PISA 2022 Technical Report

13 Sampling Outcomes

This chapter reports on the PISA 2022 sampling outcomes. Details of the sample design and selection are provided in Chapter 6 of this Technical Report.

Population coverage

Quality indicators for population coverage and the information used to develop them are presented in Table 13.1 and Table 13.2, for participating countries/economies and adjudicated regions, respectively. The following notes explain the meaning of each coverage index and how the data in each column of the table were used.

Coverage indices 1, 2 and 3 are intended to measure PISA population coverage. Coverage indices 4 and 5 are intended to be diagnostic in cases where indices 1, 2 or 3 have unexpected values. Many references are made in this chapter to the various sampling tasks on which National Project Managers (NPMs) documented statistics and other information needed in undertaking the sampling of schools and students. Note that although no comparison is made between the total population of 15-year-olds and the enrolled population of 15-year-old students, generally the enrolled population was expected to be less than or equal to the total population. Occasionally this was not the case due to differing data sources for these two values.

The components used for the coverage indices are the following:

- ST7a_1: National population of all 15-year-olds based on national statistics.
- ST7a_2.1: Enrolled 15-year-old students in grades 7 and above based on national statistics.
- ST7b_1: Target population that includes all enrolled 15-year-old students in grades 7 and above that omits schools based on national statistics such as schools located in unsafe areas.
- ST7b_3: Target population that includes all enrolled 15-year-old students in grades 7 and above, minus school-level exclusions, based on national statistics.
- P: Weighted number of participating students calculated from the PISA sample.
- E: Weighted estimate of within-school excluded students calculated from the PISA sample.
- S: Estimate of enrolled students from school sampling frame calculated as the sum over all sampled schools of the product of each school's sampling weight and its number of 15-year-old students.

Coverage Index 1: Coverage of the national *target* population, $P/(P+E) \times (\text{ST7b\_3/ST7b\_1})$. This estimates the extent to which the weighted participants covered the final *target* population after all exclusions. It indicates the overall proportion of the *target* population covered by the non-excluded portion of the student sample.

Coverage Index 2: Coverage of the national *enrolled* population, $P/(P+E) \times (\text{ST7b\_3/ST7a\_2.1})$. This estimates the extent to which the weighted participants covered the population of all *enrolled* students in grades 7 and above. Thus, this index may be somewhat lower than Index 1.

Coverage Index 3: Coverage of the national *15-year-old* population, *P*/ST7a_1. This estimates the proportion of the national population of 15-year-olds covered by the non-excluded portion of the student sample. It is below 1.0 to the extent that 15-year-olds were excluded, or not enrolled in grade 7 or higher.

Coverage Index 4: Coverage of the estimated school population, (*P*+*E*)/*S*. This estimates the proportion of the estimated school 15-year-old population that is represented by the weighted student sample of all PISA-eligible 15-year-old students. Its purpose is to assess whether the enrolment data on the sampling frame is a reliable measure of the number of enrolled 15-year-olds. As the enrolment data on the frame was often inaccurate, this index usually differed noticeably from 1.0. In such cases, Indexes 1 and 2 may be suspect, as they rely on national enrolment data for their denominators, often derived from the same source as the school-level enrolment data.

Coverage Index 5: Coverage of the school sampling frame population, *S*/ST7b_3. This estimate provides a check as to whether the data on enrolment obtained from national statistics is consistent with the enrolment on the sampling frame. However, in most cases for PISA, the enrolment data based on national statistics were derived using data from the sampling frame by the NPM, and so this ratio was close to 1.0 for most countries/economies, even when the enrolment data on the school sampling frame were poor.

School and student response rates

Table 13.3, Table 13.4, Table 13.5, Table 13.6, Table 13.7 and Table 13.8 present school and student-level response rates at the national and regional levels. Response rates are all presented separately by participating country/economy, and by adjudicated regions.

When calculating school response rates before replacement, the numerator consisted of all original sample schools with enrolled age-eligible students who participated (i.e., assessed a sample of PISA-eligible students, and obtained a student response rate of at least 33%). The denominator consisted of all the schools in the numerator, plus those original sample schools with enrolled age-eligible students that either did not participate or failed to assess at least 33% of PISA-eligible sample students. Schools that were included in the sampling frame but were found to have no age-eligible students, or which were excluded in the field were omitted from the calculation of response rates. Replacement schools do not figure in these calculations.

When calculating school response rates after replacement, the numerator consisted of all sampled schools (original plus replacement) with enrolled age-eligible students that participated (i.e., assessed a sample of PISA-eligible students and obtained a student response rate of at least 33%). The denominator consisted of all the schools in the numerator, plus those original sample schools that had age-eligible students enrolled, but that failed to assess at least 33% of PISA-eligible sample students and for which no replacement school participated. Schools that were included in the sampling frame but were found to contain no age-eligible students, were omitted from the calculation of response rates. Replacement schools were included in rates only when they participated and were replacing a refusing school that had age-eligible students.

When calculating weighted school response rates, each school received a weight equal to the product of its base weight (the reciprocal of its selection probability) and the number of age-eligible students enrolled in the school, as indicated on the school sampling frame.

