

CHAPTER 14

Estimating Standard Errors in the TIMSS 2019 Results

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To obtain estimates of students' proficiency in mathematics and science that are both accurate and cost-effective, TIMSS 2019 made extensive use of probability sampling techniques to sample students from the national fourth and eighth grade student populations, and applied matrix-sampling assessment designs to target individual students with a subset of the complete pool of assessment items. This approach made efficient use of resources, in particular keeping student response burden to a minimum, but at a cost of some variance or uncertainty in the reported statistics, such as the means and percentages computed to estimate population parameters.

To quantify this uncertainty, each statistic in the [TIMSS 2019 international report](#) is accompanied by an estimate of its standard error. Statistics based on differences arising from comparing two estimated results also have standard errors, which serve to calculate confidence intervals or to perform statistical tests of significance. For statistics reporting student achievement, which are based on plausible values, standard errors are calculated based on two components. The first reflects the uncertainty due to generalizing from a student sample to the entire student population from which it was drawn, referred to as sampling variance. The second is known as imputation variance and reflects uncertainty due to inferring students' achievement estimates from their observed performance on a subset of achievement items and other achievement related information. This variance component reflects the posterior variance of the achievement variables given all available information used in the achievement imputation model described in [Chapter 11](#) of this volume. For parameter estimates of variables that are not plausible values, the estimates of standard errors are based entirely on sampling variance.

Estimating Sampling Variance

TIMSS makes extensive use of probability sampling to derive achievement results from national samples of students. Because many such samples are possible but only one sample is drawn, some uncertainty about

how well the sample represents the population is to be expected. The uncertainty caused by sampling students from a target population, known as sampling variance, can be estimated from the data of the one sample drawn.

Whereas estimating the sampling variance from simple random samples is a relatively simple task, estimating the sampling variance from the complex sample design of TIMSS is a more challenging endeavor. A common way to estimate the sampling variance in multistage cluster sampling designs is through resampling schemes (Efron, 1982) such as the balanced repeated replication and Jackknife techniques (Johnson & Rust, 1992; Quenouille, 1949; Tukey, 1958; Wolter, 1985). TIMSS uses a variation of the Jackknife, Jackknife Repeated Replication (JRR), to estimate sampling variances. JRR was chosen because it is computationally straightforward and provides approximately unbiased estimates of the sampling variance of means, totals, and percentages.

At the core of the JRR technique is the repeated resampling from the one sample drawn, under identical sample design conditions. In the context of TIMSS, this entails the grouping of primary sampling units into sampling zones based on the TIMSS sample design and repeated draws of subsamples from these zones. The main features of the TIMSS sample design that JRR incorporates in its repeated replication are the stratification of schools and the clustering of students within schools. This was done by defining Jackknife sampling zones as pairs of successive schools¹ to model the stratification and clustering from the national samples (see [Chapter 3](#) for information on the TIMSS Sample Design). The repeated subsampling required by JRR was applied within each sampling zone.

Sampling zones were constructed within explicit strata. When an explicit stratum had an odd number of schools, either by design or because of non-responding schools, the students in the lone school of the last sampling zone were divided randomly to make up two “quasi” schools for the purposes of calculating jackknife standard errors.² Each sampling zone then consisted of a pair of schools or “quasi” schools. Since most national samples consisted of a minimum of 150 schools, a total of 75 zones were created. If more than 150 schools were sampled, the additional zones were collapsed into the first 75 zones.³

Exhibit 14.1 shows the number of constructed Jackknife sampling zones, prior to any collapsing, for the participating countries and benchmarking participants in TIMSS 2019.⁴

- 1 When schools were sampled, they were ordered within explicit strata by implicit stratification variables and their measure of size. Based on this sorting, successively sampled schools had similar stratification attributes. More information can be found in Appendix 3A of [Chapter 3](#).
- 2 If a remaining school consisted of 2 sampled classrooms, each classroom became a “quasi” school.
- 3 The randomization used in the resampling within sampling zones preserves the sampling variance measured in the original sampling zones after collapsing.
- 4 Note that jackknife sampling zones may be constructed in a different manner under specific national conditions. Country-specific information on the construction of Jackknife sampling zones is available in Appendix 9A of [Chapter 9](#).

Exhibit 14.1: Number of Jackknife Sampling Zones in the TIMSS 2019 National Samples

Country	Fourth Grade		Eighth Grade	
	TIMSS Sample	Bridge Sample	TIMSS Sample	Bridge Sample
Albania	84	—	—	—
Armenia	76	—	—	—
Australia	145	—	145	—
Austria	98	50	—	—
Azerbaijan	97	—	—	—
Bahrain	118	—	131	—
Belgium (Flemish)	77	—	—	—
Bosnia and Herzegovina	99	—	—	—
Bulgaria	76	—	—	—
Canada	358	44	—	—
Chile	85	29	83	28
Chinese Taipei	81	34	105	29
Croatia	79	38	—	—
Cyprus	76	—	109	—
Czech Republic	77	30	—	—
Denmark	84	31	—	—
Egypt	—	—	86	—
England	71	26	69	25
Finland	80	36	79	—
France	78	30	75	—
Georgia	78	29	74	27
Germany	102	39	—	—
Hong Kong SAR	70	28	69	27
Hungary	76	26	78	27
Iran, Islamic Rep. of	112	—	110	—
Ireland	75	—	77	—
Israel	—	—	80	37
Italy	81	30	79	29
Japan	75	—	72	—
Jordan	—	—	122	—
Kazakhstan	85	—	85	—
Korea, Rep. of	76	34	85	33
Kosovo	73	—	—	—
Kuwait	82	—	87	—
Latvia	84	—	—	—

Exhibit 14.1: Number of Jackknife Sampling Zones in the TIMSS 2019 National Samples (continued)

Country	Fourth Grade		Eighth Grade	
	TIMSS Sample	Bridge Sample	TIMSS Sample	Bridge Sample
Lebanon	—	—	109	—
Lithuania	105	37	98	36
Malaysia	—	—	91	22
Malta	226	—	—	—
Montenegro	238	—	—	—
Morocco	149	—	132	—
Netherlands	57	21	—	—
New Zealand	80	—	70	—
North Macedonia	75	—	—	—
Northern Ireland	71	—	—	—
Norway	77	28	79	27
Oman	126	—	119	—
Pakistan	71	—	—	—
Philippines	91	—	—	—
Poland	75	—	—	—
Portugal	91	45	78	—
Qatar	138	33	109	32
Romania	—	—	99	—
Russian Federation	59	32	60	32
Saudi Arabia	111	—	106	—
Serbia	84	—	—	—
Singapore	187	28	153	28
Slovak Republic	80	35	—	—
South Africa	149	—	261	—
Spain	257	35	—	—
Sweden	73	26	77	27
Turkey	91	—	91	36
United Arab Emirates	722	52	671	47
United States	145	42	138	35
Benchmarking Participants				
Ontario, Canada	83	—	80	—
Quebec, Canada	75	—	63	—
Moscow City, Russian Fed.	76	—	76	—

Exhibit 14.1: Number of Jackknife Sampling Zones in the TIMSS 2019 National Samples (continued)

Country	Fourth Grade		Eighth Grade	
	TIMSS Sample	Bridge Sample	TIMSS Sample	Bridge Sample
Gauteng, RSA	—	—	75	—
Western Cape, RSA	—	—	75	—
Madrid, Spain	85	—	—	—
Abu Dhabi, UAE	263	—	254	—
Dubai, UAE	226	—	185	—

The JRR procedure draws two subsamples from each sampling zone: one where the first school in the pair is included and the second school is removed, and the other where the second school is included and the first school is removed. When a school is removed from a sampling zone, the sampling weights of the students in the remaining school are doubled to make up for the omitted school. In both subsamples, all students in the other sampling zones are included with their sampling weights unchanged. With this process applied in each of the 75 sampling zones, the JRR procedure yields a total of 150 replicate subsamples, each one with its own set of replicate sampling weights to account for the successive removal of each school from the pair of schools in any given sampling zone.

The process of creating replicate sampling weights for the replicate subsamples defines replicate factors k_{hi} as follows:

$$k_{hi} = \begin{cases} 2 & \text{for students in school } i \text{ of sampling zone } h \\ 0 & \text{for students in the other school of sampling zone } h \\ 1 & \text{for students in any other sampling zone} \end{cases} \quad (14.1)$$

These replicate factors are used to compute the 150 sets of replicate sampling weights as follows:

$$W_{hij} = k_{hi} \cdot W_{0j} \quad (14.2)$$

where W_{0j} is the overall sampling weight of student j and W_{hij} is the resulting replicate sampling weight of student j when school i from sampling zone h is included and the other school in the pair is removed.

