii*) reading is one of my favourite hobbies; *iii*) I like talking about books with other people; *iv*) I find it hard to finish books; *v*) I feel happy if I receive a book as a present; *vi*) for me, reading is a waste of time; *vii*) I enjoy going to a bookstore or a library; *viii*) I read only to get information that I need; *ix*) I cannot sit still and read for more than a few minutes; *x*) I like to express my opinions about books I have read; and *xi*) I like to exchange books with my friends.

As all items that are negatively phrased (items *i*, *iv*, *vi*, *viii* and *ix*) are inverted for scaling, higher values on this index indicate higher levels of enjoyment of reading.

Diversity of reading materials

The *index of diversity of reading materials* (DIVREAD) was derived from the frequency with which students read the following materials because they want to (ST25): magazines, comic books, fiction, non-fiction books and newspapers. Higher values on this index indicate higher diversity in reading.

Online reading activities

The *index of online reading activities* (ONLNREAD) was derived from the frequency with which students involved in the following reading activities (ST26): reading emails, <chat on line>, reading online news, using an online dictionary or encyclopaedia, searching online information to learn about a particular topic, taking part in online group discussions or forums and searching for practical information online. Higher values on this index indicate more frequent online reading activities.

Approaches to learning

How students approach learning is based on student responses in ST27 and measured through the following three indices: memorisation (MEMOR), elaboration (ELAB) and control strategies (CSTRAT).

The *index of memorisation* (MEMOR) was derived from the frequency with which students did the following when they were studying: *i*) try to memorise everything that is covered in the text; *ii*) try to memorise as many details as possible; *iii*) read the text so many times that they can recite it; and *iv*) read the text over and over again.

The *index of elaboration* (ELAB) was derived from the frequency with which students did the following when they were studying: *i*) try to relate new information to prior knowledge acquired in other subjects; *ii*) figure out how the information might be useful outside school; *iii*) try to understand the material better by relating it to my own experiences; and *iv*) figure out how the text information fits in with what happens in real life.

The *index of control strategies* (CSTRAT) was derived from students' reports on how often they did the following statements: *i*) when I study, I start by figuring out what exactly I need to learn; *ii*) when I study, I check if I understand what I have read; *iii*) when I study, I try to figure out which concepts I still haven't really understood; *iv*) when I study, I make sure that I remember the most important points in the text; and *v*) when I study and I don't understand something, I look for additional information to clarify this.

Higher values on the index indicate higher importance attached to the given strategy.

Teachers' stimulation of students' reading engagement

The *index of teachers' stimulation of students' reading engagement* (STIMREAD) was derived from students' reports on how often the following occurred in their lessons of the language of instruction (ST37): *i*) the teacher asks students to explain the meaning of a text; *ii*) the teacher asks questions that challenge students to get a better understanding of a text; *iii*) the teacher gives students enough time to think about their answers; *iv*) the teacher recommends a book or author to read; *v*) the teacher encourages students to express their opinion about a text; *vi*) the teacher helps students relate the stories they read to their lives; and *vii*) the teacher shows students how the information in texts builds on what they already know. Higher values on this index indicate higher teachers' stimulation of students' reading engagement.



Metacognition strategies: understanding and remembering

The *index of understanding and remembering* (UNDREM) was derived from students' reports on the usefulness of the following strategies for understanding and memorising the text (ST41): A) I concentrate on the parts of the text that are easy to understand; B) I quickly read through the text twice; C) After reading the text, I discuss its content with other people; D) I underline important parts of the text; E) I summarise the text in my own words; and F) I read the text aloud to another person.

This index was scored using a rater-scoring system. Through a variety of trial activities, both with reading experts and national centres, a preferred ordering of the strategies according to their effectiveness to achieve the intended goal was agreed. The experts' agreed order of the six items constituting this index is CDE > ABF. Scaling was conducted with two steps. First, a score was assigned to each student, which is a number that ranged from 0 to 1 and can be interpreted as the proportion of the total number of expert pair-wise relations that are consistent with the student ordering. For example, if the expert rule is (ABFD > CEG, 4'3=12 pair wise rules are created (i.e. A>C, A>E, A>G, B>C, B>E, B>G, F>C, F>E, F>G, D>C, D>E, D>G). If the responses of a student on this task follow 8 of the 12 rules, the student gets a score of 8/12 = 0.67. Second, these scores were standardised for the index to have a mean of 0 and a standard deviation of 1 across OECD countries. Higher values on this index indicate greater students' perception of usefulness of this strategy.

Metacognition strategies: summarising

The *index of summarising* (METASUM) was derived from students' reports on the usefulness of the following strategies for writing a summary of a long and rather difficult two-page text about fluctuations in the water levels of a lake in Africa (ST42): A) I write a summary. Then I check that each paragraph is covered in the summary, because the content of each paragraph should be included; B) I try to copy out accurately as many sentences as possible; C) before writing the summary, I read the text as many times as possible; D) I carefully check whether the most important facts in the text are represented in the summary; and E) I read through the text, underlining the most important sentences, then I write them in my own words as a summary.

This index was scored using a rater-scoring system. The experts' agreed order of the five items constituting this index is DE > AC > B. Higher values on this index indicate greater students' perception of usefulness of this strategy.

Reading for school

Students' engagement in reading for school is based on student responses to 17 items included in the last page of the test booklets and measured through the following four indices: *index of interpretation of literary texts* (RFSINTRP), *index of use of texts containing non-continuous materials* (RFSNCONT), *index of reading activities for traditional literature courses* (RFSTRLIT), *index of use of functional texts* (RFSFUMAT).

For each item students were asked to report whether they read different texts for school (either in the classroom or as homework) "many times", "two or three times", "once", or "not at all". All items are inverted for scaling, so that higher values on this index indicate higher levels of enjoyment of reading.

The *index of interpretation of literary texts* (RFSINTRP) was derived from the frequency with which students reported that in the past month they did the following: i) read fiction; ii) explain the cause of events in a text; iii) explain the way characters behave in a text; iv) explain the purpose of a text.

The *index of use of texts containing non-continuous materials* (RFSNCONT) was derived from the frequency with which students reported that in the past month they did the following: i) use texts that include diagrams or maps; ii) use texts that include tables or graphs; iii) find information from a graph, diagram or table; and iv) describe the way the information in a table or graph is organised.

The *index of reading activities for traditional literature courses* (RFSTRLIT) was derived from the frequency with which students reported that in the past month they did the following: i) read information texts about writers or books; ii) read poetry; iii) memorise a text by heart; iv) learn about the place of a text in the history of literature; v) learn about the life of the writer.

The *index of use of functional texts* (RFSFUMAT) was derived from the frequency with which students reported that in the past month they did the following: i) read newspaper reports and magazine articles; ii) read instructions or manuals telling how to make or do something (e.g. how a machine works); and iii) read advertising material (e.g. advertisements in magazines, posters).

ANNEX A2

THE PISA TARGET POPULATION, THE PISA SAMPLES AND THE DEFINITION OF SCHOOLS

Definition of the PISA target population

PISA 2009 provides an assessment of the cumulative yield of education and learning at a point at which most young adults are still enrolled in initial education.

A major challenge for an international survey is to ensure that international comparability of national target populations is guaranteed in such a venture.

Differences between countries in the nature and extent of pre-primary education and care, the age of entry into formal schooling and the institutional structure of educational systems do not allow the definition of internationally comparable grade levels of schooling. Consequently, international comparisons of educational performance typically define their populations with reference to a target age group. Some previous international assessments have defined their target population on the basis of the grade level that provides maximum coverage of a particular age cohort. A disadvantage of this approach is that slight variations in the age distribution of students across grade levels often lead to the selection of different target grades in different countries, or between education systems within countries, raising serious questions about the comparability of results across, and at times within, countries. In addition, because not all students of the desired age are usually represented in grade-based samples, there may be a more serious potential bias in the results if the unrepresented students are typically enrolled in the next higher grade in some countries and the next lower grade in others. This would exclude students with potentially higher levels of performance in the former countries and students with potentially lower levels of performance in the latter.

In order to address this problem, PISA uses an age-based definition for its target population, *i.e.* a definition that is not tied to the institutional structures of national education systems. PISA assesses students who were aged between 15 years and 3 (complete) months and 16 years and 2 (complete) months at the beginning of the assessment period, plus or minus a 1 month allowable variation, and who were enrolled in an educational institution with Grade 7 or higher, regardless of the grade levels or type of institution in which they were enrolled, and regardless of whether they were in full-time or part-time education. Educational institutions are generally referred to as schools in this publication, although some educational institutions (in particular, some types of vocational education establishments) may not be termed schools in certain countries. As expected from this definition, the average age of students across OECD countries was 15 years and 9 months. The range in country means was 2 months and 5 days (0.18 years), from the minimum country mean of 15 years and 8 months to the maximum country mean of 15 years and 10 months.

Given this definition of population, PISA makes statements about the knowledge and skills of a group of individuals who were born within a comparable reference period, but who may have undergone different educational experiences both in and outside of schools. In PISA, these knowledge and skills are referred to as the yield of education at an age that is common across countries. Depending on countries' policies on school entry, selection and promotion, these students may be distributed over a narrower or a wider range of grades across different education systems, tracks or streams. It is important to consider these differences when comparing PISA results across countries, as observed differences between students at age 15 may no longer appear as students' educational experiences converge later on.

If a country's scale scores in reading, scientific or mathematical literacy are significantly higher than those in another country, it cannot automatically be inferred that the schools or particular parts of the education system in the first country are more effective than those in the second. However, one can legitimately conclude that the cumulative impact of learning experiences in the first country, starting in early childhood and up to the age of 15, and embracing experiences both in school, home and beyond, have resulted in higher outcomes in the literacy domains that PISA measures.

The PISA target population did not include residents attending schools in a foreign country. It does, however, include foreign nationals attending schools in the country of assessment.

To accommodate countries that desired grade-based results for the purpose of national analyses, PISA 2009 provided a sampling option to supplement age-based sampling with grade-based sampling.

Population coverage

All countries attempted to maximise the coverage of 15-year-olds enrolled in education in their national samples, including students enrolled in special educational institutions. As a result, PISA 2009 reached standards of population coverage that are unprecedented in international surveys of this kind.

The sampling standards used in PISA permitted countries to exclude up to a total of 5% of the relevant population either by excluding schools or by excluding students within schools. All but 5 countries, Denmark (8.17%), Luxembourg (8.15%), Canada (6.00%), Norway (5.93%) and the United States (5.16%), achieved this standard, and in 36 countries and economies, the overall exclusion rate was less than 2%. When language exclusions were accounted for (*i.e.* removed from the overall exclusion rate), the United States no longer had an exclusion rate greater than 5%. For details, see www.pisa.oecd.org.



Exclusions within the above limits include:

- *At the school level:* *i)* schools that were geographically inaccessible or where the administration of the PISA assessment was not considered feasible; and *ii)* schools that provided teaching only for students in the categories defined under “within-school exclusions”, such as schools for the blind. The percentage of 15-year-olds enrolled in such schools had to be less than 2.5% of the nationally desired target population [0.5% maximum for *i)* and 2% maximum for *ii)*]. The magnitude, nature and justification of school-level exclusions are documented in the *PISA 2009 Technical Report* (OECD, forthcoming).
- *At the student level:* *i)* students with an intellectual disability; *ii)* students with a functional disability; *iii)* students with limited assessment language proficiency; *iv)* other – a category defined by the national centres and approved by the international centre; and *v)* students taught in a language of instruction for the main domain for which no materials were available. Students could not be excluded solely because of low proficiency or common discipline problems. The percentage of 15-year-olds excluded within schools had to be less than 2.5% of the nationally desired target population.


Table A2.1 describes the target population of the countries participating in PISA 2009. Further information on the target population and the implementation of PISA sampling standards can be found in the *PISA 2009 Technical Report* (OECD, forthcoming).