With the use of probability proportional to size sampling, where there are no certainty or small schools, the product of the initial weight and the enrolment will be a constant, so in participating countries/economies with few certainty school selections and no oversampling or undersampling of any explicit strata, weighted and unweighted rates are very similar. The weighted school response rate before replacement is given by the formula:

Formula 13.1

$$\frac{weighted\ school\ response\ rate}{before\ replacement} = \frac{\sum\limits_{i \in Y} W_i E_i}{\sum\limits_{i \in (Y \cup N)} W_i E_i}$$

where Y denotes the set of responding original sample schools with age-eligible students, N denotes the set of eligible non-responding original sample schools, W_i denotes the base weight for school i, $W_i = 1/P_i$ where P_i denotes the school selection probability for school i, and E_i denotes the enrolment size of age-eligible students, as indicated on the sampling frame. The weighted school response rate, after replacement, is given by the formula:

Formula 13.2

$$\frac{weighted\ school\ response\ rate}{after\ replacement} = \frac{\sum\limits_{i \in (Y \cup R)} W_i E_i}{\sum\limits_{i \in (Y \cup R \cup N)} W_i E_i}$$

where Y denotes the set of responding original sample schools, R denotes the set of responding replacement schools, for which the corresponding original sample school was eligible but was non-responding, N denotes the set of eligible refusing original sample schools, W_i denotes the base weight for school i, $W_i = 1/P_i$, where P_i denotes the school selection probability for school i, and for weighted rates, E_i denotes the enrolment size of age-eligible students, as indicated on the sampling frame.

For unweighted student response rates, the numerator is the number of students for whom assessment data were included in the results. The denominator is the number of sampled students who were age-eligible, and not explicitly excluded as student exclusions.

For weighted student response rates, the same students appear in the numerator and denominator as for unweighted rates, but each student is weighted by its student base weight. This is given as the product of the school base weight – for the school in which the student was enrolled – and the reciprocal of the student selection probability within the school.

In countries/economies with no oversampling of any explicit strata, weighted and unweighted student response rates are very similar.

Overall response rates are calculated as the product of school and student response rates. Although overall weighted and unweighted rates can be calculated, there is little value in presenting overall unweighted rates. The weighted rates indicate the proportion of the student population represented by the sample prior to making the school and student non-response adjustments.

Teacher response rates

Unweighted response rates for teachers were created using similar methods to those for unweighted student and school response rates – that is, ineligible teachers are not used in the denominator for the rate calculation.

For weighted teacher response rates, the same teachers appear in the numerator and denominator as for unweighted rates, but each teacher is weighted by its teacher base weight. This is given as the product of the school base weight – for the school in which the teacher was working – and the reciprocal of the teacher selection probability within the school (Table 13.9).

Design effects and effective sample sizes

Surveys in education and especially international surveys rarely sample students by simply selecting a random sample of students (known as a simple random sample, or SRS). Rather, a sampling design is used where schools are first selected and, within each selected school, classes or students are randomly sampled. Sometimes, geographic areas are first selected before sampling schools and students. This sampling design is usually referred to as a cluster sample or a multi-stage sample.

Selected students attending the same school cannot be considered as independent observations as assumed with a simple random sample because they are usually more similar to one another than to students attending other schools. For instance, the students are offered the same school resources, may have the same teachers and therefore are taught a common implemented curriculum, and so on. School differences are also larger if different educational programmes are not available in all schools. One expects to observe greater differences between a vocational school and an academic school than between two comprehensive schools.

Furthermore, it is well known that within a country/economy, within sub-national entities and within a city, people tend to live in areas according to their financial resources. As children usually attend schools close to their home, it is likely that students attending the same school come from similar social and economic backgrounds.

Therefore, a simple random sample of 4 000 students within a country/economy is thus likely to cover the diversity of the population better than a sample of 100 schools with 40 students observed within each school. It follows that the uncertainty associated with any population parameter estimate (i.e., standard error) will be larger for a clustered sample estimate than for a simple random sample estimate of the same size.

In the case of a simple random sample, the standard error of a mean estimate is equal to:

Formula 13.3

$$S_{(\hat{m})} = \sqrt{\frac{S^2}{n}}$$

where σ^2 denotes the variance of the whole student population and n is the student sample size.

For an infinite population of schools and infinite populations of students within schools, the standard error of a mean estimate from a cluster sample is equal to:

Formula 13.4

$$S_{(\hat{m})} = \sqrt{\frac{S_{schools}^2}{n_{schools}} + \frac{S_{within}^2}{n_{schools} n_{students}}}$$

where $\sigma^2 schools$ denotes the variance of the school means, $\sigma^2 within$ denotes the variances of students within schools, $nschools$ denotes the sample size of schools, and $nstudents$ denotes the sample size of students within each school.

The standard error for the mean from a simple random sample is inversely proportional to the square root of the number of selected students. The standard error for the mean from a cluster sample is proportional to the variance that lies between clusters (i.e., schools) and within clusters, and inversely proportional to the square root of the number of selected schools and is also a function of the number of students selected per school.

It is usual to express the decomposition of the total variance into the between-school variance and the within-school variance by the coefficient of intraclass correlation, also denoted *Rho*. Mathematically, this index is equal to:

Formula 13.5

$$Rho = \frac{S^2_{schools}}{S^2_{schools} + S^2_{within}}$$

This index provides an indication of the percentage of variance that lies between schools. A low intraclass *correlation* indicates that schools are performing similarly while higher values point towards large differences between school performance.

To limit the reduction of precision in the population parameter estimate, multi-stage sample designs usually use supplementary information to improve coverage of the population diversity. In PISA the following techniques were implemented to limit the increase in the standard error: (i) explicit and implicit stratification of the school sampling frame and (ii) selection of schools with probabilities proportional to their size. Complementary information generally cannot compensate totally for the increase in the standard error due to the multi-stage design however but will greatly reduce it.