Exhibit 14.2 illustrates the calculation of the replicate factors necessary to produce the replicate sampling weights. Within each sampling zone, each school is assigned randomly an indicator u_{hi} , coded either 0 or 1, such that one school has a value of 0 and the other a value of 1. This indicator serves to determine how schools within each zone will be successively included and removed. When a school is removed from a zone, the replicate factor is set to 0 and the sampling weights of all students in that school are set to 0. When a school is included, the replicate factor is set to 2 and the sampling weights of

all students in that school are doubled. The sampling weights of students in all the other sampling zones remain unchanged.

Exhibit 14.2: Construction of Replicate Factors Across Sampling Zones

Sampling Zone	School Replicate Indicator (u_{hi})	Replicate Factors for Computing JRR Replicate Sampling Weights (k_{hi})											
		Zone 1		Zone 2		Zone 3		...	Zone h		...	Zone 75	
		(1)	(2)	(3)	(4)	(5)	(6)		(2h-1)	(2h)		(149)	(150)
1	0	2	0	1	1	1	1	...	1	1	...	1	1
	1	0	2										
2	0	1	1	2	0	1	1	...	1	1	...	1	1
	1			0	2								
3	0	1	1	1	1	2	0	...	1	1	...	1	1
	1					0	2						
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
h	0	1	1	1	1	1	1	...	2	0	...	1	1
	1								0	2			
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
75	0	1	1	1	1	1	1	...	1	1	...	2	0
	1											0	2

For example, sampling Zone 1 yields two sets of replicate sampling weights, hence the two columns for Zone 1. The first set has doubled sampling weights ($k_{11} = 2$) for the students in the first school ($u_{11} = 0$) of Zone 1, zeroed sampling weights ($k_{12} = 0$) for the students in the second school ($u_{12} = 1$) of Zone 1, and unchanged sampling weights ($k_{hi} = 1$) for all students in the other sampling zones, e.g., Zones 2 through 75. This is shown in the first Zone 1 column. The second set of replicate sampling weights (shown in the second Zone 1 column) has zeroed sampling weights ($k_{11} = 0$) for the students in the first school ($u_{11} = 0$) of Zone 1, doubled sampling weights ($k_{12} = 2$) for the students in the second school ($u_{12} = 1$) of Zone 1, and unchanged sampling weights ($k_{hi} = 1$) for all students in the other sampling zones.

The process is repeated across all 75 possible sampling zones, generating 150 sets of replicate sampling weights. The replicate sampling weights are then used to estimate any statistic of interest 150 times. The variation across these 150 jackknife estimates determines the sampling variance.

Given a statistic to be computed from a national sample, the formula used to estimate the sampling variance of that statistic, based on the TIMSS JRR algorithm, is given by the following equation:

$$Var_{jrr}(t_0) = \frac{1}{2} \sum_{h=1}^{75} \sum_{i=1}^2 (t_{hi} - t_0)^2 \tag{14.3}$$

where the term t_0 denotes the statistic of interest estimated with the overall student sampling weights W_{0j} and the term t_{hi} denotes the same statistic computed using the set of replicate sampling weights W_{hij} obtained from sampling zone h ($h=1, \dots, 75$), where the i^{th} school (1st or 2nd) in the zone is included and the other removed. Efron (1982) provides a proof of why the variance can be calculated based on these squared deviations of the t_{hi} from the total sample statistics in jackknife based resampling schemes.

The sampling variance estimated with the TIMSS JRR method properly accounts for the variation arising from having sampled students using the TIMSS 2019 multi-stage stratified cluster sample design. Its square root is used as the standard error for any statistic derived from variables other than plausible values. Examples of such statistics include the mean age of students, the percentage of students with at least one parent with a university degree, and other variables that can be assessed objectively and likely only minimally affected by response variability.

Estimating Imputation Variance

For variables other than plausible values, standard errors were the result solely of sampling variation, and were computed using the JRR technique. However, the situation with achievement estimates is more complex. Achievement estimates are based on observations of how students perform on a subset of the TIMSS 2019 items. As described in the [TIMSS 2019 Assessment Frameworks](#), the TIMSS 2019 item pool was far too extensive to be administered in its entirety to any one student, and a matrix-sampling assessment design was adopted whereby each student was given a single test booklet containing only a part of the entire assessment. The results from all students and booklets were then analyzed using item response theory to provide estimates of achievement on the TIMSS 2019 scale. Any estimate of achievement based on a set of observed variables is affected by measurement error. In order to generalize to the full assessment, an imputation (Rubin, 1987) model that incorporates performance on TIMSS 2019 of each student as well as information about similarities between students was applied. This imputation model is a latent regression model described in [Chapter 11](#) of this volume and was used to derive estimates of student performance (plausible values). Student proficiency estimates incorporate uncertainty that can be quantified through measurement error and variability due to the latent regression. TIMSS 2019 followed the customary procedure of generating five imputations, or plausible values, for each student and using the variability among them as a measure of that uncertainty, known as the imputation variance.

The general procedure for estimating the imputation variance when analyzing student achievement data follows the basic principle of performing any statistical analysis five times—once for each set of plausible values—and aggregating the five sets of results (Mislevy, Beaton, Kaplan, & Sheehan, 1992). Thus, for any given achievement-based statistic t , estimating that statistic from each plausible value yields

five estimates t_m , $m = 1, \dots, 5$, all of them computed using the overall student sampling weights W_{0j} . The final estimate of that statistic, t_0 , is the average of these five estimates:

$$t_0 = \frac{1}{5} \sum_{m=1}^5 t_m \quad (14.4)$$

The imputation variance of the statistic t_0 is simply the variance of the five results from the plausible values, computed as follows:

$$Var_{imp}(t_0) = \frac{6}{5} \sum_{m=1}^5 \frac{(t_m - t_0)^2}{4} \quad (14.5)$$

where the factor $\frac{6}{5}$ is a correction factor required by the multiple imputation methodology (Rubin, 1987). This imputation variance is then added to the sampling variance to produce the total variance estimate of the statistic t_0 , as follows:

$$Var_{tot}(t_0) = Var_{jrr}(t_0) + Var_{imp}(t_0) \quad (14.6)$$

The sampling variance $Var_{jrr}(t_0)$ in this context is the average of the sampling variances from the five plausible values $Var_{jrr}(t_m)$ $m = 1, \dots, 5$, as follows:

$$Var_{jrr}(t_0) = \frac{1}{5} \sum_{m=1}^5 Var_{jrr}(t_m) \quad (14.7)$$

where

$$Var_{jrr}(t_m) = \frac{1}{2} \sum_{h=1}^{75} \sum_{i=1}^2 (t_{mhi} - t_m)^2 \quad (14.8)$$

and t_{mhi} is the appropriate JRR estimate for plausible value and computed using the set of replicate sampling weights of sampling zone h where school i is included. The square root of the total variance is then the proper standard error for any statistic based on plausible values, such as the average TIMSS mathematics achievement for girls, or the percentage of students at or above the TIMSS Advanced International Benchmark of mathematics achievement.

Appendices 14A through 14D provide details on the jackknife sampling variance, the imputation variance, the total variance, and the overall standard error for each country's mean proficiency estimates in mathematics at the fourth grade, science at the fourth grade, mathematics at the eighth grade, and science at the eighth grade, respectively, and including the content and cognitive domains. Appendices 14E and 14F provide the same details for the bridge samples, limited to overall mathematics and science.⁵

5 Information on the bridge samples is available in [Chapter 3](#).

Estimating Standard Errors for International Averages

Some exhibits in the [TIMSS 2019 international report](#) include international averages and their standard errors. For example, [Exhibit 1.5](#) of *TIMSS 2019 International Results in Mathematics and Science* reports the international average for the percentages of girls and boys and their fourth grade mathematics achievement. International averages are computed using the data from the participating countries included in the main table of an exhibit. Results from the benchmarking participants are not included in the estimation of international averages.

For any given statistic t_0 , its international average is given by

$$t_{intl} = \frac{1}{N} \sum_{k=1}^N t_{0k} \quad (14.9)$$

where N is the number of countries contributing to the international average and t_{0k} is the estimate of our statistic of interest for country k .

The total variance of the international average t_{intl} is given by

$$Var_{tot}(t_{intl}) = \frac{1}{N^2} \sum_{k=1}^N Var_{tot}(t_{0k}) \quad (14.10)$$

where $Var_{tot}(t_{0k})$ is the total variance of our statistic of interest for country k . For statistics based on plausible values, the total variance includes the sampling variance and the imputation variance, as given in equation (14.6) above. For statistics not based on plausible values, such as percentages, the total variance is based entirely on the sampling variance, as shown in equation (14.3) above. The standard error of the international average is the square root of the total variance.

Estimating Standard Errors for Comparing Independent Results

Standard errors, along with providing a measure of uncertainty for TIMSS results, also serve to perform statistical test of significance when comparing two or more results. A basic objective of TIMSS is to provide fair and accurate comparisons of student achievement across TIMSS assessment cycles. [Exhibit 1.4](#) in the *TIMSS 2019 International Results in Mathematics and Science* report is one such example, showing fourth grade mathematics trend comparisons for the TIMSS 2019 countries across the TIMSS assessment cycles. The reports also include comparisons of results across the participating countries. [Exhibit 1.2](#) shows all pairwise country comparisons for fourth grade mathematics achievement. All of these comparisons and their statistical significance tests require the computation of a standard error for a difference between two comparable results.