- **Column 1** shows the **total number of 15-year-olds** according to the most recent available information, which in most countries meant the year 2008 as the year before the assessment.
- **Column 2** shows the number of 15-year-olds enrolled in schools in Grade 7 or above (as defined above), which is referred to as the **eligible population**.
- **Column 3** shows the **national desired target population**. Countries were allowed to exclude up to 0.5% of students *a priori* from the eligible population, essentially for practical reasons. The following *a priori* exclusions exceed this limit but were agreed with the PISA Consortium: Canada excluded 1.1% of its population from Territories and Aboriginal reserves; France excluded 1.7% of its students in its *territoires d'outre-mer* and other institutions; Indonesia excluded 4.7% of its students from four provinces because of security reasons; Kyrgyzstan excluded 2.3% of its population in remote, inaccessible schools; and Serbia excluded 2% of its students taught in Serbian in Kosovo.
- **Column 4** shows the **number of students enrolled in schools that were excluded from the national desired target population** either from the sampling frame or later in the field during data collection.
- **Column 5** shows the **size of the national desired target population after subtracting the students enrolled in excluded schools**. This is obtained by subtracting Column 4 from Column 3.
- **Column 6** shows the **percentage of students enrolled in excluded schools**. This is obtained by dividing Column 4 by Column 3 and multiplying by 100.
- **Column 7** shows the **number of students participating in PISA 2009**. Note that in some cases this number does not account for 15-year-olds assessed as part of additional national options.
- **Column 8** shows the **weighted number of participating students**, *i.e.* the number of students in the nationally defined target population that the PISA sample represents.
- Each country attempted to maximise the coverage of PISA's target population within the sampled schools. In the case of each sampled school, all eligible students, namely those 15 years of age, regardless of grade, were first listed. Sampled students who were to be excluded had still to be included in the sampling documentation, and a list drawn up stating the reason for their exclusion. **Column 9** indicates the **total number of excluded students**, which is further described and classified into specific categories in Table A2.2. **Column 10** indicates the **weighted number of excluded students**, *i.e.* the overall number of students in the nationally defined target population represented by the number of students excluded from the sample, which is also described and classified by exclusion categories in Table A2.2. Excluded students were excluded based on five categories: *i)* students with an intellectual disability – the student has a mental or emotional disability and is cognitively delayed such that he/she cannot perform in the PISA testing situation; *ii)* students with a functional disability – the student has a moderate to severe permanent physical disability such that he/she cannot perform in the PISA testing situation; *iii)* students with a limited assessment language proficiency – the student is unable to read or speak any of the languages of the assessment in the country and would be unable to overcome the language barrier in the testing situation (typically a student who has received less than one year of instruction in the languages of the assessment may be excluded); *iv)* other – a category defined by the national centres and approved by the international centre; and *v)* students taught in a language of instruction for the main domain for which no materials were available.
- **Column 11** shows the **percentage of students excluded within schools**. This is calculated as the weighted number of excluded students (Column 10), divided by the weighted number of excluded and participating students (Column 8 plus Column 10), then multiplied by 100.

[Part 1/2]
Table A2.1 PISA target populations and samples

	Population and sample information							
	Total population of 15-year-olds (1)	Total enrolled population of 15-year-olds or above (2)	Total in national desired target population (3)	Total school-level exclusions (4)	Total in national desired target population after all school exclusions and before within-school exclusions (5)	School-level exclusion rate (%) (6)	Number of participating students (7)	Weighted number of participating students (8)
OECD								
Australia	286 334	269 669	269 669	7 057	262 612	2.62	14 251	240 851
Austria	99 818	94 192	94 192	115	94 077	0.12	6 590	87 326
Belgium	126 377	126 335	126 335	2 474	123 861	1.96	8 501	119 140
Canada	430 791	426 590	422 052	2 370	419 682	0.56	23 207	360 286
Chile	290 056	265 542	265 463	2 594	262 869	0.98	5 669	247 270
Czech Republic	122 027	116 153	116 153	1 619	114 534	1.39	6 064	113 951
Denmark	70 522	68 897	68 897	3 082	65 815	4.47	5 924	60 855
Estonia	14 248	14 106	14 106	436	13 670	3.09	4 727	12 978
Finland	66 198	66 198	66 198	1 507	64 691	2.28	5 810	61 463
France	749 808	732 825	720 187	18 841	701 346	2.62	4 298	677 620
Germany	852 044	852 044	852 044	7 138	844 906	0.84	4 979	766 993
Greece	102 229	105 664	105 664	696	104 968	0.66	4 969	93 088
Hungary	121 155	118 387	118 387	3 322	115 065	2.81	4 605	105 611
Iceland	4 738	4 738	4 738	20	4 718	0.42	3 646	4 410
Ireland	56 635	55 464	55 464	276	55 170	0.50	3 937	52 794
Israel	122 701	112 254	112 254	1 570	110 684	1.40	5 761	103 184
Italy	586 904	573 542	573 542	2 694	570 848	0.47	30 905	506 733
Japan	1 211 642	1 189 263	1 189 263	22 955	1 166 308	1.93	6 088	1 113 403
Korea	717 164	700 226	700 226	2 927	697 299	0.42	4 989	630 030
Luxembourg	5 864	5 623	5 623	186	5 437	3.31	4 622	5 124
Mexico	2 151 771	1 425 397	1 425 397	5 825	1 419 572	0.41	38 250	1 305 461
Netherlands	199 000	198 334	198 334	6 179	192 155	3.12	4 760	183 546
New Zealand	63 460	60 083	60 083	645	59 438	1.07	4 643	55 129
Norway	63 352	62 948	62 948	1 400	61 548	2.22	4 660	57 367
Poland	482 500	473 700	473 700	7 650	466 050	1.61	4 917	448 866
Portugal	115 669	107 583	107 583	0	107 583	0.00	6 298	96 820
Slovak Republic	72 826	72 454	72 454	1 803	70 651	2.49	4 555	69 274
Slovenia	20 314	19 571	19 571	174	19 397	0.89	6 155	18 773
Spain	433 224	425 336	425 336	3 133	422 203	0.74	25 887	387 054
Sweden	121 486	121 216	121 216	2 323	118 893	1.92	4 567	113 054
Switzerland	90 623	89 423	89 423	1 747	87 676	1.95	11 812	80 839
Turkey	1 336 842	859 172	859 172	8 569	850 603	1.00	4 996	757 298
United Kingdom	786 626	786 825	786 825	17 593	769 232	2.24	12 179	683 380
United States	4 103 738	4 210 475	4 210 475	15 199	4 195 276	0.36	5 233	3 373 264
Partners								
Albania	55 587	42 767	42 767	372	42 395	0.87	4 596	34 134
Argentina	688 434	636 713	636 713	2 238	634 475	0.35	4 774	472 106
Azerbaijan	185 481	184 980	184 980	1 886	183 094	1.02	4 727	105 886
Brazil	3 292 022	2 654 489	2 654 489	15 571	2 638 918	0.59	20 127	2 080 159
Bulgaria	80 226	70 688	70 688	1 369	69 319	1.94	4 507	57 833
Colombia	893 057	582 640	582 640	412	582 228	0.07	7 921	522 388
Croatia	48 491	46 256	46 256	535	45 721	1.16	4 994	43 065
Dubai (UAE)	10 564	10 327	10 327	167	10 160	1.62	5 620	9 179
Hong Kong-China	85 000	78 224	78 224	809	77 415	1.03	4 837	75 548
Indonesia	4 267 801	3 158 173	3 010 214	10 458	2 999 756	0.35	5 136	2 259 118
Jordan	117 732	107 254	107 254	0	107 254	0.00	6 486	104 056
Kazakhstan	281 659	263 206	263 206	7 210	255 996	2.74	5 412	250 657
Kyrgyzstan	116 795	93 989	91 793	1 149	90 644	1.25	4 986	78 493
Latvia	28 749	28 149	28 149	943	27 206	3.35	4 502	23 362
Liechtenstein	399	360	360	5	355	1.39	329	355
Lithuania	51 822	43 967	43 967	522	43 445	1.19	4 528	40 530
Macao-China	7 500	5 969	5 969	3	5 966	0.05	5 952	5 978
Montenegro	8 500	8 493	8 493	10	8 483	0.12	4 825	7 728
Panama	57 919	43 623	43 623	501	43 122	1.15	3 969	30 510
Peru	585 567	491 514	490 840	984	489 856	0.20	5 985	427 607
Qatar	10 974	10 665	10 665	114	10 551	1.07	9 078	9 806
Romania	152 084	152 084	152 084	679	151 405	0.45	4 776	151 130
Russian Federation	1 673 085	1 667 460	1 667 460	25 012	1 642 448	1.50	5 308	1 290 047
Serbia	85 121	75 128	73 628	1 580	72 048	2.15	5 523	70 796
Shanghai-China	112 000	100 592	100 592	1 287	99 305	1.28	5 115	97 045
Singapore	54 982	54 212	54 212	633	53 579	1.17	5 283	51 874
Chinese Taipei	329 249	329 189	329 189	1 778	327 411	0.54	5 831	297 203
Thailand	949 891	763 679	763 679	8 438	755 241	1.10	6 225	691 916
Trinidad and Tobago	19 260	17 768	17 768	0	17 768	0.00	4 778	14 938
Tunisia	153 914	153 914	153 914	0	153 914	0.00	4 955	136 545
Uruguay	53 801	43 281	43 281	30	43 251	0.07	5 957	33 971

Note: For a full explanation of the details in this table, please refer to the *PISA 2009 Technical Report* (OECD, forthcoming). The figure for total national population of 15-year-olds enrolled in Column 1 may occasionally be larger than the total number of 15-year-olds in Column 2 due to differing data sources. In Greece, Column 1 does not include immigrants but Column 2 does.

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[Part 2/2]

Table A2.1 PISA target populations and samples

	Population and sample information				Coverage indices		
	Number of excluded students	Weighted number of excluded students	Within-school exclusion rate (%)	Overall exclusion rate (%)	Coverage index 1: Coverage of national desired population	Coverage index 2: Coverage of national enrolled population	Coverage index 3: Coverage of 15-year-old population
	(9)	(10)	(11)	(12)	(13)	(14)	(15)
OECD							
Australia	313	4 389	1.79	4.36	0.956	0.956	0.841
Austria	45	607	0.69	0.81	0.992	0.992	0.875
Belgium	30	292	0.24	2.20	0.978	0.978	0.943
Canada	1 607	20 837	5.47	6.00	0.940	0.930	0.836
Chile	15	620	0.25	1.22	0.988	0.987	0.852
Czech Republic	24	423	0.37	1.76	0.982	0.982	0.934
Denmark	296	2 448	3.87	8.17	0.918	0.918	0.863
Estonia	32	97	0.74	3.81	0.962	0.962	0.911
Finland	77	717	1.15	3.40	0.966	0.966	0.928
France	1	304	0.04	2.66	0.973	0.957	0.904
Germany	28	3 591	0.47	1.30	0.987	0.987	0.900
Greece	142	2 977	3.10	3.74	0.963	0.963	0.911
Hungary	10	361	0.34	3.14	0.969	0.969	0.872
Iceland	187	189	4.10	4.50	0.955	0.955	0.931
Ireland	136	1 492	2.75	3.23	0.968	0.967	0.932
Israel	86	1 359	1.30	2.68	0.973	0.973	0.841
Italy	561	10 663	2.06	2.52	0.975	0.975	0.863
Japan	0	0	0.00	1.93	0.981	0.981	0.919
Korea	16	1 748	0.28	0.69	0.993	0.993	0.879
Luxembourg	196	270	5.01	8.15	0.919	0.919	0.874
Mexico	52	1 951	0.15	0.56	0.994	0.994	0.607
Netherlands	19	648	0.35	3.46	0.965	0.965	0.922
New Zealand	184	1 793	3.15	4.19	0.958	0.958	0.869
Norway	207	2 260	3.79	5.93	0.941	0.941	0.906
Poland	15	1 230	0.27	1.88	0.981	0.981	0.930
Portugal	115	1 544	1.57	1.57	0.984	0.984	0.837
Slovak Republic	106	1 516	2.14	4.58	0.954	0.954	0.951
Slovenia	43	138	0.73	1.61	0.984	0.984	0.924
Spain	775	12 673	3.17	3.88	0.961	0.961	0.893
Sweden	146	3 360	2.89	4.75	0.953	0.953	0.931
Switzerland	209	940	1.15	3.08	0.969	0.969	0.892
Turkey	11	1 497	0.20	1.19	0.988	0.988	0.566
United Kingdom	318	17 094	2.44	4.62	0.954	0.954	0.869
United States	315	170 542	4.81	5.16	0.948	0.948	0.822
Partners							
Albania	0	0	0.00	0.87	0.991	0.991	0.614
Argentina	14	1 225	0.26	0.61	0.994	0.994	0.686
Azerbaijan	0	0	0.00	1.02	0.990	0.990	0.571
Brazil	24	2 692	0.13	0.72	0.993	0.993	0.632
Bulgaria	0	0	0.00	1.94	0.981	0.981	0.721
Colombia	11	490	0.09	0.16	0.998	0.998	0.585
Croatia	34	273	0.63	1.78	0.982	0.982	0.888
Dubai (UAE)	5	7	0.07	1.69	0.983	0.983	0.869
Hong Kong-China	9	119	0.16	1.19	0.988	0.988	0.889
Indonesia	0	0	0.00	0.35	0.997	0.950	0.529
Jordan	24	443	0.42	0.42	0.996	0.996	0.884
Kazakhstan	82	3 844	1.51	4.21	0.958	0.958	0.890
Kyrgyzstan	86	1 384	1.73	2.96	0.970	0.948	0.672
Latvia	19	102	0.43	3.77	0.962	0.962	0.813
Liechtenstein	0	0	0.00	1.39	0.986	0.986	0.890
Lithuania	74	632	1.53	2.70	0.973	0.973	0.782
Macao-China	0	0	0.00	0.05	0.999	0.999	0.797
Montenegro	0	0	0.00	0.12	0.999	0.999	0.909
Panama	0	0	0.00	1.15	0.989	0.989	0.527
Peru	9	558	0.13	0.33	0.997	0.995	0.730
Qatar	28	28	0.28	1.35	0.986	0.986	0.894
Romania	0	0	0.00	0.45	0.996	0.996	0.994
Russian Federation	59	15 247	1.17	2.65	0.973	0.973	0.771
Serbia	10	133	0.19	2.33	0.977	0.957	0.832
Shanghai-China	7	130	0.13	1.41	0.986	0.986	0.866
Singapore	48	417	0.80	1.96	0.980	0.980	0.943
Chinese Taipei	32	1 662	0.56	1.09	0.989	0.989	0.903
Thailand	6	458	0.07	1.17	0.988	0.988	0.728
Trinidad and Tobago	11	36	0.24	0.24	0.998	0.998	0.776
Tunisia	7	184	0.13	0.13	0.999	0.999	0.887
Uruguay	14	67	0.20	0.26	0.997	0.997	0.631