It is usual to express the effect of the sampling design on the standard errors by a statistic referred to as the design effect. This corresponds to the ratio of the variance of the estimate obtained from the (more complex) sample to the variance of the estimate that would be obtained from a simple random sample of the same number of sampling units. The design effect has two primary uses – in sample size estimation and in appraising the efficiency of more complex sampling plans (Cochran, 1977[1]).

In PISA, as sampling variance has to be estimated by using the 80 *BRR* replicates, a design effect can be computed for a statistic *t* using:

Formula 13.6

$$Deff(t) = \frac{Var_{BRR}(t)}{Var_{SRS}(t)}$$

where *VarBRR(t)* is the sampling variance for the statistic *t* computed by the *BRR* replication method, and *VarSRS(t)* is the sampling variance for the same statistic t on the same data but considering the sample as a simple random sample.

Based on a hypothetical country/economy, where the unbiased BRR standard error on the mean proficiency estimate is equal to 1.46, and the standard deviation is equal to *102.29*, on a sample of 14 530 students, the design effect for the mean proficiency estimate is therefore calculated as:

Formula 13.7

$$Deff(t) = \frac{Var_{BRR}(t)}{Var_{SRS}(t)} = \frac{(1.46)^2}{[102.29^2/14\ 530]} = 2.96$$

This means the sampling variance on the proficiency estimate is about 2.96 times larger than it would have been with a simple random sample of the same sample size.

Another way to express the reduction of precision due to the complex sampling design is through the effective sample size, which expresses the simple random sample size that would give the same sampling

variance as the one obtained from the actual complex sample design. The effective sample size for a statistic *t* is equal to:

Formula 13.8

$$Effn(t) = \frac{n}{Deff(t)} = \frac{n \acute{} Var_{SRS}(t)}{Var_{BRR}(t)}$$

where *n* is equal to the actual number of units in the sample. The effective sample size in our example would then be equal to:

Formula 13.9

$$Effn(t) = \frac{n}{Deff(t)} = \frac{14\,530}{2.96} = 4\,909$$

In other words, a simple random sample of about *4 909* students in this hypothetical country/economy would have been as precise as the actual sample for the national proficiency estimate.

Variability of the design effect

Neither the design effect nor the effective sample size is a definitive characteristic of a sample. Both the design effect and the effective sample size vary with the variable and statistic of interest.

As previously stated, the sampling variance for estimates of the mean from a cluster sample is proportional to the intraclass correlation. In some countries/economies, student performance varies between schools. Students in academic schools usually tend to perform well while on average student performance in vocational schools is lower. Let us now suppose that the height of the students was also measured, and there are no reasons why students in academic schools should be of different height than students in vocational schools. For this particular variable, the expected value of the between-school variance should be equal to zero and therefore, the design effect should tend to one. As the segregation effect differs according to the variable, the design effect will also differ according to the variable.

The second factor that influences the size of the design effect is the choice of requested statistics. It tends to be large for means, proportions, and sums but substantially smaller for bivariate or multivariate statistics such as correlation and regression coefficients.

Design effects in PISA for performance variables

The notion of design effect as given earlier can be extended and gives rise to five different design effect formulae to describe the influence of the sampling and test designs on the standard errors for statistics.

The total errors computed for population estimates based on performance variables (scale scores) in the international PISA reports consist of two components: sampling variance (Var_{BRR}) and measurement variance. The measurement variance is approximated by means of the imputation variance ($MVar$) which is calculated from the statistics calculated from imputed plausible values assigned to the participating students.

The standard error of proficiency estimates in PISA are inflated because the students were not sampled according to a simple random sample and because the estimation of student proficiency includes some amount of measurement error.

Therefore, the variance of a statistic calculated using plausible values is then calculated as the sum of the sampling and the imputation variances, or $Var_{BRR} + MVar$.

The five design effects and their respective effective sample sizes can then be defined as follows:

Design Effect 1: This design effect shows the inflation of the total variance that would have occurred due to measurement error if in fact the samples were considered as simple random samples.

Formula 13.10

$$Deff_1(r) = \frac{Var_{SRS}(r) + MVar(r)}{Var_{SRS}(r)}$$

Design Effect 2: shows the inflation of the *total* variance due only to the use of a complex sampling design.

Formula 13.11

$$Deff_2(r) = \frac{Var_{BRR}(r) + MVar(r)}{Var_{SRS}(r) + MVar(r)}$$

Design Effect 3: shows the inflation of the sampling variance due to the use of a complex design. This is the same as Formula 13.7 introduced above.

Formula 13.12

$$Deff_3(r) = \frac{Var_{BRR}(r)}{Var_{SRS}(r)}$$

Design Effect 4: shows the inflation of the total variance due to measurement variance.

Formula 13.13

$$Deff_4(r) = \frac{Var_{BRR}(r) + MVar(r)}{Var_{BRR}(r)}$$

Design Effect 5: shows the inflation of the total variance due to the measurement variance and due to the complex sampling design.

Formula 13.14

$$Deff_5(r) = \frac{Var_{BRR}(r) + MVar(r)}{Var_{SRS}(r)}$$

Table 13.10, Table 13.11, Table 13.12, Table 13.13, Table 13.14, Table 13.15 and Table 13.16 present the values of the different design effects and the effective sample size using $Deff_5$, for each of the main PISA domains.

To better understand the design effect for a country/economy, some information related to the design effects and their respective effective sample sizes are presented in Annex C.