TIMSS 2019 results were reported by way of a statistic such as a mean or percentage, and each statistic is accompanied by its standard error, computed using either equation (14.3) or equation (14.6), as appropriate. When comparing results, either between assessment cycles or between countries, it is necessary to compute the standard error of the difference between two results. Because national samples are drawn independently of each other within an assessment cycle, as well as between assessment cycles, computing the standard error of a difference is straightforward.

When computing the difference between two TIMSS results t_A and t_B on the same TIMSS scale, which could be comparing the science achievement of countries A and B , or the science achievement of a country between assessment cycles A and B , the standard error of that difference is given by

$$SE(t_A - t_B) = \sqrt{Var_{tot}(t_A) + Var_{tot}(t_B)} \quad (14.11)$$

or, more simply

$$SE(t_A - t_B) = \sqrt{SE(t_A)^2 + SE(t_B)^2} \quad (14.12)$$

which can be stated as follows: the standard error of the difference between two independent results is the square root of the sum of their respective squared standard errors.

Estimating Standard Errors for Comparing Dependent Results

In the context of TIMSS, dependent results are statistics derived from the same national, or benchmarking, sample. The achievement difference between girls and boys, as shown in [Exhibit 1.5](#) in the *TIMSS 2019 International Results in Mathematics and Science* report, is an example of two dependent results and their difference. This dependence occurs because girls and boys are selected from the same sample of classrooms and schools. Girls and boys from the same school tend to perform more similar as compared to subgroups selected from different schools, thus inducing a correlation that needs to be accounted in the computation of the standard error of their performance difference.

The difference between two statistics is itself a statistic. With this in mind, the standard error of any difference between two dependent results is computed in the same way as any other statistic, as was described earlier. The 150 sets of replicate weights produce 150 replicate estimates of the difference of interest and equations (14.3) and (14.6) apply.

Estimating Standard Errors for Comparing Against International Average

In [TIMSS 2019 international report](#) exhibits showing international averages, it can be of interest to compare a country's results to its corresponding international average. [Exhibit 1.10.1](#) is one such example, showing percent correct statistics for a fourth grade mathematics item anchored at the TIMSS Low International Benchmark, along with a statistical significance test for comparisons of national results with the international average.

When comparing a country's result with the international average, TIMSS accounts for the fact that the country contributed to the international standard error. To correct for this contribution, the standard error of the difference needs to be adjusted. The total variance of the difference $t_k - t_{intl}$, comparing country k to the international average for a statistic t , is given by

$$Var_{tot}(t_k - t_{intl}) = Var_{tot}(t_{intl}) + \frac{(N-1)^2 - 1}{N^2} Var_{tot}(t_k) \quad (14.13)$$

where N is the number of countries contributing to the international average, $Var_{tot}(t_{intl})$ is the total variance of the international average as computed by equation (14.10), and $Var_{tot}(t_k)$ is the total variance for country k as computed by equation (14.6).

Equation (14.13) can be simplified and expressed in terms of standard errors as follows

$$SE(t_k - t_{intl}) = \sqrt{SE(t_{intl})^2 + \frac{N-2}{N} SE(t_k)^2} \quad (14.14)$$

where $SE(t_{intl})$ is the standard error of the international average and $SE(t_k)$ is the standard error for country k .

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Appendix 14A: Summary Statistics and Standard Errors for Proficiency in Grade 4 Mathematics

Summary Statistics and Standard Errors for Proficiency in Overall Mathematics—Grade 4

Country	Sample Size	Overall Mathematics				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Albania	4426	494.017	10.964	0.440	11.404	3.377
Armenia	5399	498.185	6.056	0.384	6.440	2.538
Australia	5890	515.880	7.397	0.309	7.706	2.776
Austria	5097	539.219	3.807	0.261	4.069	2.017
Azerbaijan	5245	515.455	6.950	0.492	7.443	2.728
Bahrain	5762	479.853	5.609	1.131	6.740	2.596
Belgium (Flemish)	4655	532.443	3.072	0.567	3.638	1.907
Bosnia and Herzegovina	5617	451.682	5.626	0.180	5.806	2.410
Bulgaria	4268	515.019	18.121	0.268	18.389	4.288
Canada	15572	511.564	3.135	0.313	3.448	1.857
Chile	4773	440.972	6.526	0.860	7.386	2.718
Chinese Taipei	4295	599.240	2.117	1.580	3.697	1.923
Croatia	4335	509.498	4.194	0.463	4.657	2.158
Cyprus	4062	532.094	7.948	0.221	8.169	2.858
Czech Republic	5357	532.975	5.863	0.486	6.348	2.520
Denmark	3692	524.542	3.278	0.387	3.666	1.915
England	3871	555.843	8.661	0.207	8.868	2.978
Finland	5394	532.071	4.911	0.532	5.443	2.333
France	4792	484.811	8.480	0.594	9.074	3.012
Georgia	4312	481.819	12.713	0.710	13.423	3.664
Germany	3932	520.981	4.777	0.403	5.180	2.276
Hong Kong SAR	3386	601.622	9.827	1.128	10.955	3.310
Hungary	5227	523.431	6.526	0.468	6.994	2.645
Iran, Islamic Rep. of	6010	443.035	13.526	1.343	14.869	3.856
Ireland	4582	548.465	5.998	0.173	6.172	2.484
Italy	4268	514.923	5.811	0.130	5.941	2.437
Japan	4196	592.957	2.914	0.151	3.065	1.751
Kazakhstan	4791	512.089	5.605	0.646	6.251	2.500
Korea, Rep. of	4448	599.608	4.762	0.212	4.974	2.230
Kosovo	4496	444.354	8.370	0.563	8.933	2.989
Kuwait	4437	383.318	21.475	1.009	22.483	4.742
Latvia	4481	546.133	6.301	0.391	6.693	2.587
Lithuania	4265	542.131	6.962	0.687	7.650	2.766
Malta	4152	509.125	1.205	0.858	2.063	1.436
Montenegro	5076	452.780	3.486	0.329	3.815	1.953
Morocco	7723	383.388	17.893	0.578	18.471	4.298
Netherlands	3829	537.509	4.265	0.424	4.689	2.165
New Zealand	5019	487.192	5.330	1.462	6.793	2.606
North Macedonia	3270	471.720	27.385	0.675	28.060	5.297
Northern Ireland	3497	565.800	6.632	0.917	7.550	2.748
Norway (5)	4526	542.669	4.344	0.427	4.771	2.184
Oman	6814	430.874	13.191	0.724	13.915	3.730
Pakistan	3980	327.691	140.907	2.041	142.948	11.956
Philippines	5515	296.675	37.419	3.099	40.517	6.365

Summary Statistics and Standard Errors for Proficiency in Overall Mathematics—Grade 4 (continued)

Country	Sample Size	Overall Mathematics				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Poland	4882	520.140	6.809	0.357	7.167	2.677
Portugal	4914	525.091	6.299	0.472	6.771	2.602
Qatar	5646	449.412	10.287	1.121	11.408	3.378
Russian Federation	4596	566.947	10.762	0.391	11.153	3.340
Saudi Arabia	5453	398.093	12.000	0.620	12.620	3.552
Serbia	4380	507.881	9.790	0.382	10.172	3.189
Singapore	6839	625.429	14.165	0.823	14.989	3.872
Slovak Republic	4861	509.841	10.957	0.959	11.917	3.452
South Africa (5)	11891	373.564	11.769	0.942	12.711	3.565
Spain	10945	502.472	3.404	1.152	4.556	2.134
Sweden	4532	521.229	7.505	0.272	7.778	2.789
Turkey (5)	4599	522.856	19.333	0.446	19.779	4.447
United Arab Emirates	29511	481.387	2.147	0.761	2.908	1.705
United States	10028	534.732	6.192	0.258	6.449	2.540
Benchmarking Participants						
Ontario, Canada	4358	511.715	10.510	0.447	10.957	3.310
Quebec, Canada	4383	532.133	4.595	0.636	5.231	2.287
Moscow City, Russian Fed.	4392	592.772	4.721	0.183	4.903	2.214
Madrid, Spain	3878	518.255	4.406	0.216	4.623	2.150
Abu Dhabi, UAE	10324	440.536	3.334	1.672	5.006	2.237
Dubai, UAE	8299	544.050	2.252	0.455	2.707	1.645