Note: For a full explanation of the details in this table please refer to the *PISA 2009 Technical Report* (OECD, forthcoming). The figure for total national population of 15-year-olds enrolled in Column 1 may occasionally be larger than the total number of 15-year-olds in Column 2 due to differing data sources. In Greece, Column 1 does not include immigrants but Column 2 does.

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[Part 1/1]
Table A2.2 Exclusions

	Student exclusions (unweighted)						Student exclusion (weighted)					
	Number of excluded students with a disability (Code 1)	Number of excluded students with a disability (Code 2)	Number of excluded students because of language (Code 3)	Number of excluded students for other reasons (Code 4)	Number of excluded students because of no materials available in the language of instruction (Code 5)	Total number of excluded students	Weighted number of excluded students with a disability (Code 1)	Weighted number of excluded students with a disability (Code 2)	Weighted number of excluded students because of language (Code 3)	Weighted number of excluded students for other reasons (Code 4)	Number of excluded students because of no materials available in the language of instruction (Code 5)	Total weighted number of excluded students
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
OECD												
Australia	24	210	79	0	0	313	272	2 834	1 283	0	0	4 389
Austria	0	26	19	0	0	45	0	317	290	0	0	607
Belgium	3	17	10	0	0	30	26	171	95	0	0	292
Canada	49	1 458	100	0	0	1 607	428	19 082	1 326	0	0	20 837
Chile	5	10	0	0	0	15	177	443	0	0	0	620
Czech Republic	8	7	9	0	0	24	117	144	162	0	0	423
Denmark	13	182	35	66	0	296	165	1 432	196	656	0	2 448
Estonia	3	28	1	0	0	32	8	87	2	0	0	97
Finland	4	48	12	11	2	77	38	447	110	99	23	717
France	1	0	0	0	0	1	304	0	0	0	0	304
Germany	6	20	2	0	0	28	864	2 443	285	0	0	3 591
Greece	7	11	7	117	0	142	172	352	195	2 257	0	2 977
Hungary	0	1	0	9	0	10	0	48	0	313	0	361
Iceland	3	78	64	38	1	187	3	78	65	39	1	189
Ireland	4	72	25	35	0	136	51	783	262	396	0	1 492
Israel	10	69	7	0	0	86	194	1 049	116	0	0	1 359
Italy	45	348	168	0	0	561	748	6 241	3 674	0	0	10 663
Japan	0	0	0	0	0	0	0	0	0	0	0	0
Korea	7	9	0	0	0	16	994	753	0	0	0	1 748
Luxembourg	2	132	62	0	0	196	2	206	62	0	0	270
Mexico	25	25	2	0	0	52	1 010	905	36	0	0	1 951
Netherlands	6	13	0	0	0	19	178	470	0	0	0	648
New Zealand	19	84	78	0	3	184	191	824	749	0	29	1 793
Norway	8	160	39	0	0	207	90	1 756	414	0	0	2 260
Poland	2	13	0	0	0	15	169	1 061	0	0	0	1 230
Portugal	2	100	13	0	0	115	25	1 322	197	0	0	1 544
Slovak Republic	12	37	1	56	0	106	171	558	19	768	0	1 516
Slovenia	6	10	27	0	0	43	40	32	66	0	0	138
Spain	45	441	289	0	0	775	1 007	7 141	4 525	0	0	12 673
Sweden	115	0	31	0	0	146	2 628	0	732	0	0	3 360
Switzerland	11	106	92	0	0	209	64	344	532	0	0	940
Turkey	3	3	5	0	0	11	338	495	665	0	0	1 497
United Kingdom	40	247	31	0	0	318	2 438	13 482	1 174	0	0	17 094
United States	29	236	40	10	0	315	15 367	127 486	21 718	5 971	0	170 542
Partners												
Albania	0	0	0	0	0	0	0	0	0	0	0	0
Argentina	4	10	0	0	0	14	288	937	0	0	0	1 225
Azerbaijan	0	0	0	0	0	0	0	0	0	0	0	0
Brazil	21	3	0	0	0	24	2 495	197	0	0	0	2 692
Bulgaria	0	0	0	0	0	0	0	0	0	0	0	0
Colombia	7	2	2	0	0	11	200	48	242	0	0	490
Croatia	4	30	0	0	0	34	34	239	0	0	0	273
Dubai (UAE)	1	1	3	0	0	5	2	2	3	0	0	7
Hong Kong-China	0	9	0	0	0	9	0	119	0	0	0	119
Indonesia	0	0	0	0	0	0	0	0	0	0	0	0
Jordan	11	7	6	0	0	24	166	149	127	0	0	443
Kazakhstan	10	17	0	0	55	82	429	828	0	0	2 587	3 844
Kyrgyzstan	68	13	5	0	0	86	1 093	211	80	0	0	1 384
Latvia	6	8	5	0	0	19	25	44	33	0	0	102
Liechtenstein	0	0	0	0	0	0	0	0	0	0	0	0
Lithuania	4	69	1	0	0	74	33	590	9	0	0	632
Macao-China	0	0	0	0	0	0	0	0	0	0	0	0
Montenegro	0	0	0	0	0	0	0	0	0	0	0	0
Panama	0	0	0	0	0	0	0	0	0	0	0	0
Peru	4	5	0	0	0	9	245	313	0	0	0	558
Qatar	9	18	1	0	0	28	9	18	1	0	0	28
Romania	0	0	0	0	0	0	0	0	0	0	0	0
Russian Federation	11	47	1	0	0	59	2 081	13 010	157	0	0	15 247
Serbia	4	5	0	0	1	10	66	53	0	0	13	133
Shanghai-China	1	6	0	0	0	7	19	111	0	0	0	130
Singapore	2	22	24	0	0	48	17	217	182	0	0	417
Chinese Taipei	13	19	0	0	0	32	684	977	0	0	0	1 662
Thailand	0	5	1	0	0	6	0	260	198	0	0	458
Trinidad and Tobago	1	10	0	0	0	11	3	33	0	0	0	36
Tunisia	4	1	2	0	0	7	104	21	58	0	0	184
Uruguay	2	9	3	0	0	14	14	34	18	0	0	67

Exclusion codes:

Code 1 Functional disability – student has a moderate to severe permanent physical disability.


Code 2 Intellectual disability – student has a mental or emotional disability and has either been tested as cognitively delayed or is considered in the professional opinion of qualified staff to be cognitively delayed.

Code 3 Limited assessment language proficiency – student is not a native speaker of any of the languages of the assessment in the country and has been resident in the country for less than one year.

Code 4 Other defined by the national centres and approved by the international centre.

Code 5 No materials available in the language of instruction.

Note: For a full explanation of other details in this table, please refer to the *PISA 2009 Technical Report* (OECD, forthcoming).

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- **Column 12** shows the **overall exclusion rate**, which represents the weighted percentage of the national desired target population excluded from PISA either through school-level exclusions or through the exclusion of students within schools. It is calculated as the school-level exclusion rate (Column 6 divided by 100) plus within-school exclusion rate (Column 11 divided by 100) multiplied by 1 minus the school-level exclusion rate (Column 6 divided by 100). This result is then multiplied by 100. Five countries, Denmark, Luxembourg, Canada, Norway and the United States, had exclusion rates higher than 5%. When language exclusions were accounted for (*i.e.* removed from the overall exclusion rate), the United States no longer had an exclusion rate greater than 5%.
- **Column 13** presents an **index of the extent to which the national desired target population is covered by the PISA sample**. Denmark, Luxembourg, Canada, Norway and the United States were the only countries where the coverage is below 95%.
- **Column 14** presents an **index of the extent to which 15-year-olds enrolled in schools are covered by the PISA sample**. The index measures the overall proportion of the national enrolled population that is covered by the non-excluded portion of the student sample. The index takes into account both school-level and student-level exclusions. Values close to 100 indicate that the PISA sample represents the entire education system as defined for PISA 2009. The index is the weighted number of participating students (Column 8) divided by the weighted number of participating and excluded students (Column 8 plus Column 10), times the nationally defined target population (Column 5) divided by the eligible population (Column 2) (times 100).
- **Column 15** presents an **index of the coverage of the 15-year-old population**. This index is the weighted number of participating students (Column 8) divided by the total population of 15-year-old students (Column 1).

This high level of coverage contributes to the comparability of the assessment results. For example, even assuming that the excluded students would have systematically scored worse than those who participated, and that this relationship is moderately strong, an exclusion rate in the order of 5% would likely lead to an overestimation of national mean scores of less than 5 score points (on a scale with an international mean of 500 score points and a standard deviation of 100 score points). This assessment is based on the following calculations: if the correlation between the propensity of exclusions and student performance is 0.3, resulting mean scores would likely be overestimated by 1 score point if the exclusion rate is 1%, by 3 score points if the exclusion rate is 5%, and by 6 score points if the exclusion rate is 10%. If the correlation between the propensity of exclusions and student performance is 0.5, resulting mean scores would be overestimated by 1 score point if the exclusion rate is 1%, by 5 score points if the exclusion rate is 5%, and by 10 score points if the exclusion rate is 10%. For this calculation, a model was employed that assumes a bivariate normal distribution for performance and the propensity to participate. For details, see the *PISA 2009 Technical Report* (OECD, forthcoming).

Sampling procedures and response rates

The accuracy of any survey results depends on the quality of the information on which national samples are based as well as on the sampling procedures. Quality standards, procedures, instruments and verification mechanisms were developed for PISA that ensured that national samples yielded comparable data and that the results could be compared with confidence.

Most PISA samples were designed as two-stage stratified samples (where countries applied different sampling designs, these are documented in the *PISA 2009 Technical Report* [OECD, forthcoming]). The first stage consisted of sampling individual schools in which 15-year-old students could be enrolled. Schools were sampled systematically with probabilities proportional to size, the measure of size being a function of the estimated number of eligible (15-year-old) students enrolled. A minimum of 150 schools were selected in each country (where this number existed), although the requirements for national analyses often required a somewhat larger sample. As the schools were sampled, replacement schools were simultaneously identified, in case a sampled school chose not to participate in PISA 2009.

In the case of Iceland, Liechtenstein, Luxembourg, Macao-China and Qatar, all schools and all eligible students within schools were included in the sample.

Experts from the PISA Consortium performed the sample selection process for most participating countries and monitored it closely in those countries that selected their own samples. The second stage of the selection process sampled students within sampled schools. Once schools were selected, a list of each sampled school's 15-year-old students was prepared. From this list, 35 students were then selected with equal probability (all 15-year-old students were selected if fewer than 35 were enrolled). The number of students to be sampled per school could deviate from 35, but could not be less than 20.

Data-quality standards in PISA required minimum participation rates for schools as well as for students. These standards were established to minimise the potential for response biases. In the case of countries meeting these standards, it was likely that any bias resulting from non-response would be negligible, *i.e.* typically smaller than the sampling error.