References

Cochran, W. (1977), *Sampling Techniques (3rd ed.)*, John Wiley and Sons.   [1]

Chapter 13 tables

Tables	Title
Table 13.1	Population characteristics, sample characteristics, exclusions and coverage indices for participating countries/economies
Table 13.2	Population characteristics, sample characteristics, exclusions and coverage indices for participating adjudicated regions
Table 13.3	Response rates for participating countries/economies calculated by using only original schools and no replacement schools
Table 13.4	Response rates for adjudicated regions calculated by using only original schools and no replacement schools
Table 13.5	Response rates for participating countries/economies when first and second replacement schools were accounted for in the rates
Table 13.6	Response rates for adjudicated regions when first and second replacement schools were accounted for in the rates
Table 13.7	Student response rates among the full set of participating schools in participating countries/economies
Table 13.8	Student response rates among the full set of participating schools in adjudicated regions
Table 13.9	Teacher response rates among the full set of participating schools in participating countries
Table 13.10	Standard errors and related statistics for the average mathematics proficiency
Table 13.11	Standard errors and related statistics for the average reading proficiency
Table 13.12	Standard errors and related statistics for the average science proficiency
Table 13.13	Standard errors and related statistics for the average creative thinking proficiency
Table 13.14	Standard errors and related statistics for the average financial literacy proficiency (Financial Literacy sample)
Table 13.15	Standard errors and related statistics for the average mathematics proficiency (Financial Literacy sample)
Table 13.16	Standard errors and related statistics for the average reading proficiency (Financial Literacy sample)

Table 13.1. Population characteristics, sample characteristics, exclusions and coverage indices for participating countries/economies

Please refer to Excel file PISA2022 TecReport-Ch 13 Sampling Outcomes_Tables 13.1 - 13.9.xlsx on line for this table.

Table 13.2. Population characteristics, sample characteristics, exclusions and coverage indices for participating adjudicated regions

Please refer to Excel file PISA2022 TecReport-Ch 13 Sampling Outcomes_Tables 13.1 - 13.9.xlsx on line for this table.

Table 13.3. Response rates for participating countries/economies calculated by using only original schools and no replacement schools

Country/economy	Weighted School Participation Rate Before Replacement (%) (SCHRRW1)	Weighted Number of Responding Schools (Weighted also by enrolment) (NUMW1)	Weighted Number of Schools Sampled (responding + nonresponding) (Weighted also by enrolment) (DENW1)	Unweighted School Participation Rate Before Replacement (%) (SCHRRU1)	Number of Responding Schools (Unweighted) (NUMU1)	Number of Responding and Nonresponding Schools (Unweighted) DENU1)
Albania	94.7	27530	29067	93.2	274	294
Argentina	98.3	661503	673069	98.5	454	461
Australia	92.5	260643	281781	90.9	722	794
Austria	95.7	77289	80733	94.3	300	318
Baku (Azerbaijan)	100.0	31925	31925	100.0	178	178
Belgium	80.3	101303	126138	76.4	243	318
Brazil	80.9	2153176	2660537	79.4	505	636
Brunei	100.0	6675	6675	100.0	54	54
Bulgaria	84.5	47378	56052	85.5	177	207
Cambodia	99.6	205960	206763	99.5	182	183
Canada	81.3	305746	375877	78.9	828	1049
Chile	84.3	187116	222091	82.0	205	250
Chinese Taipei	82.6	161354	195232	83.3	180	216
Colombia	96.6	658016	681141	94.3	249	264
Costa Rica	99.0	64480	65122	99.0	198	200
Croatia	99.8	37398	37475	98.9	180	182
Cyprus	97.5	8875	9100	96.2	101	105
Czech Republic	100.0	98609	98609	100.0	430	430
Denmark	90.1	53540	59431	87.6	325	371
Dominican Republic	98.5	131827	133900	96.9	249	257
El Salvador	99.6	73847	74135	99.0	288	291
Estonia	99.4	13659	13745	98.5	196	199
Finland	99.5	60180	60501	98.4	241	245
France	99.6	790568	794003	99.6	282	283
Georgia	93.6	40653	43421	93.3	250	268
Germany	92.9	674828	726200	91.3	241	264
Greece	90.1	90812	100785	89.7	217	242
Guatemala	85.0	143290	168547	73.4	265	361
Hong Kong (China)	59.6	32428	54402	59.8	122	204
Hungary	88.8	82009	92393	89.2	249	279
Iceland	96.4	4435	4601	89.9	134	149
Indonesia	99.3	3985101	4011189	99.3	408	411
Ireland	99.4	68814	69234	99.4	169	170
Israel	90.7	124237	137007	89.5	188	210
Italy	96.0	493350	513656	95.4	334	350
Jamaica	89.8	41020	45680	89.0	145	163
Japan	91.9	949447	1033001	91.5	182	199
Jordan	100.0	146365	146365	100.0	260	260
Kazakhstan	98.5	279305	283489	98.9	565	571
Korea	88.9	369002	415104	88.8	166	187
Kosovo	96.1	23183	24127	91.2	229	251
Latvia	83.9	15494	18464	80.3	208	259
Lithuania	99.6	25311	25418	98.3	288	293
Macao (China)	100.0	4453	4453	100.0	46	46