Summary Statistics and Standard Errors for Proficiency in Number—Grade 4

Country	Sample Size	Number				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Albania	4426	495.037	12.316	0.774	13.089	3.618
Armenia	5399	517.920	4.452	0.760	5.212	2.283
Australia	5890	506.179	8.708	0.702	9.410	3.068
Austria	5097	541.815	3.008	0.627	3.635	1.907
Azerbaijan	5245	525.634	6.492	0.697	7.189	2.681
Bahrain	5762	478.348	6.162	0.349	6.511	2.552
Belgium (Flemish)	4655	526.283	3.066	0.870	3.935	1.984
Bosnia and Herzegovina	5617	458.811	5.057	0.243	5.301	2.302
Bulgaria	4268	521.387	14.965	1.096	16.060	4.008
Canada	15582	505.263	3.266	1.209	4.475	2.115
Chile	4775	438.254	6.533	2.477	9.010	3.002
Chinese Taipei	4295	599.412	2.072	0.692	2.764	1.663
Croatia	4335	511.817	3.286	0.145	3.431	1.852
Cyprus	4062	537.968	7.600	0.447	8.047	2.837
Czech Republic	5358	535.705	5.121	0.873	5.995	2.448
Denmark	3693	517.765	4.080	0.216	4.296	2.073
England	3872	558.990	10.487	0.510	10.997	3.316
Finland	5397	527.881	4.710	0.646	5.355	2.314
France	4792	480.262	9.222	1.209	10.431	3.230
Georgia	4316	500.924	10.726	1.968	12.694	3.563
Germany	3933	517.367	4.227	0.390	4.617	2.149
Hong Kong SAR	3386	597.913	11.105	1.715	12.821	3.581
Hungary	5227	530.588	6.008	0.617	6.625	2.574
Iran, Islamic Rep. of	6010	446.090	14.802	0.944	15.746	3.968
Ireland	4582	554.615	6.340	0.906	7.246	2.692
Italy	4269	521.999	5.393	0.730	6.123	2.475
Japan	4196	585.911	2.711	0.633	3.344	1.829
Kazakhstan	4791	522.658	4.882	0.761	5.643	2.375
Korea, Rep. of	4448	593.447	5.589	0.152	5.742	2.396
Kosovo	4496	447.397	7.405	0.388	7.793	2.792
Kuwait	4437	–	–	–	–	–
Latvia	4481	546.956	6.553	0.052	6.604	2.570
Lithuania	4265	538.090	7.405	0.317	7.722	2.779
Malta	4154	511.977	1.220	1.107	2.326	1.525
Montenegro	5076	453.534	3.182	1.709	4.891	2.211
Morocco	7723	383.032	17.238	2.026	19.263	4.389
Netherlands	3831	532.919	3.937	0.801	4.738	2.177
New Zealand	5019	478.489	6.662	1.526	8.188	2.861
North Macedonia	3270	472.331	25.779	1.016	26.794	5.176
Northern Ireland	3497	572.448	8.218	1.439	9.657	3.107
Norway (5)	4527	539.844	4.074	0.085	4.159	2.039
Oman	6814	423.562	14.899	0.914	15.814	3.977
Pakistan	3980	351.471	115.358	3.999	119.356	10.925
Philippines	5515	308.074	33.043	3.841	36.884	6.073
Poland	4882	512.658	7.242	0.742	7.984	2.826
Portugal	4915	524.243	7.023	1.600	8.623	2.936
Qatar	5646	454.894	10.939	0.465	11.404	3.377
Russian Federation	4596	567.443	10.191	1.229	11.420	3.379

Summary Statistics and Standard Errors for Proficiency in Number—Grade 4 (continued)

Country	Sample Size	Number				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Saudi Arabia	5453	–	–	–	–	–
Serbia	4380	517.752	7.751	0.536	8.287	2.879
Singapore	6839	635.167	15.775	0.284	16.059	4.007
Slovak Republic	4862	512.314	10.238	2.434	12.672	3.560
South Africa (5)	11891	370.249	11.994	1.250	13.245	3.639
Spain	10946	506.240	3.120	0.621	3.741	1.934
Sweden	4535	516.995	7.230	1.056	8.285	2.878
Turkey (5)	4599	525.396	22.198	0.345	22.543	4.748
United Arab Emirates	29515	485.159	2.250	0.481	2.731	1.652
United States	10029	542.260	6.521	0.292	6.812	2.610
Benchmarking Participants						
Ontario, Canada	4360	501.494	10.897	1.903	12.800	3.578
Quebec, Canada	4384	529.549	4.826	0.868	5.694	2.386
Moscow City, Russian Fed.	4392	590.825	4.572	0.396	4.968	2.229
Madrid, Spain	3879	524.494	4.725	0.206	4.931	2.221
Abu Dhabi, UAE	10328	442.787	3.240	0.832	4.072	2.018
Dubai, UAE	8299	547.844	2.542	0.485	3.028	1.740

Summary Statistics and Standard Errors for Proficiency in Measurement and Geometry—Grade 4

Country	Sample Size	Measurement and Geometry				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Albania	4426	495.776	10.239	1.329	11.568	3.401
Armenia	5399	490.284	8.306	0.952	9.259	3.043
Australia	5890	515.924	8.113	2.516	10.629	3.260
Austria	5097	541.628	4.420	1.303	5.723	2.392
Azerbaijan	5245	502.585	8.528	1.623	10.151	3.186
Bahrain	5762	473.914	6.582	0.166	6.748	2.598
Belgium (Flemish)	4655	550.815	3.208	0.899	4.107	2.027
Bosnia and Herzegovina	5617	457.795	6.477	1.983	8.460	2.909
Bulgaria	4268	521.531	20.206	4.090	24.295	4.929
Canada	15582	510.605	3.081	0.047	3.128	1.769
Chile	4775	438.502	5.106	1.247	6.353	2.521
Chinese Taipei	4295	607.480	2.502	0.677	3.179	1.783
Croatia	4335	517.771	5.301	1.745	7.046	2.654
Cyprus	4062	525.855	7.670	1.893	9.563	3.092
Czech Republic	5358	539.826	6.182	2.194	8.376	2.894
Denmark	3693	536.224	3.116	2.527	5.642	2.375
England	3872	545.075	9.475	1.373	10.849	3.294
Finland	5397	538.434	5.356	3.534	8.890	2.982
France	4792	497.646	8.568	2.319	10.887	3.300
Georgia	4316	469.507	15.030	1.642	16.672	4.083
Germany	3933	531.170	5.153	1.459	6.612	2.571
Hong Kong SAR	3386	607.990	8.797	0.751	9.549	3.090
Hungary	5227	519.326	8.306	2.793	11.099	3.332
Iran, Islamic Rep. of	6010	445.206	12.254	0.373	12.627	3.553
Ireland	4582	540.368	6.293	0.753	7.046	2.654
Italy	4269	510.261	7.611	2.340	9.951	3.155
Japan	4196	601.117	3.823	3.414	7.238	2.690
Kazakhstan	4791	513.122	6.556	1.030	7.586	2.754
Korea, Rep. of	4448	607.585	4.979	1.603	6.582	2.566
Kosovo	4496	450.249	9.239	1.621	10.861	3.296
Kuwait	4437	–	–	–	–	–
Latvia	4481	547.744	7.137	0.483	7.621	2.761
Lithuania	4265	543.118	7.024	1.766	8.790	2.965
Malta	4154	496.988	1.180	2.084	3.264	1.807
Montenegro	5076	459.380	3.790	0.649	4.438	2.107
Morocco	7723	385.647	19.198	0.911	20.109	4.484
Netherlands	3831	537.123	3.983	0.667	4.649	2.156
New Zealand	5019	481.268	4.792	2.465	7.256	2.694
North Macedonia	3270	475.047	29.272	4.244	33.516	5.789
Northern Ireland	3497	555.761	7.610	1.459	9.068	3.011
Norway (5)	4527	546.419	5.130	2.512	7.642	2.764
Oman	6814	428.651	16.539	0.862	17.401	4.171
Pakistan	3980	286.038	191.857	7.959	199.815	14.136
Philippines	5515	259.291	45.122	4.782	49.904	7.064
Poland	4882	529.183	6.871	0.443	7.313	2.704
Portugal	4915	520.073	7.092	1.138	8.230	2.869
Qatar	5646	434.405	8.803	2.455	11.259	3.355
Russian Federation	4596	570.651	12.611	0.900	13.511	3.676

Summary Statistics and Standard Errors for Proficiency in Measurement and Geometry—Grade 4 (continued)

Country	Sample Size	Measurement and Geometry				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Saudi Arabia	5453	–	–	–	–	–
Serbia	4380	499.171	12.382	1.408	13.790	3.713
Singapore	6839	620.252	14.310	0.567	14.877	3.857
Slovak Republic	4862	505.503	10.877	2.544	13.421	3.663
South Africa (5)	11891	362.254	12.841	1.042	13.884	3.726
Spain	10946	493.645	4.008	0.899	4.906	2.215
Sweden	4535	521.350	9.811	1.565	11.376	3.373
Turkey (5)	4599	526.938	16.622	2.777	19.399	4.404
United Arab Emirates	29515	471.672	2.400	0.881	3.280	1.811
United States	10029	519.502	6.697	0.155	6.852	2.618
Benchmarking Participants						
Ontario, Canada	4360	516.387	9.539	0.805	10.344	3.216
Quebec, Canada	4384	531.905	4.690	2.077	6.767	2.601
Moscow City, Russian Fed.	4392	590.479	5.506	0.394	5.899	2.429
Madrid, Spain	3879	508.131	5.073	6.155	11.227	3.351
Abu Dhabi, UAE	10328	429.207	3.481	0.882	4.363	2.089
Dubai, UAE	8299	535.274	2.822	1.722	4.545	2.132