A minimum response rate of 85% was required for the schools initially selected. Where the initial response rate of schools was between 65 and 85%, however, an acceptable school response rate could still be achieved through the use of replacement schools. This procedure brought with it a risk of increased response bias. Participating countries were, therefore, encouraged to persuade as many of the schools in the original sample as possible to participate. Schools with a student participation rate between 25% and 50% were not regarded as participating schools, but data from these schools were included in the database and contributed to the various estimations. Data from schools with a student participation rate of less than 25% were excluded from the database.

[Part 1/2]
Table A2.3 Response rates

	Initial sample – before school replacement					Final sample – after school replacement		
	Weighted school participation rate before replacement (%)	Weighted number of responding schools (weighted also by enrolment)	Weighted number of schools sampled (responding and non-responding) (weighted also by enrolment)	Number of responding schools (unweighted)	Number of non-responding schools (unweighted)	Weighted school participation rate after replacement (%)	Weighted number of responding schools (weighted also by enrolment)	Weighted number of schools sampled (responding and non-responding) (weighted also by enrolment)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OECD								
Australia	97.78	265 659	271 696	342	357	98.85	268 780	271 918
Austria	93.94	88 551	94 261	280	291	93.94	88 551	94 261
Belgium	88.76	112 594	126 851	255	292	95.58	121 291	126 899
Canada	88.04	362 152	411 343	893	1 001	89.64	368 708	411 343
Chile	94.34	245 583	260 331	189	201	99.04	257 594	260 099
Czech Republic	83.09	94 696	113 961	226	270	97.40	111 091	114 062
Denmark	83.94	55 375	65 967	264	325	90.75	59 860	65 964
Estonia	100.00	13 230	13 230	175	175	100.00	13 230	13 230
Finland	98.65	62 892	63 751	201	204	100.00	63 748	63 751
France	94.14	658 769	699 776	166	177	94.14	658 769	699 776
Germany	98.61	826 579	838 259	223	226	100.00	838 259	838 259
Greece	98.19	98 710	100 529	181	184	99.40	99 925	100 529
Hungary	98.21	101 523	103 378	184	190	99.47	103 067	103 618
Iceland	98.46	4 488	4 558	129	141	98.46	4 488	4 558
Ireland	87.18	48 821	55 997	139	160	88.44	49 526	55 997
Israel	92.03	103 141	112 069	170	186	95.40	106 918	112 069
Italy	94.27	532 432	564 811	1 054	1 108	99.08	559 546	564 768
Japan	87.77	999 408	1 138 694	171	196	94.99	1 081 662	1 138 694
Korea	100.00	683 793	683 793	157	157	100.00	683 793	683 793
Luxembourg	100.00	5 437	5 437	39	39	100.00	5 437	5 437
Mexico	95.62	1 338 291	1 399 638	1 512	1 560	97.71	1 367 668	1 399 730
Netherlands	80.40	154 471	192 140	155	194	95.54	183 555	192 118
New Zealand	84.11	49 917	59 344	148	179	91.00	54 130	59 485
Norway	89.61	55 484	61 920	183	207	96.53	59 759	61 909
Poland	88.16	409 513	464 535	159	187	97.70	453 855	464 535
Portugal	93.61	102 225	109 205	201	216	98.43	107 535	109 251
Slovak Republic	93.33	67 284	72 092	180	191	99.01	71 388	72 105
Slovenia	98.36	19 798	20 127	337	352	98.36	19 798	20 127
Spain	99.53	422 692	424 705	888	892	99.53	422 692	424 705
Sweden	99.91	120 693	120 802	189	191	99.91	120 693	120 802
Switzerland	94.25	81 005	85 952	413	429	98.71	84 896	86 006
Turkey	100.00	849 830	849 830	170	170	100.00	849 830	849 830
United Kingdom	71.06	523 271	736 341	418	549	87.35	643 027	736 178
United States	67.83	2 673 852	3 941 908	140	208	77.50	3 065 651	3 955 606
Partners								
Albania	97.29	39 168	40 259	177	182	99.37	39 999	40 253
Argentina	97.18	590 215	607 344	194	199	99.42	603 817	607 344
Azerbaijan	99.86	168 646	168 890	161	162	100.00	168 890	168 890
Brazil	93.13	2 435 250	2 614 824	899	976	94.75	2 477 518	2 614 806
Bulgaria	98.16	56 922	57 991	173	178	99.10	57 823	58 346
Colombia	90.21	507 649	562 728	260	285	94.90	533 899	562 587
Croatia	99.19	44 561	44 926	157	159	99.86	44 862	44 926
Dubai (UAE)	100.00	10 144	10 144	190	190	100.00	10 144	10 144
Hong Kong-China	69.19	53 800	77 758	108	156	96.75	75 232	77 758
Indonesia	94.54	2 337 438	2 472 502	172	183	100.00	2 473 528	2 473 528
Jordan	100.00	105 906	105 906	210	210	100.00	105 906	105 906
Kazakhstan	100.00	257 427	257 427	199	199	100.00	257 427	257 427
Kyrgyzstan	98.53	88 412	89 733	171	174	99.47	89 260	89 733
Latvia	97.46	26 986	27 689	180	185	99.39	27 544	27 713
Liechtenstein	100.00	356	356	12	12	100.00	356	356
Lithuania	98.13	41 759	42 555	192	197	99.91	42 526	42 564
Macao-China	100.00	5 966	5 966	45	45	100.00	5 966	5 966
Montenegro	100.00	8 527	8 527	52	52	100.00	8 527	8 527
Panama	82.58	33 384	40 426	180	220	83.76	33 779	40 329
Peru	100.00	480 640	480 640	240	240	100.00	480 640	480 640
Qatar	97.30	10 223	10 507	149	154	97.30	10 223	10 507
Romania	100.00	150 114	150 114	159	159	100.00	150 114	150 114
Russian Federation	100.00	1 392 765	1 392 765	213	213	100.00	1 392 765	1 392 765
Serbia	99.21	70 960	71 524	189	191	99.97	71 504	71 524
Shanghai-China	99.32	98 841	99 514	151	152	100.00	99 514	99 514
Singapore	96.19	51 552	53 592	168	175	97.88	52 454	53 592
Chinese Taipei	99.34	322 005	324 141	157	158	100.00	324 141	324 141
Thailand	98.01	737 225	752 193	225	230	100.00	752 392	752 392
Trinidad and Tobago	97.21	17 180	17 673	155	160	97.21	17 180	17 673
Tunisia	100.00	153 198	153 198	165	165	100.00	153 198	153 198
Uruguay	98.66	42 820	43 400	229	233	98.66	42 820	43 400



[Part 2/2]
Table A2.3 Response rates

	Final sample – after school replacement		Final sample – students within schools after school replacement				
	Number of responding schools (unweighted)	Number of responding and non-responding schools (unweighted)	Weighted student participation rate after replacement (%)	Number of students assessed (weighted)	Number of students sampled (assessed and absent) (weighted)	Number of students assessed (unweighted)	Number of students sampled (assessed and absent) (unweighted)
OECD							
Australia	345	357	86.05	205 234	238 498	14 060	16 903
Austria	280	291	88.63	72 793	82 135	6 568	7 587
Belgium	275	292	91.38	104 263	114 097	8 477	9 245
Canada	908	1 001	79.52	257 905	324 342	22 383	27 603
Chile	199	201	92.88	227 541	244 995	5 663	6 097
Czech Republic	260	270	90.75	100 685	110 953	6 049	6 656
Denmark	285	325	89.29	49 236	55 139	5 924	6 827
Estonia	175	175	94.06	12 208	12 978	4 727	5 023
Finland	203	204	92.27	56 709	61 460	5 810	6 309
France	166	177	87.12	556 054	638 284	4 272	4 900
Germany	226	226	93.93	720 447	766 993	4 979	5 309
Greece	183	184	95.95	88 875	92 631	4 957	5 165
Hungary	187	190	93.25	97 923	105 015	4 605	4 956
Iceland	129	141	83.91	3 635	4 332	3 635	4 332
Ireland	141	160	83.81	39 248	46 830	3 896	4 654
Israel	176	186	89.45	88 480	98 918	5 761	6 440
Italy	1 095	1 108	92.13	462 655	502 190	30 876	33 390
Japan	185	196	95.32	1 010 801	1 060 382	6 077	6 377
Korea	157	157	98.76	622 187	630 030	4 989	5 057
Luxembourg	39	39	95.57	4 897	5 124	4 622	4 833
Mexico	1 531	1 560	95.13	1 214 827	1 276 982	38 213	40 125
Netherlands	185	194	89.78	157 912	175 897	4 747	5 286
New Zealand	161	179	84.65	42 452	50 149	4 606	5 476
Norway	197	207	89.92	49 785	55 366	4 660	5 194
Poland	179	187	85.87	376 767	438 739	4 855	5 674
Portugal	212	216	87.11	83 094	95 386	6 263	7 169
Slovak Republic	189	191	93.03	63 854	68 634	4 555	4 898
Slovenia	337	352	90.92	16 777	18 453	6 135	6 735
Spain	888	892	89.60	345 122	385 164	25 871	28 280
Sweden	189	191	92.97	105 026	112 972	4 567	4 912
Switzerland	425	429	93.58	74 712	79 836	11 810	12 551
Turkey	170	170	97.85	741 029	757 298	4 996	5 108
United Kingdom	481	549	86.96	520 121	598 110	12 168	14 046
United States	160	208	86.99	2 298 889	2 642 598	5 165	5 951
Partners							
Albania	181	182	95.39	32 347	33 911	4 596	4 831
Argentina	198	199	88.25	414 166	469 285	4 762	5 423
Azerbaijan	162	162	99.14	105 095	106 007	4 691	4 727
Brazil	926	976	89.04	1 767 872	1 985 479	19 901	22 715
Bulgaria	176	178	97.34	56 096	57 630	4 499	4 617
Colombia	274	285	92.83	462 602	498 331	7 910	8 483
Croatia	158	159	93.76	40 321	43 006	4 994	5 326
Dubai (UAE)	190	190	90.39	8 297	9 179	5 620	6 218
Hong Kong-China	151	156	93.19	68 142	73 125	4 837	5 195
Indonesia	183	183	96.91	2 189 287	2 259 118	5 136	5 313
Jordan	210	210	95.85	99 734	104 056	6 486	6 777
Kazakhstan	199	199	98.49	246 872	250 657	5 412	5 489
Kyrgyzstan	173	174	98.04	76 523	78 054	4 986	5 086
Latvia	184	185	91.27	21 241	23 273	4 502	4 930
Liechtenstein	12	12	92.68	329	355	329	355
Lithuania	196	197	93.36	37 808	40 495	4 528	4 854
Macao-China	45	45	99.57	5 952	5 978	5 952	5 978
Montenegro	52	52	95.43	7 375	7 728	4 825	5 062
Panama	183	220	88.67	22 666	25 562	3 913	4 449
Peru	240	240	96.35	412 011	427 607	5 985	6 216
Qatar	149	154	93.63	8 990	9 602	8 990	9 602
Romania	159	159	99.47	150 331	151 130	4 776	4 803
Russian Federation	213	213	96.77	1 248 353	1 290 047	5 308	5 502
Serbia	190	191	95.37	67 496	70 775	5 522	5 804
Shanghai-China	152	152	98.89	95 966	97 045	5 115	5 175
Singapore	171	175	91.04	46 224	50 775	5 283	5 809
Chinese Taipei	158	158	95.30	283 239	297 203	5 831	6 108
Thailand	230	230	97.37	673 688	691 916	6 225	6 396
Trinidad and Tobago	155	160	85.92	12 275	14 287	4 731	5 518
Tunisia	165	165	96.93	132 354	136 545	4 955	5 113
Uruguay	229	233	87.03	29 193	33 541	5 924	6 815

PISA 2009 also required a minimum participation rate of 80% of students within participating schools. This minimum participation rate had to be met at the national level, not necessarily by each participating school. Follow-up sessions were required in schools in which too few students had participated in the original assessment sessions. Student participation rates were calculated over all original schools, and also over all schools, whether original sample or replacement schools, and from the participation of students in both the original assessment and any follow-up sessions. A student who participated in the original or follow-up cognitive sessions was regarded as a participant. Those who attended only the questionnaire session were included in the international database and contributed to the statistics presented in this publication if they provided at least a description of their father's or mother's occupation.

Table A2.3 shows the response rates for students and schools, before and after replacement.