Country/economy	Weighted School Participation Rate Before Replacement (%) (SCHRRW1)	Weighted Number of Responding Schools (Weighted also by enrolment) (NUMW1)	Weighted Number of Schools Sampled (responding + nonresponding) (Weighted also by enrolment) (DENW1)	Unweighted School Participation Rate Before Replacement (%) (SCHRRU1)	Number of Responding Schools (Unweighted) (NUMU1)	Number of Responding and Nonresponding Schools (Unweighted) DENU1)
Malaysia	99.7	406803	407861	99.5	199	200
Malta	100.0	4114	4114	100.0	46	46
Mexico	95.9	1473466	1535688	94.1	272	289
Mongolia	100.0	43631	43631	100.0	195	195
Montenegro	98.8	6581	6659	98.4	63	64
Morocco	99.8	479666	480608	99.4	177	178
Netherlands	65.5	116517	177833	65.1	114	175
New Zealand	61.4	35524	57847	61.7	140	227
North Macedonia	100.0	17919	17919	100.0	111	111
Norway	98.7	62129	62943	98.2	266	271
Palestinian Authority	99.0	94105	95053	98.9	271	274
Panama	84.1	54532	64834	78.2	190	243
Paraguay	98.7	87772	88922	97.9	278	284
Peru	94.0	489130	520113	91.1	308	338
Philippines	100.0	1719012	1719012	100.0	188	188
Poland	88.6	309061	348856	88.5	223	252
Portugal	94.7	95312	100641	93.8	213	227
Qatar	100.0	18927	18927	100.0	229	229
Republic of Moldova	99.7	29607	29687	98.9	265	268
Romania	100.0	167589	167589	100.0	262	262
Saudi Arabia	91.9	300026	326333	91.3	178	195
Serbia	98.7	63599	64435	96.8	183	189
Singapore	98.5	41915	42567	98.2	164	167
Slovak Republic	90.5	44081	48692	90.0	271	301
Slovenia	97.2	18729	19264	91.7	344	375
Spain	97.7	473996	485037	97.4	959	985
Sweden	97.8	113994	116574	96.6	259	268
Switzerland	95.1	73464	77247	93.3	249	267
Thailand	98.8	685471	693755	98.6	276	280
Turkey	99.4	1079992	1086638	99.5	195	196
Ukraine (18 of 27 Regions)	79.8	178606	223859	74.6	141	189
United Arab Emirates	99.8	63395	63507	99.6	840	843
United Kingdom	67.3	490313	728369	66.9	388	580
United States of America	51.4	2019439	3927302	49.4	125	253
Uruguay	99.4	43188	43447	99.1	221	223
Uzbekistan	100.0	510406	510406	100.0	202	202
Vietnam	100.0	1020528	1020528	100.0	178	178

Table 13.4. Response rates for adjudicated regions calculated by using only original schools and no replacement schools

Country/economy	Weighted School Participation Rate Before Replacement (%) (SCHRRW1)	Weighted Number of Responding Schools (Weighted also by enrolment) (NUMW1)	Weighted Number of Schools Sampled (responding + nonresponding) (Weighted also by enrolment) (DENW1)	Unweighted School Participation Rate Before Replacement (%) (SCHRRU1)	Number of Responding Schools (Unweighted) (NUMU1)	Number of Responding and Nonresponding Schools (Unweighted) DENU1)
Argentina (CABA)	100.0	38009	38009	100.0	80	80
Argentina (Córdoba)	98.7	53002	53675	98.8	83	84
Argentina (Mendoza)	100.0	30381	30381	100.0	92	92
Belgium (Flanders)	71.8	51049	71073	67.8	135	199
United Arab Emirates (Abu Dhabi)	100.0	23381	23381	100.0	289	289
United Arab Emirates (Dubai)	99.4	17548	17660	98.8	250	253
United Arab Emirates (Sharjah)	100.0	13232	13232	100.0	183	183
United Kingdom (Scotland)	87.5	51700	59080	87.6	106	121

Table 13.5. Response rates for participating countries/economies when first and second replacement schools were accounted for in the rates

Country/economy	Weighted School Participation Rate After All Replacements (%) (SCHRRW3)	Weighted Number of Responding Schools (Weighted also by enrolment) (NUMW3)	Weighted Number of Schools Sampled (responding + nonresponding) (Weighted also by enrolment) (DENW3)	Unweighted School Participation Rate After All Replacements (%) (SCHRRU3)	Number of Responding Schools (Unweighted) (NUMU3)	Number of Responding and Nonresponding Schools (Unweighted) DENU3)
Albania	94.7	27530	29067	93.2	274	294
Argentina	99.2	668001	673236	99.1	457	461
Australia	95.6	269918	282241	93.6	743	794
Austria	96.3	77799	80750	95.0	302	318
Baku (Azerbaijan)	100.0	31925	31925	100.0	178	178
Belgium	91.4	115591	126446	89.6	285	318
Brazil	95.6	2541343	2659664	94.2	599	636
Brunei	100.0	6675	6675	100.0	54	54
Bulgaria	97.7	54795	56079	97.6	202	207
Cambodia	100.0	207046	207046	100.0	183	183
Canada	85.6	321877	376040	82.7	867	1049
Chile	94.2	208702	221439	92.0	230	250
Chinese Taipei	83.8	163590	195232	84.3	182	216
Colombia	99.2	683439	688995	99.2	262	264
Costa Rica	99.0	64480	65122	99.0	198	200
Croatia	99.8	37398	37475	98.9	180	182
Cyprus	97.5	8875	9100	96.2	101	105
Czech Republic	100.0	98609	98609	100.0	430	430
Denmark	96.2	57254	59517	93.5	347	371
Dominican Republic	99.4	133159	133900	98.4	253	257
El Salvador	99.9	74136	74212	99.7	290	291
Estonia	99.4	13659	13745	98.5	196	199
Finland	99.5	60180	60501	98.4	241	245