Summary Statistics and Standard Errors for Proficiency in Data—Grade 4

Country	Sample Size	Data				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Albania	4426	489.603	12.580	3.084	15.664	3.958
Armenia	5399	446.495	14.881	2.513	17.394	4.171
Australia	5890	534.158	8.039	3.826	11.865	3.445
Austria	5097	528.303	6.040	1.338	7.377	2.716
Azerbaijan	5245	503.973	8.201	0.995	9.196	3.032
Bahrain	5762	483.168	6.779	3.825	10.603	3.256
Belgium (Flemish)	4655	526.539	4.283	0.561	4.844	2.201
Bosnia and Herzegovina	5617	412.975	8.287	6.037	14.324	3.785
Bulgaria	4268	489.750	28.516	3.143	31.659	5.627
Canada	15582	522.589	3.937	1.613	5.551	2.356
Chile	4775	438.175	7.576	1.537	9.113	3.019
Chinese Taipei	4295	590.000	2.463	3.069	5.533	2.352
Croatia	4335	494.031	5.375	1.832	7.207	2.685
Cyprus	4062	523.541	11.570	0.078	11.648	3.413
Czech Republic	5358	517.888	7.235	1.145	8.379	2.895
Denmark	3693	525.274	4.783	0.652	5.435	2.331
England	3872	564.772	7.085	2.409	9.494	3.081
Finland	5397	533.949	6.282	1.324	7.606	2.758
France	4792	475.921	9.368	1.968	11.336	3.367
Georgia	4316	444.167	19.010	2.027	21.037	4.587
Germany	3933	514.969	7.740	1.565	9.305	3.050
Hong Kong SAR	3386	606.787	8.553	4.393	12.946	3.598
Hungary	5227	507.997	9.727	0.547	10.274	3.205
Iran, Islamic Rep. of	6010	424.447	12.946	1.439	14.385	3.793
Ireland	4582	542.599	8.254	0.938	9.192	3.032
Italy	4269	498.162	8.479	0.728	9.208	3.034
Japan	4196	605.568	3.826	0.433	4.259	2.064
Kazakhstan	4791	481.279	8.150	0.943	9.092	3.015
Korea, Rep. of	4448	602.348	4.966	1.453	6.418	2.533
Kosovo	4496	423.399	12.797	1.132	13.929	3.732
Kuwait	4437	–	–	–	–	–
Latvia	4481	542.028	7.480	3.073	10.553	3.249
Lithuania	4265	544.701	7.244	1.906	9.150	3.025
Malta	4154	511.745	1.769	1.415	3.184	1.784
Montenegro	5076	438.941	5.236	2.093	7.328	2.707
Morocco	7723	374.307	26.721	0.967	27.689	5.262
Netherlands	3831	549.356	6.651	2.214	8.864	2.977
New Zealand	5019	503.795	6.152	3.394	9.547	3.090
North Macedonia	3270	464.375	34.069	2.781	36.850	6.070
Northern Ireland	3497	564.088	5.388	0.743	6.131	2.476
Norway (5)	4527	546.747	7.074	3.198	10.272	3.205
Oman	6814	432.765	12.206	2.497	14.703	3.834
Pakistan	3980	277.861	206.922	2.972	209.894	14.488
Philippines	5515	290.984	45.650	5.163	50.813	7.128
Poland	4882	524.057	7.417	1.258	8.675	2.945
Portugal	4915	528.085	5.533	0.977	6.510	2.551
Qatar	5646	445.438	13.336	0.950	14.286	3.780
Russian Federation	4596	559.843	12.285	2.540	14.825	3.850

Summary Statistics and Standard Errors for Proficiency in Data—Grade 4 (continued)

Country	Sample Size	Data				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Saudi Arabia	5453	–	–	–	–	–
Serbia	4380	489.187	15.143	2.259	17.402	4.172
Singapore	6839	613.499	13.784	0.750	14.534	3.812
Slovak Republic	4862	505.622	15.045	2.092	17.137	4.140
South Africa (5)	11891	390.013	12.252	2.380	14.632	3.825
Spain	10946	499.410	4.318	2.348	6.665	2.582
Sweden	4535	527.046	10.149	1.890	12.039	3.470
Turkey (5)	4599	510.321	19.449	0.787	20.236	4.498
United Arab Emirates	29515	476.228	1.997	1.132	3.130	1.769
United States	10029	533.224	6.384	2.877	9.261	3.043
Benchmarking Participants						
Ontario, Canada	4360	527.205	13.685	1.917	15.603	3.950
Quebec, Canada	4384	534.805	5.964	3.392	9.356	3.059
Moscow City, Russian Fed.	4392	603.254	5.642	0.443	6.085	2.467
Madrid, Spain	3879	512.794	5.275	2.916	8.191	2.862
Abu Dhabi, UAE	10328	434.920	3.302	1.866	5.168	2.273
Dubai, UAE	8299	546.189	2.653	1.307	3.960	1.990

Summary Statistics and Standard Errors for Proficiency in Knowing in Mathematics—Grade 4

Country	Sample Size	Mathematics Knowing				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Albania	4426	492.008	12.230	1.733	13.963	3.737
Armenia	5399	496.887	6.012	1.058	7.070	2.659
Australia	5890	509.225	8.101	2.569	10.670	3.266
Austria	5097	540.214	3.265	0.612	3.877	1.969
Azerbaijan	5245	513.116	5.116	0.280	5.396	2.323
Bahrain	5762	477.568	6.100	1.156	7.256	2.694
Belgium (Flemish)	4655	546.158	3.938	2.051	5.989	2.447
Bosnia and Herzegovina	5617	444.171	5.257	1.908	7.166	2.677
Bulgaria	4268	510.965	15.592	1.144	16.736	4.091
Canada	15582	506.483	3.526	0.940	4.466	2.113
Chile	4775	427.279	6.096	0.831	6.927	2.632
Chinese Taipei	4295	621.564	2.272	1.380	3.651	1.911
Croatia	4335	507.643	3.934	0.868	4.802	2.191
Cyprus	4062	529.883	8.817	1.931	10.748	3.278
Czech Republic	5358	528.194	5.622	3.193	8.815	2.969
Denmark	3693	523.892	4.057	0.803	4.860	2.205
England	3872	562.728	10.076	0.545	10.621	3.259
Finland	5397	530.888	5.218	0.530	5.749	2.398
France	4792	487.518	9.102	2.051	11.152	3.340
Georgia	4316	473.424	13.333	1.550	14.883	3.858
Germany	3933	523.431	4.736	0.625	5.361	2.315
Hong Kong SAR	3386	599.917	8.586	0.562	9.148	3.025
Hungary	5227	524.599	6.495	0.454	6.948	2.636
Iran, Islamic Rep. of	6010	436.394	14.250	1.341	15.591	3.949
Ireland	4582	550.224	7.395	1.652	9.046	3.008
Italy	4269	514.972	6.325	2.730	9.055	3.009
Japan	4196	597.367	3.325	0.540	3.865	1.966
Kazakhstan	4791	509.915	4.589	0.745	5.334	2.310
Korea, Rep. of	4448	612.367	6.050	6.579	12.629	3.554
Kosovo	4496	444.770	9.651	0.494	10.145	3.185
Kuwait	4437	–	–	–	–	–
Latvia	4481	537.095	6.113	0.637	6.750	2.598
Lithuania	4265	535.443	6.091	1.802	7.893	2.809
Malta	4154	509.508	1.238	0.630	1.868	1.367
Montenegro	5076	444.654	3.261	1.249	4.510	2.124
Morocco	7723	379.300	19.089	0.364	19.454	4.411
Netherlands	3831	534.084	3.751	0.467	4.218	2.054
New Zealand	5019	475.997	6.090	1.065	7.155	2.675
North Macedonia	3270	469.801	28.765	3.154	31.919	5.650
Northern Ireland	3497	574.459	8.240	2.448	10.688	3.269
Norway (5)	4527	540.539	4.141	1.028	5.168	2.273
Oman	6814	423.923	16.661	2.574	19.235	4.386
Pakistan	3980	326.675	153.107	4.480	157.587	12.553
Philippines	5515	301.905	38.734	1.333	40.067	6.330
Poland	4882	509.333	6.648	0.665	7.314	2.704
Portugal	4915	523.035	6.398	1.684	8.081	2.843
Qatar	5646	447.336	12.633	0.248	12.881	3.589
Russian Federation	4596	554.537	8.452	0.304	8.757	2.959

Summary Statistics and Standard Errors for Proficiency in Knowing in Mathematics—Grade 4 (continued)