- **Column 1** shows the **weighted participation rate of schools before replacement**. This is obtained by dividing Column 2 by Column 3.
- **Column 2** shows the **weighted number of responding schools before school replacement** (weighted by student enrolment).
- **Column 3** shows the **weighted number of sampled schools before school replacement** (including both responding and non-responding schools, weighted by student enrolment).
- **Column 4** shows the unweighted number of **responding schools before school replacement**.
- **Column 5** shows the unweighted **number of responding and non-responding schools before school replacement**.
- **Column 6** shows the **weighted participation rate of schools after replacement**. This is obtained by dividing Column 7 by Column 8.
- **Column 7** shows the **weighted number of responding schools after school replacement** (weighted by student enrolment).
- **Column 8** shows the **weighted number of schools sampled after school replacement** (including both responding and non-responding schools, weighted by student enrolment).
- **Column 9** shows the unweighted number of responding schools after school replacement.
- **Column 10** shows the unweighted number of responding and non-responding schools after school replacement.
- **Column 11** shows the **weighted student participation rate after replacement**. This is obtained by dividing Column 12 by Column 13.
- **Column 12** shows the **weighted number of students assessed**.
- **Column 13** shows the **weighted number of students sampled** (including both students who were assessed and students who were absent on the day of the assessment).
- **Column 14** shows the **unweighted number of students assessed**. Note that any students in schools with student-response rates less than 50% were not included in these rates (both weighted and unweighted).
- **Column 15** shows the **unweighted number of students sampled** (including both students that were assessed and students who were absent on the day of the assessment). Note that any students in schools where fewer than half of the eligible students were assessed were not included in these rates (neither weighted nor unweighted).

Definition of schools

In some countries, sub-units within schools were sampled instead of schools and this may affect the estimation of the between-school variance components. In Austria, the Czech Republic, Germany, Hungary, Japan, Romania and Slovenia, schools with more than one study programme were split into the units delivering these programmes. In the Netherlands, for schools with both lower and upper secondary programmes, schools were split into units delivering each programme level. In the Flemish Community of Belgium, in the case of multi-campus schools, implantations (campuses) were sampled, whereas in the French Community, in the case of multi-campus schools, the larger administrative units were sampled. In Australia, for schools with more than one campus, the individual campuses were listed for sampling. In Argentina, Croatia and Dubai (UAE), schools that had more than one campus had the locations listed for sampling. In Spain, the schools in the Basque region with multi-linguistic models were split into linguistic models for sampling.

Grade levels

Students assessed in PISA 2009 are at various grade levels. The percentage of students at each grade level is presented by country in Table A2.4a and by gender within each country in Table A2.4b.



Table A2.4a [Part 1/1]
Percentage of students at each grade level

	Grade level												
	7th grade		8th grade		9th grade		10th grade		11th grade		12th grade		
	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	
OECD													
Australia	0.0	(0.0)	0.1	(0.0)	10.4	(0.6)	70.8	(0.6)	18.6	(0.6)	0.1	(0.0)	
Austria	0.7	(0.2)	6.2	(1.0)	42.4	(0.9)	50.7	(1.0)	0.0	(0.0)	0.0	c	
Belgium	0.4	(0.2)	5.5	(0.5)	32.0	(0.6)	60.8	(0.7)	1.2	(0.1)	0.0	(0.0)	
Canada	0.0	(0.0)	1.2	(0.2)	13.6	(0.5)	84.1	(0.5)	1.1	(0.1)	0.0	(0.0)	
Chile	1.0	(0.2)	3.9	(0.5)	20.5	(0.8)	69.4	(1.0)	5.2	(0.3)	0.0	(0.0)	
Czech Republic	0.5	(0.2)	3.8	(0.3)	48.9	(1.0)	46.7	(1.1)	0.0	c	0.0	c	
Denmark	0.1	(0.0)	14.7	(0.6)	83.5	(0.8)	1.7	(0.5)	0.0	c	0.0	c	
Estonia	1.6	(0.3)	24.0	(0.7)	72.4	(0.9)	1.8	(0.3)	0.1	(0.1)	0.0	c	
Finland	0.5	(0.1)	11.8	(0.5)	87.3	(0.5)	0.0	c	0.4	(0.1)	0.0	c	
France	1.3	(0.9)	3.6	(0.7)	34.4	(1.2)	56.6	(1.5)	4.0	(0.7)	0.1	(0.0)	
Germany	1.2	(0.2)	11.0	(0.5)	54.8	(0.8)	32.5	(0.8)	0.4	(0.1)	0.0	(0.0)	
Greece	0.4	(0.2)	1.4	(0.5)	5.5	(0.8)	92.7	(1.0)	0.0	c	0.0	c	
Hungary	2.8	(0.6)	7.6	(1.1)	67.1	(1.4)	22.4	(0.9)	0.1	(0.1)	0.0	(0.0)	
Iceland	0.0	c	0.0	c	0.0	(0.0)	98.3	(0.1)	1.7	(0.1)	0.0	c	
Ireland	0.1	(0.0)	2.4	(0.3)	59.1	(1.0)	24.0	(1.4)	14.4	(1.1)	0.0	c	
Israel	0.0	c	0.3	(0.1)	17.9	(1.0)	81.3	(1.0)	0.5	(0.2)	0.0	(0.0)	
Italy	0.1	(0.1)	1.4	(0.3)	16.9	(0.4)	78.4	(0.6)	3.2	(0.3)	0.0	c	
Japan	0.0	c	0.0	c	0.0	c	100.0	(0.0)	0.0	c	0.0	c	
Korea	0.0	c	0.0	(0.0)	4.2	(0.9)	95.1	(0.9)	0.7	(0.1)	0.0	c	
Luxembourg	0.6	(0.1)	11.6	(0.2)	51.6	(0.3)	36.0	(0.2)	0.3	(0.0)	0.0	c	
Mexico	1.7	(0.1)	7.4	(0.3)	34.5	(0.8)	55.6	(0.9)	0.7	(0.2)	0.0	(0.0)	
Netherlands	0.2	(0.2)	2.7	(0.3)	46.2	(1.1)	50.5	(1.1)	0.5	(0.1)	0.0	c	
New Zealand	0.0	c	0.0	c	0.0	(0.0)	5.9	(0.4)	88.8	(0.5)	5.3	(0.3)	
Norway	0.0	c	0.0	c	0.5	(0.1)	99.3	(0.2)	0.2	(0.1)	0.0	c	
Poland	1.0	(0.2)	4.5	(0.4)	93.6	(0.6)	0.9	(0.3)	0.0	c	0.0	c	
Portugal	2.3	(0.3)	9.0	(0.8)	27.9	(1.6)	60.4	(2.2)	0.4	(0.1)	0.0	c	
Slovak Republic	1.0	(0.2)	2.6	(0.3)	35.7	(1.4)	56.9	(1.6)	3.8	(0.8)	0.0	(0.0)	
Slovenia	0.0	c	0.1	(0.1)	3.0	(0.7)	90.7	(0.7)	6.2	(0.2)	0.0	c	
Spain	0.1	(0.0)	9.9	(0.4)	26.5	(0.6)	63.4	(0.7)	0.0	(0.0)	0.0	c	
Sweden	0.1	(0.1)	3.2	(0.3)	95.1	(0.6)	1.6	(0.5)	0.0	c	0.0	c	
Switzerland	0.6	(0.1)	15.5	(0.9)	61.7	(1.3)	21.0	(1.1)	1.2	(0.5)	0.0	(0.0)	
Turkey	0.7	(0.1)	3.5	(0.8)	25.2	(1.3)	66.6	(1.5)	3.8	(0.3)	0.2	(0.1)	
United Kingdom	0.0	c	0.0	c	0.0	c	1.2	(0.1)	98.0	(0.1)	0.8	(0.0)	
United States	0.0	c	0.1	(0.1)	10.9	(0.8)	68.5	(1.0)	20.3	(0.7)	0.1	(0.1)	
OECD average	0.8	(0.1)	5.8	(0.1)	37.0	(0.2)	52.9	(0.2)	9.9	(0.1)	0.5	(0.0)	
Partners													
Albania	0.4	(0.1)	2.2	(0.3)	50.9	(2.0)	46.4	(2.0)	0.1	(0.0)	0.0	c	
Argentina	4.7	(0.9)	12.9	(1.3)	20.4	(1.2)	57.8	(2.1)	4.3	(0.5)	0.0	c	
Azerbaijan	0.6	(0.2)	5.3	(0.5)	49.4	(1.3)	44.3	(1.3)	0.4	(0.1)	0.0	c	
Brazil	6.8	(0.4)	18.0	(0.7)	37.5	(0.8)	35.7	(0.8)	2.1	(0.1)	0.0	c	
Bulgaria	1.5	(0.3)	6.1	(0.6)	88.7	(0.9)	3.8	(0.6)	0.0	c	0.0	c	
Colombia	4.4	(0.5)	10.3	(0.7)	22.1	(0.8)	42.3	(1.0)	21.0	(1.0)	0.0	c	
Croatia	0.0	c	0.2	(0.2)	77.5	(0.4)	22.3	(0.4)	0.0	c	0.0	c	
Dubai (UAE)	1.1	(0.1)	3.4	(0.1)	14.8	(0.4)	56.9	(0.5)	22.9	(0.4)	0.9	(0.1)	
Hong Kong-China	1.7	(0.2)	7.2	(0.5)	25.2	(0.5)	65.9	(0.9)	0.1	(0.0)	0.0	c	
Indonesia	1.5	(0.5)	6.5	(0.8)	46.0	(3.1)	40.5	(3.2)	5.0	(0.8)	0.5	(0.4)	
Jordan	0.1	(0.1)	1.3	(0.2)	7.0	(0.5)	91.6	(0.6)	0.0	c	0.0	c	
Kazakhstan	0.4	(0.1)	6.4	(0.4)	73.3	(1.9)	19.7	(2.0)	0.1	(0.0)	0.0	c	
Kyrgyzstan	0.2	(0.1)	7.9	(0.5)	71.4	(1.3)	19.8	(1.4)	0.7	(0.1)	0.0	c	
Latvia	2.7	(0.5)	15.5	(0.7)	79.4	(0.9)	2.4	(0.3)	0.1	(0.1)	0.0	(0.0)	
Liechtenstein	0.8	(0.5)	17.5	(1.1)	71.3	(0.8)	10.4	(1.0)	0.0	c	0.0	c	
Lithuania	0.5	(0.1)	10.2	(0.9)	80.9	(0.8)	8.4	(0.6)	0.0	(0.0)	0.0	c	
Macao-China	6.7	(0.1)	19.2	(0.2)	34.9	(0.1)	38.7	(0.1)	0.5	(0.1)	0.0	c	
Montenegro	0.0	c	2.5	(1.7)	82.7	(1.5)	14.8	(0.3)	0.0	c	0.0	c	
Panama	2.9	(0.8)	10.6	(1.6)	30.6	(3.3)	49.8	(4.5)	6.1	(1.4)	0.0	c	
Peru	4.0	(0.4)	8.9	(0.6)	17.1	(0.7)	44.6	(1.1)	25.4	(0.8)	0.0	c	
Qatar	1.7	(0.1)	3.6	(0.1)	13.5	(0.2)	62.6	(0.2)	18.2	(0.2)	0.4	(0.1)	
Romania	0.0	c	7.2	(1.0)	88.6	(1.1)	4.3	(0.6)	0.0	c	0.0	c	
Russian Federation	0.9	(0.2)	10.0	(0.7)	60.1	(1.8)	28.1	(1.6)	0.9	(0.2)	0.0	c	
Serbia	0.2	(0.1)	2.1	(0.5)	96.0	(0.6)	1.7	(0.2)	0.0	c	0.0	c	
Shanghai-China	1.0	(0.2)	4.1	(0.4)	37.4	(0.8)	57.1	(0.9)	0.4	(0.2)	0.0	(0.0)	
Singapore	1.0	(0.2)	2.6	(0.2)	34.7	(0.4)	61.6	(0.3)	0.0	c	0.0	(0.0)	
Chinese Taipei	0.0	c	0.1	(0.0)	34.4	(0.9)	65.5	(0.9)	0.0	(0.0)	0.0	c	
Thailand	0.1	(0.0)	0.5	(0.1)	23.2	(1.1)	73.5	(1.1)	2.7	(0.4)	0.0	c	
Trinidad and Tobago	2.1	(0.2)	8.8	(0.4)	25.3	(0.4)	56.1	(0.4)	7.7	(0.3)	0.0	c	
Tunisia	6.4	(0.4)	13.4	(0.6)	23.9	(0.9)	50.9	(1.4)	5.4	(0.4)	0.0	c	
Uruguay	7.1	(0.8)	10.6	(0.6)	21.5	(0.8)	56.2	(1.1)	4.6	(0.4)	0.0	c	