Country/economy	Weighted School Participation Rate After All Replacements (%) (SCHRRW3)	Weighted Number of Responding Schools (Weighted also by enrolment) (NUMW3)	Weighted Number of Schools Sampled (responding + nonresponding) (Weighted also by enrolment) (DENW3)	Unweighted School Participation Rate After All Replacements (%) (SCHRRU3)	Number of Responding Schools (Unweighted) (NUMU3)	Number of Responding and Nonresponding Schools (Unweighted) DENU3
France	99.6	790568	794003	99.6	282	283
Georgia	99.8	43539	43611	99.6	267	268
Germany	98.2	712724	725905	97.3	257	264
Greece	96.1	96821	100772	95.0	230	242
Guatemala	92.6	155960	168475	80.3	290	361
Hong Kong (China)	79.9	43491	54402	79.9	163	204
Hungary	98.6	90673	91964	96.8	270	279
Iceland	96.4	4435	4601	89.9	134	149
Indonesia	99.8	4002841	4011189	99.8	410	411
Ireland	100.0	69234	69234	100.0	170	170
Israel	92.9	127287	137007	91.9	193	210
Italy	99.4	510819	513842	98.6	345	350
Jamaica	90.9	41545	45680	90.2	147	163
Japan	91.9	949447	1033001	91.5	182	199
Jordan	100.0	146365	146365	100.0	260	260
Kazakhstan	100.0	283481	283481	100.0	571	571
Korea	99.7	413724	415104	99.5	186	187
Kosovo	96.1	23183	24127	91.2	229	251
Latvia	88.7	16424	18516	86.9	225	259
Lithuania	100.0	25408	25414	99.7	292	293
Macao (China)	100.0	4453	4453	100.0	46	46
Malaysia	99.7	406803	407861	99.5	199	200
Malta	100.0	4114	4114	100.0	46	46
Mexico	98.9	1519261	1535688	96.9	280	289
Mongolia	100.0	43631	43631	100.0	195	195
Montenegro	98.8	6581	6659	98.4	63	64
Morocco	100.0	479939	479939	100.0	178	178
Netherlands	89.6	159228	177613	88.0	154	175
New Zealand	72.4	41871	57865	74.4	169	227
North Macedonia	100.0	17919	17919	100.0	111	111
Norway	99.1	62393	62943	98.5	267	271
Palestinian Authority	100.0	94988	95027	99.6	273	274
Panama	91.3	59341	64996	88.5	215	243
Paraguay	99.6	88602	88922	98.9	281	284
Peru	99.9	521500	522136	99.7	337	338
Philippines	100.0	1719012	1719012	100.0	188	188
Poland	96.1	335389	348856	95.2	240	252
Portugal	99.2	99768	100578	98.7	224	227
Qatar	100.0	18927	18927	100.0	229	229
Republic of Moldova	99.7	29607	29687	98.9	265	268
Romania	100.0	167589	167589	100.0	262	262
Saudi Arabia	99.6	325174	326372	99.0	193	195
Serbia	98.7	63599	64435	96.8	183	189
Singapore	98.5	41915	42567	98.2	164	167
Slovak Republic	95.5	46387	48549	95.7	288	301
Slovenia	97.3	18747	19264	92.0	345	375
Spain	99.1	480541	485037	98.1	966	985

Country/economy	Weighted School Participation Rate After All Replacements (%) (SCHRRW3)	Weighted Number of Responding Schools (Weighted also by enrolment) (NUMW3)	Weighted Number of Schools Sampled (responding + nonresponding) (Weighted also by enrolment) (DENW3)	Unweighted School Participation Rate After All Replacements (%) (SCHRRU3)	Number of Responding Schools (Unweighted) (NUMU3)	Number of Responding and Nonresponding Schools (Unweighted) DENU3
Sweden	98.9	115248	116574	97.8	262	268
Switzerland	98.2	76060	77488	97.0	259	267
Thailand	99.5	690286	693755	99.6	279	280
Turkey	100.0	1086638	1086638	100.0	196	196
Ukraine (18 of 27 Regions)	91.0	204043	224119	86.8	164	189
United Arab Emirates	99.8	63395	63507	99.6	840	843
United Kingdom	81.8	593600	725986	77.8	451	580
United States of America	63.3	2485876	3926991	60.9	154	253
Uruguay	99.9	43395	43447	99.6	222	223
Uzbekistan	100.0	510406	510406	100.0	202	202
Vietnam	100.0	1020528	1020528	100.0	178	178

Table 13.6. Response rates for adjudicated regions when first and second replacement schools were accounted for in the rates

Country/economy	Weighted School Participation Rate After All Replacements (%) (SCHRRW3)	Weighted Number of Responding Schools (Weighted also by enrolment) (NUMW3)	Weighted Number of Schools Sampled (responding + nonresponding) (Weighted also by enrolment) (DENW3)	Unweighted School Participation Rate After All Replacements (%) (SCHRRU3)	Number of Responding Schools (Unweighted) (NUMU3)	Number of Responding and Nonresponding Schools (Unweighted) DENU3
Argentina (CABA)	100.0	38009	38009	100.0	80	80
Argentina (Córdoba)	98.7	53002	53675	98.8	83	84
Argentina (Mendoza)	100.0	30381	30381	100.0	92	92
Belgium (Flanders)	88.6	63321	71477	86.4	172	199
United Arab Emirates (Abu Dhabi)	100.0	23381	23381	100.0	289	289
United Arab Emirates (Dubai)	99.4	17548	17660	98.8	250	253
United Arab Emirates (Sharjah)	100.0	13232	13232	100.0	183	183
United Kingdom (Scotland)	96.4	57164	59316	96.7	117	121

Table 13.7. Student response rates among the full set of participating schools in participating countries/economies