Country	Sample Size	Mathematics Knowing				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Saudi Arabia	5453	–	–	–	–	–
Serbia	4380	504.015	8.524	2.490	11.014	3.319
Singapore	6839	640.096	14.607	0.572	15.179	3.896
Slovak Republic	4862	501.590	10.324	0.583	10.906	3.302
South Africa (5)	11891	372.353	12.734	1.028	13.763	3.710
Spain	10946	499.496	3.767	1.974	5.741	2.396
Sweden	4535	515.376	7.412	2.289	9.701	3.115
Turkey (5)	4599	514.413	19.051	0.479	19.530	4.419
United Arab Emirates	29515	479.344	2.365	0.305	2.671	1.634
United States	10029	536.492	6.608	0.276	6.884	2.624
Benchmarking Participants						
Ontario, Canada	4360	503.914	11.510	2.407	13.917	3.731
Quebec, Canada	4384	535.016	5.116	2.128	7.243	2.691
Moscow City, Russian Fed.	4392	576.540	3.440	1.004	4.443	2.108
Madrid, Spain	3879	514.609	5.230	10.531	15.761	3.970
Abu Dhabi, UAE	10328	439.150	3.707	0.289	3.996	1.999
Dubai, UAE	8299	542.494	2.552	0.626	3.177	1.783

Summary Statistics and Standard Errors for Proficiency in Applying in Mathematics—Grade 4

Country	Sample Size	Mathematics Applying				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Albania	4426	497.712	10.503	0.649	11.152	3.339
Armenia	5399	501.345	6.687	1.964	8.651	2.941
Australia	5890	515.948	7.378	0.905	8.282	2.878
Austria	5097	537.632	3.843	0.365	4.208	2.051
Azerbaijan	5245	519.348	8.536	0.794	9.330	3.055
Bahrain	5762	479.466	6.657	0.205	6.861	2.619
Belgium (Flemish)	4655	526.453	3.080	0.748	3.828	1.957
Bosnia and Herzegovina	5617	451.822	6.086	2.439	8.525	2.920
Bulgaria	4268	518.288	19.395	1.120	20.515	4.529
Canada	15582	512.930	3.097	0.621	3.719	1.928
Chile	4775	445.626	6.786	2.321	9.107	3.018
Chinese Taipei	4295	600.223	2.124	0.173	2.297	1.516
Croatia	4335	509.240	3.923	1.250	5.173	2.274
Cyprus	4062	536.422	8.417	0.525	8.942	2.990
Czech Republic	5358	531.499	6.009	0.850	6.860	2.619
Denmark	3693	519.860	3.732	1.761	5.493	2.344
England	3872	553.177	8.442	2.201	10.643	3.262
Finland	5397	531.330	5.275	0.386	5.661	2.379
France	4792	481.687	8.915	0.645	9.560	3.092
Georgia	4316	489.562	11.944	1.356	13.300	3.647
Germany	3933	514.027	4.884	1.196	6.079	2.466
Hong Kong SAR	3386	606.477	9.781	1.329	11.110	3.333
Hungary	5227	521.226	7.109	0.976	8.084	2.843
Iran, Islamic Rep. of	6010	449.546	14.199	1.726	15.925	3.991
Ireland	4582	551.333	6.180	0.917	7.098	2.664
Italy	4269	517.381	6.215	0.788	7.003	2.646
Japan	4196	592.841	2.799	1.386	4.185	2.046
Kazakhstan	4791	514.005	6.603	0.619	7.222	2.687
Korea, Rep. of	4448	594.160	4.985	1.356	6.341	2.518
Kosovo	4496	445.293	8.054	0.894	8.948	2.991
Kuwait	4437	–	–	–	–	–
Latvia	4481	546.604	6.509	1.046	7.554	2.749
Lithuania	4265	546.946	7.435	0.022	7.457	2.731
Malta	4154	507.516	1.068	0.368	1.436	1.198
Montenegro	5076	453.817	3.806	0.691	4.497	2.121
Morocco	7723	387.008	17.215	3.429	20.643	4.544
Netherlands	3831	535.971	4.467	0.513	4.980	2.232
New Zealand	5019	487.375	5.498	0.503	6.001	2.450
North Macedonia	3270	476.657	25.566	1.332	26.898	5.186
Northern Ireland	3497	564.756	7.353	0.444	7.798	2.792
Norway (5)	4527	539.724	4.871	0.615	5.485	2.342
Oman	6814	434.099	12.421	0.173	12.594	3.549
Pakistan	3980	306.379	167.860	3.563	171.423	13.093
Philippines	5515	286.298	41.963	5.853	47.816	6.915
Poland	4882	521.408	7.172	0.542	7.713	2.777
Portugal	4915	528.083	6.178	0.559	6.737	2.596
Qatar	5646	453.181	9.907	1.337	11.244	3.353
Russian Federation	4596	570.548	11.325	1.314	12.639	3.555

Summary Statistics and Standard Errors for Proficiency in Applying in Mathematics—Grade 4 (continued)

Country	Sample Size	Mathematics Applying				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Saudi Arabia	5453	–	–	–	–	–
Serbia	4380	508.983	11.027	1.116	12.143	3.485
Singapore	6839	625.586	14.408	0.559	14.967	3.869
Slovak Republic	4862	508.027	10.737	1.074	11.811	3.437
South Africa (5)	11891	375.471	11.031	1.722	12.752	3.571
Spain	10946	505.530	3.171	0.465	3.637	1.907
Sweden	4535	517.812	7.540	0.313	7.852	2.802
Turkey (5)	4599	530.746	19.559	0.235	19.794	4.449
United Arab Emirates	29515	484.287	2.153	0.602	2.755	1.660
United States	10029	537.435	6.417	0.589	7.006	2.647
Benchmarking Participants						
Ontario, Canada	4360	513.734	10.374	1.062	11.436	3.382
Quebec, Canada	4384	533.351	4.554	0.867	5.422	2.328
Moscow City, Russian Fed.	4392	598.612	4.973	1.334	6.308	2.511
Madrid, Spain	3879	520.490	4.207	1.539	5.746	2.397
Abu Dhabi, UAE	10328	441.848	3.349	0.577	3.926	1.981
Dubai, UAE	8299	547.365	2.365	0.328	2.693	1.641

Summary Statistics and Standard Errors for Proficiency in Reasoning in Mathematics—Grade 4

Country	Sample Size	Mathematics Reasoning				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Albania	4426	489.866	12.706	1.225	13.931	3.732
Armenia	5399	482.947	6.571	1.814	8.385	2.896
Australia	5890	522.334	7.181	1.955	9.136	3.023
Austria	5097	537.327	4.399	1.271	5.670	2.381
Azerbaijan	5245	506.384	8.801	1.102	9.904	3.147
Bahrain	5762	479.032	4.998	1.080	6.078	2.465
Belgium (Flemish)	4655	530.363	3.215	0.627	3.843	1.960
Bosnia and Herzegovina	5617	461.310	6.931	2.009	8.940	2.990
Bulgaria	4268	509.400	23.474	1.308	24.782	4.978
Canada	15582	513.184	2.821	1.323	4.144	2.036
Chile	4775	447.788	6.567	9.457	16.025	4.003
Chinese Taipei	4295	576.130	3.178	0.087	3.265	1.807
Croatia	4335	509.579	6.524	1.198	7.722	2.779
Cyprus	4062	526.492	8.086	0.102	8.188	2.861
Czech Republic	5358	541.354	6.771	0.911	7.683	2.772
Denmark	3693	534.908	3.519	1.364	4.882	2.210
England	3872	554.243	8.213	3.475	11.688	3.419
Finland	5397	535.274	4.889	1.304	6.193	2.489
France	4792	480.293	10.053	0.635	10.688	3.269
Georgia	4316	468.961	17.836	2.064	19.900	4.461
Germany	3933	531.209	5.146	2.480	7.626	2.761
Hong Kong SAR	3386	595.785	13.208	4.373	17.580	4.193
Hungary	5227	522.152	8.319	0.952	9.271	3.045
Iran, Islamic Rep. of	6010	426.403	13.031	5.822	18.854	4.342
Ireland	4582	541.952	5.564	0.606	6.170	2.484
Italy	4269	503.988	5.031	3.154	8.186	2.861
Japan	4196	588.749	4.091	0.845	4.937	2.222
Kazakhstan	4791	507.328	6.371	0.665	7.035	2.652
Korea, Rep. of	4448	596.499	5.798	2.513	8.311	2.883
Kosovo	4496	441.253	8.773	1.752	10.525	3.244
Kuwait	4437	–	–	–	–	–
Latvia	4481	554.327	8.639	0.558	9.198	3.033
Lithuania	4265	533.508	8.818	1.957	10.775	3.282
Malta	4154	507.999	1.284	0.631	1.916	1.384
Montenegro	5076	462.869	4.294	2.896	7.189	2.681
Morocco	7723	379.809	21.977	5.363	27.340	5.229
Netherlands	3831	545.763	5.618	3.026	8.644	2.940
New Zealand	5019	501.111	5.137	2.072	7.210	2.685
North Macedonia	3270	470.146	25.049	7.096	32.145	5.670
Northern Ireland	3497	558.367	5.297	3.076	8.373	2.894
Norway (5)	4527	550.732	4.681	3.590	8.271	2.876
Oman	6814	424.489	13.180	0.679	13.859	3.723
Pakistan	3980	354.332	84.595	2.266	86.861	9.320
Philippines	5515	271.924	41.199	2.558	43.758	6.615
Poland	4882	527.177	6.716	0.927	7.643	2.765
Portugal	4915	519.489	6.618	1.702	8.320	2.884
Qatar	5646	439.848	10.867	1.109	11.976	3.461
Russian Federation	4596	572.825	12.976	0.341	13.317	3.649