[Part 1/2]

Table A2.4b Percentage of students at each grade level, by gender

		Boys – grade level											
		7th grade		8th grade		9th grade		10th grade		11th grade		12th grade	
		%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
OECD	Australia	0.0	c	0.1	(0.0)	13.1	(0.9)	69.6	(1.1)	17.1	(0.8)	0.1	(0.0)
	Austria	0.7	(0.2)	7.4	(1.2)	42.6	(1.3)	49.3	(1.3)	0.0	(0.0)	0.0	c
	Belgium	0.6	(0.2)	6.4	(0.7)	34.6	(0.9)	57.3	(1.0)	1.1	(0.2)	0.0	(0.0)
	Canada	0.0	(0.0)	1.4	(0.3)	14.6	(0.6)	82.9	(0.6)	1.1	(0.1)	0.0	(0.0)
	Chile	1.3	(0.3)	4.9	(0.6)	23.2	(1.0)	65.9	(1.3)	4.7	(0.3)	0.0	c
	Czech Republic	0.7	(0.2)	4.5	(0.5)	52.5	(2.2)	42.3	(2.4)	0.0	c	0.0	c
	Denmark	0.1	(0.0)	19.5	(0.9)	79.5	(1.0)	0.8	(0.3)	0.0	c	0.0	c
	Estonia	2.4	(0.5)	27.0	(1.0)	69.6	(1.1)	1.0	(0.3)	0.0	c	0.0	c
	Finland	0.6	(0.2)	14.0	(0.8)	85.2	(0.8)	0.0	c	0.2	(0.1)	0.0	c
	France	1.3	(0.9)	4.0	(0.6)	39.6	(1.5)	51.4	(1.9)	3.6	(0.8)	0.0	(0.0)
	Germany	1.4	(0.3)	13.1	(0.7)	56.1	(1.0)	28.8	(0.9)	0.6	(0.1)	0.0	c
	Greece	0.5	(0.2)	1.9	(0.5)	6.2	(1.2)	91.4	(1.5)	0.0	c	0.0	c
	Hungary	3.2	(0.8)	9.3	(1.3)	68.8	(1.6)	18.7	(0.9)	0.0	(0.0)	0.0	(0.0)
	Iceland	0.0	c	0.0	c	0.0	c	98.7	(0.2)	1.3	(0.2)	0.0	c
	Ireland	0.1	(0.0)	2.8	(0.5)	60.9	(1.3)	22.4	(1.5)	13.8	(1.4)	0.0	c
	Israel	0.0	c	0.5	(0.2)	19.9	(1.1)	78.7	(1.2)	1.0	(0.4)	0.0	c
	Italy	0.1	(0.1)	1.7	(0.4)	20.1	(0.6)	75.7	(0.7)	2.5	(0.3)	0.0	c
	Japan	0.0	c	0.0	c	0.0	c	100.0	(0.0)	0.0	c	0.0	c
	Korea	0.0	c	0.1	(0.1)	4.7	(1.3)	94.5	(1.4)	0.7	(0.2)	0.0	c
	Luxembourg	0.8	(0.2)	12.5	(0.4)	52.4	(0.5)	34.0	(0.4)	0.3	(0.1)	0.0	c
	Mexico	2.0	(0.2)	8.8	(0.5)	37.6	(0.9)	51.0	(0.9)	0.5	(0.2)	0.0	c
	Netherlands	0.4	(0.3)	3.0	(0.4)	48.9	(1.3)	47.3	(1.3)	0.3	(0.1)	0.0	c
	New Zealand	0.0	c	0.0	c	0.0	c	6.9	(0.5)	87.9	(0.6)	5.2	(0.5)
	Norway	0.0	c	0.0	c	0.5	(0.1)	99.2	(0.2)	0.3	(0.2)	0.0	c
	Poland	1.5	(0.3)	6.5	(0.6)	91.6	(0.7)	0.5	(0.2)	0.0	c	0.0	c
	Portugal	3.4	(0.5)	10.5	(0.9)	30.9	(2.0)	54.9	(2.6)	0.4	(0.1)	0.0	c
	Slovak Republic	1.4	(0.3)	3.7	(0.5)	40.1	(1.9)	51.6	(2.1)	3.3	(0.7)	0.0	c
	Slovenia	0.0	c	0.1	(0.1)	4.0	(1.2)	91.1	(1.2)	4.7	(0.4)	0.0	c
	Spain	0.1	(0.0)	12.2	(0.6)	28.7	(0.8)	58.9	(0.9)	0.0	(0.0)	0.0	c
	Sweden	0.0	(0.0)	4.1	(0.4)	94.7	(0.6)	1.1	(0.3)	0.0	c	0.0	c
	Switzerland	0.8	(0.2)	18.0	(1.2)	60.7	(1.8)	19.4	(1.8)	1.0	(0.4)	0.1	(0.1)
	Turkey	1.0	(0.2)	4.0	(0.9)	30.2	(1.4)	61.3	(1.7)	3.2	(0.3)	0.2	(0.1)
United Kingdom	0.0	c	0.0	c	0.0	c	1.3	(0.2)	98.0	(0.2)	0.7	(0.1)	
United States	0.0	c	0.1	(0.0)	13.2	(1.0)	68.6	(1.4)	17.9	(0.9)	0.1	(0.1)	
OECD average	1.0	(0.1)	7.0	(0.1)	40.8	(0.2)	50.8	(0.2)	9.8	(0.1)	0.7	(0.0)	
Partners	Albania	0.5	(0.2)	2.6	(0.4)	54.0	(2.0)	42.9	(2.1)	0.0	(0.0)	0.0	c
	Argentina	5.9	(1.1)	15.4	(1.4)	22.7	(1.5)	52.5	(2.4)	3.5	(0.5)	0.0	c
	Azerbaijan	0.6	(0.2)	4.7	(0.5)	47.8	(1.4)	46.5	(1.5)	0.3	(0.1)	0.0	c
	Brazil	8.4	(0.6)	21.0	(0.9)	37.8	(0.8)	31.1	(0.9)	1.7	(0.2)	0.0	c
	Bulgaria	2.0	(0.4)	7.4	(0.9)	86.9	(1.2)	3.7	(0.6)	0.0	c	0.0	c
	Colombia	5.5	(0.9)	11.5	(0.9)	21.9	(1.1)	42.4	(1.4)	18.7	(1.2)	0.0	c
	Croatia	0.0	c	0.1	(0.1)	79.1	(0.6)	20.7	(0.6)	0.0	c	0.0	c
	Dubai (UAE)	1.6	(0.2)	4.5	(0.3)	16.0	(0.6)	53.6	(0.7)	23.1	(0.6)	1.1	(0.2)
	Hong Kong-China	1.9	(0.3)	7.3	(0.6)	26.6	(0.7)	64.1	(1.0)	0.1	(0.1)	0.0	c
	Indonesia	1.8	(0.7)	8.2	(1.0)	49.3	(3.4)	36.2	(3.6)	4.0	(0.9)	0.5	(0.3)
	Jordan	0.1	(0.1)	1.2	(0.4)	7.5	(0.8)	91.2	(0.9)	0.0	c	0.0	c
	Kazakhstan	0.5	(0.1)	7.1	(0.6)	75.2	(2.2)	17.2	(2.3)	0.1	(0.0)	0.0	c
	Kyrgyzstan	0.2	(0.1)	8.9	(0.7)	72.9	(1.6)	17.4	(1.6)	0.5	(0.2)	0.0	c
	Latvia	3.6	(0.9)	19.9	(1.1)	74.7	(1.4)	1.6	(0.4)	0.1	(0.1)	0.0	(0.0)
	Liechtenstein	1.1	(0.7)	19.7	(1.6)	68.9	(1.2)	10.3	(1.2)	0.0	c	0.0	c
	Lithuania	0.6	(0.2)	12.3	(1.2)	80.0	(1.2)	7.2	(0.7)	0.0	c	0.0	c
	Macao-China	8.9	(0.2)	22.0	(0.2)	34.9	(0.2)	33.6	(0.2)	0.5	(0.1)	0.0	c
	Montenegro	0.0	c	3.0	(2.0)	85.0	(1.8)	12.0	(0.4)	0.0	c	0.0	c
	Panama	3.4	(1.1)	13.6	(2.5)	32.6	(4.4)	45.7	(5.5)	4.7	(1.8)	0.0	c
	Peru	4.9	(0.5)	11.2	(0.8)	18.8	(1.0)	42.3	(1.4)	22.9	(0.9)	0.0	c
	Qatar	1.9	(0.1)	4.3	(0.2)	14.8	(0.3)	60.4	(0.3)	18.2	(0.2)	0.4	(0.1)
	Romania	0.0	c	6.3	(1.1)	89.9	(1.3)	3.9	(0.7)	0.0	c	0.0	c
	Russian Federation	1.4	(0.3)	10.4	(0.9)	61.2	(1.9)	26.3	(1.9)	0.8	(0.2)	0.0	c
	Serbia	0.3	(0.1)	2.7	(0.7)	95.6	(0.8)	1.4	(0.2)	0.0	c	0.0	c
	Shanghai-China	1.2	(0.3)	5.1	(0.6)	38.8	(1.2)	54.7	(1.4)	0.2	(0.1)	0.0	c
	Singapore	0.8	(0.2)	2.9	(0.3)	35.7	(0.6)	60.6	(0.5)	0.0	c	0.0	c
	Chinese Taipei	0.0	c	0.2	(0.1)	35.2	(1.5)	64.7	(1.5)	0.0	c	0.0	c
	Thailand	0.2	(0.1)	0.8	(0.2)	26.3	(1.4)	70.5	(1.4)	2.2	(0.5)	0.0	c
	Trinidad and Tobago	2.7	(0.3)	10.7	(0.5)	28.4	(0.6)	51.0	(0.5)	7.1	(0.4)	0.0	c
	Tunisia	8.9	(0.6)	16.8	(0.9)	24.4	(1.1)	45.3	(1.5)	4.7	(0.5)	0.0	c
	Uruguay	9.1	(1.0)	12.0	(0.8)	24.9	(0.8)	50.4	(1.3)	3.6	(0.4)	0.0	c