Country/economy	Weighted Student Participation Rate After All Replacements (%) (STURRW3)	Number of Students Assessed (Weighted) (NUMSTW3)	Number of Students Sampled (assessed + absent) (Weighted) (DENSTW3)	Unweighted Student Participation Rate After All Replacements (%) (STURRU3)	Number of Students Assessed (Unweighted) (NUMSTU3)	Number of Students Sampled (assessed + absent) (Unweighted) (DENSTU3)
Albania	86.5	23274	26915	86.5	6129	7089
Argentina	85.8	508035	592257	86.4	12111	14014
Australia	76.1	193102	253899	75.6	13437	17771
Austria	88.8	65057	73230	86.7	6151	7092
Baku (Azerbaijan)	87.8	26799	30529	87.8	7720	8793
Belgium	86.6	101344	117082	86.9	8286	9533
Brazil	84.2	1832626	2177600	83.8	10798	12879
Brunei	93.2	5576	5980	93.2	5576	5980
Bulgaria	88.8	46335	52192	88.79	6107	6878
Cambodia	99.4	125643	126409	99.45	5279	5308
Canada	77.0	233773	303622	78.93	23073	29234
Chile	84.0	168773	201037	85.07	6488	7627
Chinese Taipei	82.3	131517	159821	83.22	5857	7038
Colombia	91.8	532284	580114	92.15	7804	8469
Costa Rica	92.0	52220	56750	91.84	6113	6656
Croatia	85.2	29804	34963	85.28	6135	7194
Cyprus	83.8	7190	8578	83.90	6515	7765
Czech Republic	91.2	91518	100330	91.14	8460	9282
Denmark	84.2	46126	54775	83.17	6200	7455
Dominican Republic	92.7	112417	121281	92.60	6868	7417
El Salvador	93.6	63767	68101	93.67	6705	7158
Estonia	88.2	11693	13262	88.34	6392	7236
Finland	88.7	52007	58641	86.69	10239	11811
France	90.7	705197	777730	90.16	6770	7509
Georgia	98.1	39587	40348	98.08	6583	6712
Germany	88.0	588741	669277	87.82	6116	6964
Greece	92.4	87038	94215	92.52	6403	6921
Guatemala	91.4	143084	156600	90.91	5190	5709
Hong Kong (China)	75.3	29278	38858	75.55	5907	7819
Hungary	92.3	80160	86877	92.44	6198	6705
Iceland	80.1	3360	4195	80.10	3360	4195
Indonesia	95.2	3602554	3782864	95.72	13439	14040
Ireland	76.8	50274	65497	76.73	5569	7258
Israel	84.1	103556	123165	84.05	6251	7437
Italy	91.9	452653	492440	92.33	10552	11429
Jamaica	67.6	15622	23123	66.88	3873	5791
Japan	91.9	858514	934656	91.57	5760	6290
Jordan	97.5	140640	144269	97.32	7799	8014
Kazakhstan	98.3	267773	272446	98.22	19769	20128
Korea	94.4	383999	406986	94.4	6454	6840
Kosovo	91.1	18427	20220	91.1	6027	6616
Latvia	88.5	13215	14935	88.6	5373	6067
Lithuania	92.7	22470	24245	92.7	7257	7826
Macao (China)	99.1	4384	4423	99.1	4384	4423
Malaysia	93.5	362809	387928	93.6	7069	7554
Malta	79.1	3127	3955	79.1	3127	3955

Country/economy	Weighted Student Participation Rate After All Replacements (%) (STURRW3)	Number of Students Assessed (Weighted) (NUMSTW3)	Number of Students Sampled (assessed + absent) (Weighted) (DENSTW3)	Unweighted Student Participation Rate After All Replacements (%) (STURRU3)	Number of Students Assessed (Unweighted) (NUMSTU3)	Number of Students Sampled (assessed + absent) (Unweighted) (DENSTU3)
Mexico	94.9	1313477	1383827	94.2	6288	6675
Mongolia	97.9	39969	40828	97.8	6999	7155
Montenegro	94.6	5954	6291	94.7	5793	6117
Morocco	98.1	446431	454986	98.1	6867	7000
Netherlands	80.9	113351	140125	81.1	5046	6221
New Zealand	71.7	29219	40758	71.3	4682	6567
North Macedonia	89.6	14832	16548	89.6	6610	7380
Norway	86.7	50577	58362	86.6	6611	7635
Palestinian Authority	96.2	85017	88348	95.9	7905	8239
Panama	76.8	29491	38418	75.5	4544	6017
Paraguay	92.0	74217	80700	92.1	5084	5522
Peru	97.5	486292	498888	97.6	6968	7136
Philippines	95.2	1698135	1782896	95.3	7193	7550
Poland	81.0	266114	328452	81.0	6011	7422
Portugal	86.1	82496	95838	86.1	6793	7888
Qatar	89.0	16346	18361	88.8	7676	8649
Republic of Moldova	94.1	27114	28799	94.1	6235	6623
Romania	97.4	157838	162019	97.6	7364	7543
Saudi Arabia	97.1	307363	316501	97.0	6928	7144
Serbia	91.2	53150	58297	91.2	6413	7033
Singapore	91.4	37797	41358	91.3	6606	7235
Slovak Republic	90.9	41319	45438	91.4	5824	6375
Slovenia	82.5	15142	18355	82.6	6721	8134
Spain	86.3	392413	454692	86.8	30800	35472
Sweden	85.1	91230	107261	85.1	6072	7133
Switzerland	90.9	67555	74335	91.4	6829	7471
Thailand	96.4	580014	601524	96.4	8495	8816
Turkey	98.0	914714	933402	98.1	7250	7387
Ukraine (18 of 27 Regions)	86.9	131271	151104	86.0	3876	4508
United Arab Emirates	92.9	56369	60658	92.5	24600	26592
United Kingdom	75.2	448396	596519	76.2	12972	17023
United States of America	79.9	1866014	2336430	79.6	4552	5719
Uruguay	86.7	35308	40728	86.7	6618	7637
Uzbekistan	98.1	472726	482059	98.0	7293	7445
Vietnam	99.4	933854	939459	99.4	6068	6105