Summary Statistics and Standard Errors for Proficiency in Reasoning in Mathematics—Grade 4 (continued)

Country	Sample Size	Mathematics Reasoning				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Saudi Arabia	5453	–	–	–	–	–
Serbia	4380	503.200	13.045	0.865	13.910	3.730
Singapore	6839	613.975	15.570	0.650	16.220	4.027
Slovak Republic	4862	521.638	11.487	0.675	12.162	3.487
South Africa (5)	11891	370.204	11.837	2.304	14.141	3.760
Spain	10946	496.836	3.676	0.342	4.018	2.005
Sweden	4535	535.770	7.667	0.830	8.497	2.915
Turkey (5)	4599	508.961	22.865	3.009	25.874	5.087
United Arab Emirates	29515	474.278	2.188	0.784	2.972	1.724
United States	10029	523.744	5.847	0.534	6.381	2.526
Benchmarking Participants						
Ontario, Canada	4360	515.653	9.052	3.423	12.475	3.532
Quebec, Canada	4384	523.872	4.827	2.926	7.752	2.784
Moscow City, Russian Fed.	4392	601.547	6.724	1.067	7.791	2.791
Madrid, Spain	3879	514.454	4.514	2.627	7.141	2.672
Abu Dhabi, UAE	10328	434.535	3.313	2.337	5.650	2.377
Dubai, UAE	8299	537.919	2.417	0.880	3.297	1.816

Appendix 14B: Summary Statistics and Standard Errors for Proficiency in Grade 4 Science

Summary Statistics and Standard Errors for Proficiency in Overall Science—Grade 4

Country	Sample Size	Overall Science				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Albania	4426	489.480	11.533	0.908	12.441	3.527
Armenia	5399	466.432	8.525	3.268	11.793	3.434
Australia	5890	532.575	5.420	0.460	5.881	2.425
Austria	5097	522.061	4.281	2.351	6.632	2.575
Azerbaijan	5245	426.735	9.989	0.817	10.807	3.287
Bahrain	5762	492.542	10.410	1.214	11.624	3.409
Belgium (Flemish)	4655	501.017	3.383	1.052	4.435	2.106
Bosnia and Herzegovina	5617	458.594	6.755	1.928	8.682	2.947
Bulgaria	4268	521.302	23.747	0.593	24.340	4.934
Canada	15577	523.033	2.235	1.304	3.539	1.881
Chile	4773	469.116	5.797	0.820	6.618	2.572
Chinese Taipei	4295	558.050	2.031	1.067	3.098	1.760
Croatia	4335	523.864	2.843	1.810	4.653	2.157
Cyprus	4062	511.419	6.960	2.263	9.223	3.037
Czech Republic	5358	533.720	3.991	2.707	6.699	2.588
Denmark	3692	522.163	3.415	2.197	5.612	2.369
England	3871	537.026	6.153	1.023	7.176	2.679
Finland	5395	554.561	4.877	1.746	6.623	2.573
France	4791	487.728	8.011	0.783	8.794	2.966
Georgia	4313	454.213	12.496	2.990	15.486	3.935
Germany	3933	518.346	4.696	0.190	4.886	2.210
Hong Kong SAR	3386	531.250	9.782	1.427	11.210	3.348
Hungary	5227	529.438	6.151	0.978	7.129	2.670
Iran, Islamic Rep. of	6010	440.828	16.546	0.419	16.964	4.119
Ireland	4582	527.970	9.038	0.968	10.006	3.163
Italy	4269	509.728	6.219	2.829	9.048	3.008
Japan	4196	561.659	2.705	0.432	3.137	1.771
Kazakhstan	4791	494.155	8.139	1.260	9.399	3.066
Korea, Rep. of	4448	587.607	3.775	0.745	4.520	2.126
Kosovo	4496	413.059	11.384	2.272	13.656	3.695
Kuwait	4437	392.295	32.017	5.232	37.250	6.103
Latvia	4481	541.858	5.508	0.179	5.687	2.385
Lithuania	4265	538.079	5.350	0.987	6.337	2.517
Malta	4153	495.791	1.379	0.229	1.608	1.268
Montenegro	5076	453.321	4.138	2.071	6.208	2.492
Morocco	7723	374.066	29.024	4.927	33.951	5.827
Netherlands	3829	518.471	6.588	1.821	8.410	2.900
New Zealand	5019	502.551	4.061	1.245	5.305	2.303
North Macedonia	3270	426.043	35.158	3.731	38.889	6.236
Northern Ireland	3497	518.491	3.486	1.809	5.295	2.301
Norway (5)	4526	539.402	4.314	0.494	4.808	2.193
Oman	6814	434.944	14.574	1.977	16.551	4.068
Pakistan	3980	290.097	171.577	9.136	180.713	13.443
Philippines	5515	249.018	48.177	8.390	56.567	7.521

Summary Statistics and Standard Errors for Proficiency in Overall Science—Grade 4 (continued)

Country	Sample Size	Overall Science				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Poland	4882	530.833	5.574	1.119	6.693	2.587
Portugal	4915	503.815	3.840	2.666	6.507	2.551
Qatar	5645	449.472	14.335	1.183	15.518	3.939
Russian Federation	4596	567.255	8.334	0.769	9.103	3.017
Saudi Arabia	5453	402.237	12.027	4.535	16.562	4.070
Serbia	4380	516.907	10.649	1.604	12.252	3.500
Singapore	6837	594.529	11.309	0.250	11.558	3.400
Slovak Republic	4862	520.732	12.738	0.955	13.693	3.700
South Africa (5)	11891	324.234	21.945	2.378	24.323	4.932
Spain	10945	511.282	2.891	1.152	4.043	2.011
Sweden	4534	537.233	8.897	1.999	10.897	3.301
Turkey (5)	4599	526.355	16.508	1.317	17.825	4.222
United Arab Emirates	29508	472.544	2.748	1.464	4.212	2.052
United States	10028	538.643	5.876	1.640	7.516	2.742
Benchmarking Participants						
Ontario, Canada	4359	523.918	7.784	2.160	9.944	3.153
Quebec, Canada	4384	521.962	4.190	2.215	6.405	2.531
Moscow City, Russian Fed.	4392	594.862	4.178	0.812	4.989	2.234
Madrid, Spain	3879	522.822	3.446	0.519	3.965	1.991
Abu Dhabi, UAE	10324	417.825	4.409	3.156	7.565	2.751
Dubai, UAE	8299	544.504	2.065	0.849	2.914	1.707