[Part 2/2]
Table A2.4b Percentage of students at each grade level, by gender

	Girls – grade level													
	7th grade		8th grade		9th grade		10th grade		11th grade		12th grade			
	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.		
OECD														
Australia	0.0	(0.0)	0.1	(0.0)	7.9	(0.5)	72.0	(0.8)	20.0	(0.8)	0.1	(0.0)		
Austria	0.6	(0.4)	5.0	(1.2)	42.2	(1.4)	52.1	(1.5)	0.0	(0.0)	0.0	c		
Belgium	0.3	(0.1)	4.5	(0.5)	29.3	(1.1)	64.5	(1.1)	1.3	(0.2)	0.0	(0.0)		
Canada	0.0	(0.0)	1.0	(0.2)	12.5	(0.5)	85.3	(0.5)	1.1	(0.1)	0.0	(0.0)		
Chile	0.7	(0.1)	2.9	(0.5)	17.7	(0.9)	73.0	(1.1)	5.6	(0.4)	0.0	(0.0)		
Czech Republic	0.3	(0.2)	3.1	(0.4)	44.8	(1.9)	51.8	(1.9)	0.0	c	0.0	c		
Denmark	0.1	(0.0)	10.0	(0.7)	87.3	(0.9)	2.5	(0.8)	0.0	c	0.0	c		
Estonia	0.9	(0.3)	20.8	(0.9)	75.4	(1.1)	2.7	(0.5)	0.2	(0.2)	0.0	c		
Finland	0.4	(0.1)	9.6	(0.6)	89.4	(0.6)	0.0	c	0.6	(0.2)	0.0	c		
France	1.3	(0.9)	3.2	(0.9)	29.4	(1.5)	61.6	(1.7)	4.4	(0.8)	0.1	(0.1)		
Germany	1.1	(0.2)	8.8	(0.6)	53.4	(1.1)	36.4	(1.1)	0.3	(0.1)	0.0	(0.0)		
Greece	0.2	(0.2)	0.9	(0.5)	4.9	(0.7)	94.0	(0.9)	0.0	c	0.0	c		
Hungary	2.3	(0.7)	5.9	(1.1)	65.4	(1.6)	26.2	(1.2)	0.2	(0.1)	0.0	c		
Iceland	0.0	c	0.0	c	0.0	(0.1)	97.9	(0.2)	2.1	(0.2)	0.0	c		
Ireland	0.1	(0.1)	2.0	(0.4)	57.3	(1.5)	25.7	(2.0)	15.1	(1.5)	0.0	c		
Israel	0.0	c	0.1	(0.1)	15.9	(1.0)	83.8	(1.1)	0.2	(0.1)	0.0	(0.0)		
Italy	0.2	(0.1)	1.0	(0.2)	13.5	(0.6)	81.4	(0.7)	3.9	(0.3)	0.0	c		
Japan	0.0	c	0.0	c	0.0	c	100.0	(0.0)	0.0	c	0.0	c		
Korea	0.0	c	0.0	c	3.6	(1.0)	95.6	(1.0)	0.8	(0.1)	0.0	c		
Luxembourg	0.4	(0.1)	10.6	(0.3)	50.8	(0.4)	38.0	(0.3)	0.2	(0.1)	0.0	c		
Mexico	1.5	(0.2)	6.1	(0.4)	31.5	(0.9)	60.1	(1.0)	0.8	(0.3)	0.0	(0.0)		
Netherlands	0.1	(0.1)	2.3	(0.4)	43.4	(1.4)	53.5	(1.3)	0.7	(0.2)	0.0	c		
New Zealand	0.0	c	0.0	c	0.1	(0.1)	4.8	(0.5)	89.8	(0.6)	5.4	(0.5)		
Norway	0.0	c	0.0	c	0.4	(0.1)	99.4	(0.2)	0.1	(0.1)	0.0	c		
Poland	0.6	(0.2)	2.5	(0.3)	95.6	(0.7)	1.3	(0.6)	0.0	c	0.0	c		
Portugal	1.4	(0.2)	7.7	(0.8)	25.1	(1.4)	65.4	(1.9)	0.4	(0.1)	0.0	c		
Slovak Republic	0.7	(0.2)	1.5	(0.3)	31.4	(1.8)	62.1	(2.1)	4.3	(0.9)	0.0	(0.0)		
Slovenia	0.0	c	0.0	c	1.9	(0.7)	90.3	(0.8)	7.8	(0.5)	0.0	c		
Spain	0.1	(0.1)	7.6	(0.4)	24.2	(0.7)	68.0	(0.8)	0.0	(0.0)	0.0	c		
Sweden	0.1	(0.1)	2.3	(0.3)	95.4	(0.7)	2.2	(0.7)	0.0	c	0.0	c		
Switzerland	0.4	(0.1)	12.9	(0.9)	62.6	(1.8)	22.7	(2.0)	1.4	(0.6)	0.0	c		
Turkey	0.4	(0.2)	2.9	(0.8)	19.8	(1.3)	72.3	(1.6)	4.4	(0.4)	0.2	(0.1)		
United Kingdom	0.0	c	0.0	c	0.0	c	1.0	(0.1)	98.1	(0.1)	0.9	(0.1)		
United States	0.0	c	0.2	(0.2)	8.5	(0.7)	68.4	(1.1)	22.8	(1.0)	0.1	(0.1)		
OECD average	0.6	(0.1)	5.0	(0.1)	35.6	(0.2)	55.0	(0.2)	10.2	(0.1)	0.5	(0.0)		
Partners														
Albania	0.2	(0.1)	1.8	(0.4)	47.6	(2.3)	50.2	(2.3)	0.2	(0.1)	0.0	c		
Argentina	3.6	(0.9)	10.7	(1.5)	18.4	(1.2)	62.3	(2.2)	4.9	(0.6)	0.0	c		
Azerbaijan	0.6	(0.3)	5.8	(0.6)	51.0	(1.5)	42.1	(1.4)	0.4	(0.1)	0.0	c		
Brazil	5.4	(0.4)	15.3	(0.6)	37.1	(0.9)	39.7	(0.9)	2.5	(0.2)	0.0	c		
Bulgaria	0.9	(0.3)	4.6	(0.7)	90.6	(1.0)	3.9	(0.7)	0.0	c	0.0	c		
Colombia	3.3	(0.4)	9.1	(0.8)	22.4	(1.0)	42.2	(1.1)	23.0	(1.1)	0.0	c		
Croatia	0.0	c	0.2	(0.2)	75.8	(0.6)	24.1	(0.5)	0.0	c	0.0	c		
Dubai (UAE)	0.6	(0.1)	2.2	(0.2)	13.5	(0.5)	60.4	(0.6)	22.7	(0.7)	0.6	(0.1)		
Hong Kong-China	1.5	(0.2)	7.1	(0.6)	23.5	(0.6)	67.9	(1.0)	0.0	c	0.0	c		
Indonesia	1.2	(0.3)	4.9	(0.8)	42.7	(3.7)	44.6	(3.8)	6.0	(1.1)	0.6	(0.5)		
Jordan	0.1	(0.0)	1.3	(0.3)	6.5	(0.7)	92.1	(0.9)	0.0	c	0.0	c		
Kazakhstan	0.4	(0.1)	5.7	(0.5)	71.5	(2.0)	22.3	(2.1)	0.2	(0.1)	0.0	c		
Kyrgyzstan	0.1	(0.1)	7.1	(0.6)	69.9	(1.5)	22.0	(1.6)	0.9	(0.2)	0.0	c		
Latvia	1.7	(0.4)	11.2	(0.6)	83.9	(0.8)	3.1	(0.4)	0.1	(0.1)	0.0	c		
Liechtenstein	0.6	(0.6)	15.0	(1.5)	74.0	(1.2)	10.4	(1.6)	0.0	c	0.0	c		
Lithuania	0.3	(0.1)	8.1	(0.8)	81.9	(0.9)	9.6	(0.7)	0.0	(0.0)	0.0	c		
Macao-China	4.4	(0.1)	16.3	(0.2)	34.9	(0.2)	43.9	(0.2)	0.5	(0.1)	0.0	c		
Montenegro	0.0	c	2.0	(1.4)	80.3	(1.3)	17.8	(0.4)	0.0	c	0.0	c		
Panama	2.4	(0.6)	7.7	(1.1)	28.7	(3.0)	53.8	(4.0)	7.5	(1.6)	0.0	c		
Peru	3.2	(0.4)	6.5	(0.6)	15.4	(0.8)	47.0	(1.2)	27.9	(1.2)	0.0	c		
Qatar	1.4	(0.1)	3.0	(0.1)	12.1	(0.2)	64.9	(0.2)	18.1	(0.2)	0.5	(0.1)		
Romania	0.0	c	8.1	(1.5)	87.3	(1.5)	4.7	(0.6)	0.0	c	0.0	c		
Russian Federation	0.5	(0.1)	9.7	(0.8)	59.0	(2.0)	29.8	(1.8)	1.0	(0.2)	0.0	c		
Serbia	0.1	(0.1)	1.4	(0.5)	96.4	(0.6)	2.0	(0.2)	0.0	c	0.0	c		
Shanghai-China	0.8	(0.2)	3.0	(0.4)	36.1	(1.0)	59.5	(1.0)	0.6	(0.2)	0.0	(0.0)		
Singapore	1.2	(0.2)	2.3	(0.3)	33.7	(0.5)	62.7	(0.4)	0.0	c	0.0	(0.0)		
Chinese Taipei	0.0	c	0.0	(0.0)	33.7	(1.5)	66.3	(1.5)	0.0	(0.0)	0.0	c		
Thailand	0.0	c	0.3	(0.1)	20.9	(1.4)	75.8	(1.4)	3.0	(0.4)	0.0	c		
Trinidad and Tobago	1.5	(0.3)	6.9	(0.5)	22.3	(0.6)	61.0	(0.6)	8.3	(0.4)	0.0	c		
Tunisia	4.2	(0.4)	10.3	(0.5)	23.4	(1.0)	56.1	(1.4)	6.0	(0.5)	0.0	c		
Uruguay	5.4	(0.6)	9.4	(0.5)	18.5	(0.9)	61.4	(1.2)	5.4	(0.6)	0.0	c		

Students in or out of the regular education system in Argentina


The low performance of 15-year-old students in Argentina is, to some extent, influenced by a fairly large proportion of 15-year-olds enrolled in programmes outside the regular education system. Table A2.5 shows the proportion of students inside and outside the regular education system, alongside their performance in PISA 2009.

Table A2.5 Percentage of students and mean scores in reading, mathematics and science, according to whether students are in or out of the regular education system in Argentina

	Percentage of students		Mean performance					
			Reading		Mathematics		Science	
	%	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
Students in the regular educational system ¹	60.9	2.2	439	5.1	421	4.8	439	4.9
Students out of the regular educational system ²	39.1	2.2	335	8.0	337	6.7	341	8.3

1. Students who are not in grade 10 or 11 and in programme 3, 4, 5, 6, 7 or 8.

2. Students who are in grade 10 or 11 and in programme 3, 4, 5, 6, 7 or 8.

StatLink  <http://dx.doi.org/10.1787/888932343190>



ANNEX A3 STANDARD ERRORS, SIGNIFICANCE TESTS AND SUB-GROUP COMPARISONS

The statistics in this report represent estimates of national performance based on samples of students, rather than values that could be calculated if every student in every country had answered every question. Consequently, it is important to measure the degree of uncertainty of the estimates. In PISA, each estimate has an associated degree of uncertainty, which is expressed through a standard error. The use of confidence intervals provides a way to make inferences about the population means and proportions in a manner that reflects the uncertainty associated with the sample estimates. From an observed sample statistic and assuming a normal distribution, it can be inferred that the corresponding population result would lie within the confidence interval in 95 out of 100 replications of the measurement on different samples drawn from the same population.

In many cases, readers are primarily interested in whether a given value in a particular country is different from a second value in the same or another country, e.g. whether girls in a country perform better than boys in the same country. In the tables and charts used in this report, differences are labelled as statistically significant when a difference of that size, smaller or larger, would be observed less than 5% of the time, if there were actually no difference in corresponding population values. Similarly, the risk of reporting a correlation as significant if there is, in fact, no correlation between two measures, is contained at 5%.

Throughout the report, significance tests were undertaken to assess the statistical significance of the comparisons made. Except when noted statistical test evaluate whether the estimate is significantly different from zero. In specific cases statistical tests evaluate whether the estimates for individual countries are statistically different from the OECD average.

Gender differences

Gender differences in student performance or other indices were tested for statistical significance. Positive differences indicate higher scores for boys while negative differences indicate higher scores for girls. Generally, differences marked in bold in the tables in this volume are statistically significant at the 95% confidence level.

Performance differences between the top and bottom quartiles of PISA indices and scales

Differences in average performance between the top and bottom quarters of the PISA indices and scales were tested for statistical significance. Figures marked in bold indicate that performance between the top and bottom quarters of students on the respective index is statistically significantly different at the 95% confidence level.

Change in the performance per unit of the index

For many tables, the difference in student performance per unit of the index shown was calculated. Figures in bold indicate that the differences are statistically significantly different from zero at the 95% confidence level.

Relative risk or increased likelihood

The relative risk is a measure of association between an antecedent factor and an outcome factor. The relative risk is simply the ratio of two risks, i.e. the risk of observing the outcome when the antecedent is present and the risk of observing the outcome when the antecedent is not present. Figure A3.1 presents the notation that is used in the following.

■ Figure A3.1 ■

Labels used in a two-way table

p_{11}	p_{12}	$p_{1.}$
p_{21}	p_{22}	$p_{2.}$
$p_{.1}$	$p_{.2}$	$p_{..}$

$p_{.}$ is equal to $\frac{n_{.}}{n_{..}}$, with $n_{.}$ the total number of students and $p_{..}$ is therefore equal to 1, $p_{i.}$, $p_{.j}$ respectively represent the marginal probabilities for each row and for each column. The marginal probabilities are equal to the marginal frequencies divided by the total number of students. Finally, the p_{ij} represent the probabilities for each cell and are equal to the number of observations in a particular cell divided by the total number of observations.

In PISA, the rows represent the antecedent factor with the first row for “having the antecedent” and the second row for “not having the antecedent” and the columns represent the outcome with, the first column for “having the outcome” and the second column for “not having the outcome”. The relative risk is then equal to:

$$RR = \frac{(p_{11} / p_{1.})}{(p_{21} / p_{2.})}$$

Figures in bold in the data tables presented in Annex B of this report indicate that the relative risk is statistically significantly different from 1 at the 95% confidence level.

Difference in reading performance between native students and students with an immigrant background

Differences in performance between native and non-native students were tested for statistical significance. For this purpose, first-generation and second-generation students were jointly considered as students with an immigrant background. Positive differences represent higher scores for native students, while negative differences represent higher scores for first-generation and second-generation students. Figures in bold in data tables presented in this volume indicate statistically significantly different scores at the 95% confidence level.