Table 13.8. Student response rates among the full set of participating schools in adjudicated regions

Country/economy	Weighted Student Participation Rate After All Replacements (%) (STURRW3)	Number of Students Assessed (Weighted) (NUMSTW3)	Number of Students Sampled (assessed + absent) (Weighted) (DENSTW3)	Unweighted Student Participation Rate After All Replacements (%) (STURRU3)	Number of Students Assessed (Unweighted) (NUMSTU3)	Number of Students Sampled (assessed + absent) (Unweighted) (DENSTU3)
Argentina (CABA)	85.5	29481	34493	85.5	2251	2634
Argentina (Córdoba)	89.9	42309	47068	90.5	2217	2449
Argentina (Mendoza)	85.7	26446	30842	86.3	2514	2914
Belgium (Flanders)	87.4	55935	63968	87.4	4714	5393
United Arab Emirates (Abu Dhabi)	92.6	20493	22132	92.2	8316	9017
United Arab Emirates (Dubai)	91.4	15404	16856	90.9	7374	8113
United Arab Emirates (Sharjah)	94.7	11122	11747	94.2	5239	5560
United Kingdom (Scotland)	79.4	39590	49889	79.1	3257	4115

Table 13.9. Teacher response rates among the full set of participating schools in participating countries

Country/economy	Weighted Teacher Participation Rate After All Replacements (%) (TCHRRW3)	Number of Teachers Assessed (Weighted) (NUMTQW3)	Number of Teachers Sampled (assessed + absent) (Weighted) (DENTQW3)	Unweighted Teacher Participation Rate After All Replacements (%) (TCHRRU3)	Number of Teachers Assessed (Unweighted) (NUMTCH3)	Number of Teachers Sampled (assessed + absent) (Unweighted) (DENTCH3)
Australia	80.6	56269.97	69781.97	80.1	11397	14223
Baku (Azerbaijan)	48.6	7409.80	15249.37	51.3	1915	3736
Brazil	75.5	295437.52	391530.17	77.2	5646	7310
Colombia	87.4	112921.28	129161.43	88.5	2615	2956
Costa Rica	86.6	12440.54	14369.05	87.2	2476	2841
Dominican Republic	58.6	25934.14	44254.82	62.7	2179	3473
Georgia	89.1	18848.29	21154.93	88.1	3202	3635
Germany	72.0	155734.55	216273.34	73.5	3631	4940
Hong Kong (China)	74.1	9148.35	12341.55	75.0	2335	3113
Korea	92.1	176093.25	191096.45	92.5	3614	3906
Kosovo	74.4	2286.30	3072.22	74.1	1290	1741
Macao (China)	99.6	1916.00	1923.00	99.6	1916	1923
Malaysia	99.8	87458.39	87598.58	99.8	3956	3964
Morocco	95.4	93849.95	98337.49	95.7	2998	3134
Panama	78.5	5639.86	7184.30	82.4	1597	1937
Peru	99.2	138807.45	139990.72	99.1	3708	3740
Portugal	92.1	26253.77	28515.19	92.6	3487	3767
United Arab Emirates	85.6	13420.60	15675.31	85.4	10092	11819
Abu Dhabi (United Arab Emirates)	89.5	4932.80	5510.47	89.6	3832	4278
Dubai (United Arab Emirates)	82.3	4118.53	5003.07	81.9	2809	3429
Sharjah (United Arab Emirates)	81.6	2271.97	2784.27	81.4	1961	2410

Table 13.10. Standard errors and related statistics for the average mathematics proficiency

Please refer to Excel file PISA2022 TecReport-Ch 13 Sampling Outcomes_Tables 13.10 - 13.13.xlsx on line for this table.

Table 13.11. Standard errors and related statistics for the average reading proficiency

Please refer to Excel file PISA2022 TecReport-Ch 13 Sampling Outcomes_Tables 13.10 - 13.13.xlsx on line for this table.

Table 13.12. Standard errors and related statistics for the average science proficiency

Please refer to Excel file PISA2022 TecReport-Ch 13 Sampling Outcomes_Tables 13.10 - 13.13.xlsx on line for this table.

Table 13.13. Standard errors and related statistics for the average creative thinking proficiency

Please refer to Excel file PISA2022 TecReport-Ch 13 Sampling Outcomes_Tables 13.10 - 13.13.xlsx on line for this table.

Table 13.14. Standard errors and related statistics for the average financial literacy proficiency (Financial Literacy sample)

Please refer to Excel file PISA2022 TecReport-Ch 13 Sampling Outcomes_Tables 13.14 - 13.16.xlsx on line for this table.

Table 13.15. Standard errors and related statistics for the average mathematics proficiency (Financial Literacy sample)

Please refer to Excel file PISA2022 TecReport-Ch 13 Sampling Outcomes_Tables 13.14 - 13.16.xlsx on line for this table.

Table 13.16. Standard errors and related statistics for the average reading proficiency (Financial Literacy sample)

Please refer to Excel file PISA2022 TecReport-Ch 13 Sampling Outcomes_Tables 13.14 - 13.16.xlsx on line for this table.