Effect sizes

Sometimes it is useful to compare differences in an index between groups, such as males and females, across countries. A problem that may occur in such instances is that the distribution of the index varies across groups or countries. One way to resolve this is to calculate an effect size that accounts for differences in the distributions. An effect size measures the difference between, say, the self-efficacy in reading of male and female students in a given country, relative to the average variation in self-efficacy in reading scores among male and female students in the country.

An effect size also allows a comparison of differences across measures that differ in their metric. For example, it is possible to compare effect sizes between the PISA indices and the PISA test scores, as when, for example, gender differences in performance in reading are compared with the gender differences in several of the indices.

In accordance with common practices, effect sizes less than 0.20 are considered small in this volume, effect sizes in the order of 0.50 are considered medium, and effect sizes greater than 0.80 are considered large. Many comparisons in this report consider differences only if the effect sizes are equal to or greater than 0.20, even if smaller differences are still statistically significant; figures in bold in data tables presented in Annex B of this report indicate values equal to or greater than 0.20. Values smaller than 0.20 but that due to rounding are shown as 0.20 in tables and figures have not been highlighted. Light shading represents the absolute value of effect size is equal or more than 0.2 and less than 0.5; medium shading represents the absolute value of effect size is equal or more than 0.5 and less than 0.8; and dark shading represents the absolute value of effect size is equal or more than 0.8.

The effect size between two sub-groups is calculated as:

$$\frac{m_1 - m_2}{\sqrt{\frac{\sigma_1^2 + \sigma_2^2}{2}}}, \text{ i.e.}$$

m_1 and m_2 respectively represent the mean values for the sub-groups 1 and 2. σ_1^2 and σ_2^2 respectively represent the values of variance for the sub-groups 1 and 2. The effect size between the two sub-groups 1 and 2 is calculated as dividing the mean difference between the two sub-groups ($m_1 - m_2$), by the square root of the sum of the sub-group's variance ($\sigma_1^2 + \sigma_2^2$) divided by 2.



ANNEX A4

QUALITY ASSURANCE

Quality assurance procedures were implemented in all parts of PISA 2009, as was done for all previous PISA surveys.

The consistent quality and linguistic equivalence of the PISA 2009 assessment instruments were facilitated by providing countries with equivalent source versions of the assessment instruments in English and French, and requiring countries (other than those assessing students in English and French) to prepare and consolidate two independent translations using both source versions. Precise translation and adaptation guidelines were supplied, also including instructions for selecting and training the translators. For each country, the translation and format of the assessment instruments (including test materials, marking guides, questionnaires and manuals) were verified by expert translators appointed by the PISA Consortium before they were used in the PISA 2009 Field Trial and Main Study. These translators' mother tongue was the language of instruction in the country concerned and they were knowledgeable about education systems. For further information on the PISA translation procedures, see the *PISA 2009 Technical Report* (OECD, forthcoming).

The survey was implemented through standardised procedures. The PISA Consortium provided comprehensive manuals that explained the implementation of the survey, including precise instructions for the work of School Co-ordinators and scripts for Test Administrators to use during the assessment sessions. Proposed adaptations to survey procedures, or proposed modifications to the assessment session script, were submitted to the PISA Consortium for approval prior to verification. The PISA Consortium then verified the national translation and adaptation of these manuals.

To establish the credibility of PISA as valid and unbiased, and to encourage uniformity in administering the assessment sessions, Test Administrators in participating countries were selected using the following criteria: it was required that the Test Administrator not be the reading, mathematics or science instructor of any students in the sessions he or she would administer for PISA; it was recommended that the Test Administrator not be a member of the staff of any school where he or she would administer for PISA; and it was considered preferable that the Test Administrator not be a member of the staff of any school in the PISA sample. Participating countries organised an in-person training session for Test Administrators.

Participating countries were required to ensure that: Test Administrators worked with the School Co-ordinator to prepare the assessment session, including updating student tracking forms and identifying excluded students; no extra time was given for the cognitive items (while it was permissible to give extra time for the student questionnaire); no instrument was administered before the two one-hour parts of the cognitive session; Test Administrators recorded the student participation status on the student tracking forms and filled in a Session Report Form; no cognitive instrument was permitted to be photocopied; no cognitive instrument could be viewed by school staff before the assessment session; and Test Administrators returned the material to the National Centre immediately after the assessment sessions.

National Project Managers were encouraged to organise a follow-up session when more than 15% of the PISA sample was not able to attend the original assessment session.

National Quality Monitors from the PISA Consortium visited all National Centres to review data-collection procedures. Finally, School Quality Monitors from the PISA Consortium visited a sample of 15 schools during the assessment. For further information on the field operations, see the *PISA 2009 Technical Report* (OECD, forthcoming).

Marking procedures were designed to ensure consistent and accurate application of the marking guides outlined in the PISA Operations Manuals. National Project Managers were required to submit proposed modifications to these procedures to the Consortium for approval. Reliability studies to analyse the consistency of marking were implemented, these are discussed in more detail below.

Software specially designed for PISA facilitated data entry, detected common errors during data entry, and facilitated the process of data cleaning. Training sessions familiarised National Project Managers with these procedures.

For a description of the quality assurance procedures applied in PISA and in the results, see the *PISA 2009 Technical Report* (OECD, forthcoming).

The results of data adjudication show that the PISA Technical Standards were fully met in all countries and economies that participated in PISA 2009, though for one country, some serious doubts were raised. Analysis of the data for Azerbaijan suggest that the PISA Technical Standards may not have been fully met for the following four main reasons: *i*) the order of difficulty of the clusters is inconsistent with previous experience and the ordering varies across booklets; *ii*) the percentage correct on some items is higher than that of the highest scoring countries; *iii*) the difficulty of the clusters varies widely across booklets; and *iv*) the coding of items in Azerbaijan is at an extremely high level of agreement between independent coders, and was judged, on some items, to be too lenient. However, further investigation of the survey instruments, the procedures for test implementation and coding of student responses at the national level did not provide sufficient evidence of systematic errors or violations of the PISA Technical Standards. Azerbaijan's data are, therefore, included in the PISA 2009 international dataset.



For the PISA 2009 assessment in Austria, a dispute between teacher unions and the education minister has led to the announcement of a boycott of PISA which was withdrawn after the first week of testing. The boycott required the OECD to remove identifiable cases from the dataset. Although the Austrian dataset met the PISA 2009 technical standards after the removal of these cases, the negative atmosphere in regard to educational assessment has affected the conditions under which the assessment was administered and could have adversely affected student motivation to respond to the PISA tasks. The comparability of the 2009 data with data from earlier PISA assessments can therefore not be ensured and data for Austria have therefore been excluded from trend comparisons.



ANNEX A5 LATENT PROFILE ANALYSIS

This annex describes the methods used for the classification of students presented in Chapters 1 and 2. Latent profile analysis was performed to identify profiles of readers based on the extent to which students read comic books, magazines, newspapers, fiction and non-fiction books for enjoyment, as well as on their awareness of effective learning strategies to understand, remember and summarise information. The analysis shows how different reading patterns are associated with reading performance.

Method

A key aim of the report is to identify what it takes to be an effective learner – whereby effectiveness is measured in terms of performance on the PISA reading assessment – in different countries. Latent profile analysis was used to ascertain whether students could be reliably assigned to a small number of groups that share similar profiles. Unlike traditional cluster analysis, latent profile analysis is model-based, and so provides the opportunity to assess the validity of the latent profile classes rigorously.

Latent profile analysis is a method that allows researchers to ascertain whether individual observations – in the context of Chapter 2 of this Volume students – can be reliably assigned to a small number of groups that share similar profiles. In a sense, latent profile analysis “clusters” students into unique profile groups. Latent profile analysis assumes that the population distribution of the observed variables is a mixture of several normal distributions. Thus, each variable y_i , given the model parameters ($\theta = \pi_k, \mu_k, \Sigma_k$), can be represented as a weighted mixture of K classes, where K is specified by the analyst according to theory, although exploratory studies of the number of latent profiles can also be conducted. The distribution for each class was defined by a mean vector (μ_k) and a covariance vector (Σ_k) (Pastor et al, 2006). In functional form, $f(y_i | \theta) = \sum_{k=1}^K \pi_k f_k(y_i | \mu_k, \Sigma_k)$.

In the report, latent profile analysis was conducted with *multiple categorical latent variables*. This model assumes that there are several dimensions (*i.e.* latent variables) when classifying students into groups. Because latent profile analysis is model-based, several dimensions were hypothesised according to findings presented in the Volume on the strong association between reading performance and reading different types of materials and awareness of effective strategies to understand, remember and summarise information.

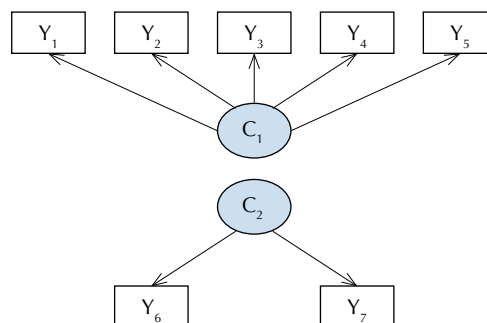
Figure A5.1 illustrates the two categorical latent variables model (a model with two dimensions) employed to estimate profiles of students in Chapter 2. Figure A5.1 shows how the first dimension, characterising the material students read several times a month or several times a week – *i.e.* categorical latent variable C1 – is identified by five variables: whether students read comic books, fiction, non-fiction, magazines and newspapers. The second dimension, characterising students’ awareness of effective learning strategies – *i.e.* categorical latent variable C2 – is identified by two variables: awareness of effective strategies to understand and remember information and awareness of effective strategies summarise information. Means are specified to vary only across the classes within each dimension. After grouping students into classes within each dimension, groupings are assigned according to the combination of the two dimensions, C1 and C2. Three classes were extracted from the first dimension, and two classes were extracted from the second dimension, resulting in a total of 6 groups that students could be assigned (3 x 2). The models were estimated by maximum likelihood with robust standard errors.

Models were estimated for the 295,074 students in 34 OECD countries. Because all countries contributed equally to the analysis, students in larger countries were given a somewhat lower weight in estimates than students in smaller countries. Students from partner countries and economies were grouped into each class using estimates for the OECD countries: once the estimates for the 34 OECD countries were obtained, these coefficients were applied to partner countries and economies to find their fit within the classes obtained for OECD countries. The fit statistics for students in partner countries and economies using the OECD estimates were generally satisfactory and in line with those obtained for OECD countries.

Mplus software was used to estimate the latent profile analyses.

■ Figure A5.1 ■

Latent profile analysis with two categorical latent variables





Missing data

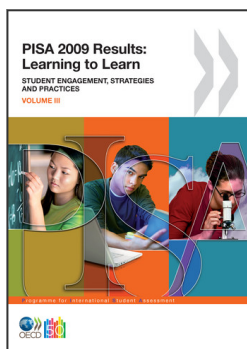
Unfortunately, some information for the variables used in the latent profile analysis was not available for all students: 3 380 students had to be excluded from the analyses because of missing information, approximately 1.1% of entire sample. The model-based approach for categorical and continuous data implemented in Mplus was used to estimate parameters. Model-based approaches can estimate parameters even when data are missing (Lüdtke, Robitzsch, Trautwein & Köller, 2007). Specifically, Mplus uses the EM algorithm (for a detailed description, see Dempster, Laird & Rubin, 1977) and assumes that the missing data are missing at random (MAR). MAR means missing values on an observed variable are not dependent on that variable but may be a function of other variables. For example, if a student did not report whether he or she reads fiction several times a month or several times a week, the model assumes that this is not due to reading fiction, but may be due to other characteristics of the student (Schafer & Graham, 2002).

Models

The model has two dimensions (*i.e.* categorical latent variables): materials students read several times a month or several times a week and awareness of effective learning strategies in reading. The first dimension, material students read either several times a month or several times a week is characterised by five variables: whether students read comic books, magazines, newspapers, fiction and non-fiction books. The second dimension, awareness of learning strategies in reading, is characterised by two variables: awareness of effective strategies to understand and remember information and awareness of effective strategies to summarise information. Given the model fit, three classes were extracted from the first dimension, and two classes were extracted from the second dimension. Given the combination of these classes, students were assigned to 6 groups (3 x 2).

Entropy index

The entropy index value for the OECD countries and partner countries is 0.691 and 0.685 respectively. The entropy index is measured on a zero-to-one scale with a value of one indicating that students are perfectly classified. High values of the entropy index therefore indicate a good classification of students into different groups.



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