Summary Statistics and Standard Errors for Proficiency in Life Science—Grade 4

Country	Sample Size	Life Science				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Albania	4426	488.235	10.851	2.967	13.818	3.717
Armenia	5399	475.812	8.178	2.171	10.349	3.217
Australia	5890	539.141	5.857	1.831	7.688	2.773
Austria	5097	523.171	4.066	1.321	5.386	2.321
Azerbaijan	5245	423.083	9.538	1.789	11.327	3.366
Bahrain	5762	491.680	11.564	1.315	12.880	3.589
Belgium (Flemish)	4655	499.731	3.645	2.358	6.003	2.450
Bosnia and Herzegovina	5617	471.113	6.833	4.032	10.865	3.296
Bulgaria	4268	525.291	24.469	2.436	26.904	5.187
Canada	15582	531.891	2.155	1.316	3.471	1.863
Chile	4775	477.897	4.975	1.304	6.278	2.506
Chinese Taipei	4295	540.497	2.185	1.991	4.175	2.043
Croatia	4335	520.242	3.043	2.025	5.067	2.251
Cyprus	4062	514.903	7.284	3.828	11.112	3.333
Czech Republic	5358	535.472	4.427	0.597	5.024	2.241
Denmark	3693	526.397	3.644	1.013	4.657	2.158
England	3872	537.469	6.008	0.738	6.746	2.597
Finland	5397	558.312	4.761	3.490	8.251	2.873
France	4792	493.601	8.348	1.117	9.465	3.077
Georgia	4316	456.951	12.997	3.346	16.342	4.043
Germany	3933	521.427	4.763	0.617	5.380	2.319
Hong Kong SAR	3386	523.155	10.597	2.250	12.847	3.584
Hungary	5227	533.350	6.240	5.540	11.780	3.432
Iran, Islamic Rep. of	6010	429.949	16.037	4.422	20.460	4.523
Ireland	4582	527.948	9.977	2.013	11.990	3.463
Italy	4269	513.748	6.311	4.565	10.875	3.298
Japan	4196	550.278	2.536	1.567	4.103	2.026
Kazakhstan	4791	486.196	8.623	3.341	11.963	3.459
Korea, Rep. of	4448	574.267	4.081	2.415	6.497	2.549
Kosovo	4496	407.760	12.803	5.756	18.559	4.308
Kuwait	4437	–	–	–	–	–
Latvia	4481	534.568	5.420	1.804	7.224	2.688
Lithuania	4265	536.658	5.187	2.532	7.719	2.778
Malta	4154	499.335	1.531	4.543	6.074	2.464
Montenegro	5076	464.311	4.530	0.521	5.050	2.247
Morocco	7723	363.768	31.147	4.138	35.285	5.940
Netherlands	3831	517.876	7.104	3.596	10.700	3.271
New Zealand	5019	510.077	3.999	1.405	5.404	2.325
North Macedonia	3270	421.842	32.352	2.157	34.510	5.874
Northern Ireland	3497	520.134	3.438	4.331	7.769	2.787
Norway (5)	4527	547.003	4.338	4.802	9.140	3.023
Oman	6814	434.459	14.580	6.970	21.550	4.642
Pakistan	3980	–	–	–	–	–
Philippines	5515	–	–	–	–	–
Poland	4882	533.749	5.181	4.297	9.478	3.079
Portugal	4915	508.825	3.420	0.370	3.791	1.947
Qatar	5646	448.118	15.116	6.112	21.228	4.607
Russian Federation	4596	570.364	7.330	2.565	9.895	3.146

Summary Statistics and Standard Errors for Proficiency in Life Science—Grade 4 (continued)

Country	Sample Size	Life Science				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Saudi Arabia	5453	–	–	–	–	–
Serbia	4380	520.783	10.714	3.916	14.630	3.825
Singapore	6839	603.016	12.558	0.743	13.300	3.647
Slovak Republic	4862	520.034	12.170	2.918	15.088	3.884
South Africa (5)	11891	–	–	–	–	–
Spain	10946	513.882	2.646	2.096	4.742	2.178
Sweden	4535	541.434	9.250	1.340	10.590	3.254
Turkey (5)	4599	518.678	17.496	3.325	20.821	4.563
United Arab Emirates	29515	466.709	2.923	1.071	3.993	1.998
United States	10029	546.431	5.566	0.821	6.386	2.527
Benchmarking Participants						
Ontario, Canada	4360	534.859	7.100	1.391	8.491	2.914
Quebec, Canada	4384	529.545	4.069	1.928	5.998	2.449
Moscow City, Russian Fed.	4392	595.338	4.339	3.029	7.368	2.714
Madrid, Spain	3879	524.595	3.650	7.943	11.592	3.405
Abu Dhabi, UAE	10328	413.051	4.445	1.714	6.159	2.482
Dubai, UAE	8299	537.447	2.062	1.429	3.490	1.868

Summary Statistics and Standard Errors for Proficiency in Physical Science—Grade 4

Country	Sample Size	Physical Science				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Albania	4426	493.368	13.752	2.873	16.626	4.077
Armenia	5399	453.897	9.309	2.272	11.580	3.403
Australia	5890	525.828	6.274	0.928	7.202	2.684
Austria	5097	519.431	4.820	1.897	6.716	2.592
Azerbaijan	5245	426.872	9.955	0.881	10.836	3.292
Bahrain	5762	496.246	12.388	2.424	14.812	3.849
Belgium (Flemish)	4655	502.074	3.390	1.844	5.235	2.288
Bosnia and Herzegovina	5617	450.345	7.573	3.596	11.169	3.342
Bulgaria	4268	518.080	32.938	7.467	40.405	6.357
Canada	15582	512.830	2.423	0.788	3.211	1.792
Chile	4775	457.694	7.631	6.984	14.614	3.823
Chinese Taipei	4295	573.203	2.577	1.126	3.703	1.924
Croatia	4335	527.709	2.895	2.684	5.579	2.362
Cyprus	4062	511.033	9.208	0.867	10.074	3.174
Czech Republic	5358	527.994	4.430	2.010	6.441	2.538
Denmark	3693	507.047	3.254	2.124	5.378	2.319
England	3872	536.978	7.463	2.839	10.302	3.210
Finland	5397	544.061	5.400	5.076	10.476	3.237
France	4792	477.467	7.913	1.827	9.740	3.121
Georgia	4316	452.496	15.278	5.678	20.956	4.578
Germany	3933	518.375	5.375	3.824	9.199	3.033
Hong Kong SAR	3386	528.796	11.179	1.271	12.450	3.528
Hungary	5227	523.884	6.019	1.607	7.626	2.762
Iran, Islamic Rep. of	6010	452.770	20.607	1.766	22.373	4.730
Ireland	4582	522.775	8.264	1.919	10.183	3.191
Italy	4269	501.845	6.379	5.495	11.874	3.446
Japan	4196	578.571	3.285	0.283	3.569	1.889
Kazakhstan	4791	506.307	10.574	0.513	11.088	3.330
Korea, Rep. of	4448	606.851	4.132	3.185	7.316	2.705
Kosovo	4496	415.201	12.106	5.180	17.286	4.158
Kuwait	4437	–	–	–	–	–
Latvia	4481	553.378	6.309	6.663	12.972	3.602
Lithuania	4265	547.325	6.077	3.199	9.275	3.046
Malta	4154	491.791	1.676	6.505	8.182	2.860
Montenegro	5076	445.837	4.458	3.470	7.927	2.816
Morocco	7723	378.516	33.324	5.369	38.692	6.220
Netherlands	3831	515.520	6.715	1.147	7.861	2.804
New Zealand	5019	492.277	3.897	0.367	4.264	2.065
North Macedonia	3270	431.900	47.856	3.482	51.338	7.165
Northern Ireland	3497	510.827	4.432	0.335	4.767	2.183
Norway (5)	4527	525.225	4.148	5.020	9.168	3.028
Oman	6814	436.716	18.617	3.024	21.641	4.652
Pakistan	3980	–	–	–	–	–
Philippines	5515	–	–	–	–	–
Poland	4882	525.764	6.554	1.710	8.263	2.875
Portugal	4915	496.429	3.688	2.167	5.855	2.420
Qatar	5646	450.999	14.751	1.397	16.149	4.019
Russian Federation	4596	572.092	7.604	1.000	8.605	2.933

Summary Statistics and Standard Errors for Proficiency in Physical Science—Grade 4 (continued)

Country	Sample Size	Physical Science				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Saudi Arabia	5453	–	–	–	–	–
Serbia	4380	524.273	12.399	5.165	17.564	4.191
Singapore	6839	613.119	13.060	0.586	13.646	3.694
Slovak Republic	4862	525.382	13.915	1.168	15.084	3.884
South Africa (5)	11891	–	–	–	–	–
Spain	10946	503.461	3.344	2.153	5.497	2.344
Sweden	4535	525.075	8.860	1.969	10.829	3.291
Turkey (5)	4599	537.992	17.660	3.341	21.001	4.583
United Arab Emirates	29515	477.422	3.591	1.215	4.807	2.192
United States	10029	527.099	6.262	1.650	7.912	2.813
Benchmarking Participants						
Ontario, Canada	4360	512.245	8.292	0.225	8.517	2.918
Quebec, Canada	4384	513.586	4.803	3.171	7.974	2.824
Moscow City, Russian Fed.	4392	598.457	4.564	2.501	7.065	2.658
Madrid, Spain	3879	514.091	3.962	2.538	6.500	2.550
Abu Dhabi, UAE	10328	417.734	5.420	1.315	6.735	2.595
Dubai, UAE	8299	555.628	2.803	1.682	4.485	2.118

Summary Statistics and Standard Errors for Proficiency in Earth Science—Grade 4

Country	Sample Size	Earth Science				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Albania	4426	474.909	16.389	1.234	17.623	4.198
Armenia	5399	451.275	12.441	2.054	14.494	3.807
Australia	5890	526.772	6.078	1.595	7.673	2.770
Austria	5097	523.718	5.431	6.593	12.024	3.468
Azerbaijan	5245	423.738	10.102	11.926	22.028	4.693
Bahrain	5762	477.747	11.341	4.901	16.242	4.030
Belgium (Flemish)	4655	496.356	3.955	0.746	4.701	2.168
Bosnia and Herzegovina	5617	436.773	8.279	1.755	10.034	3.168
Bulgaria	4268	514.125	21.546	1.481	23.027	4.799
Canada	15582	518.659	2.720	2.024	4.745	2.178
Chile	4775	460.043	7.619	11.055	18.674	4.321
Chinese Taipei	4295	567.902	2.169	1.047	3.216	1.793
Croatia	4335	523.109	4.302	4.827	9.129	3.021
Cyprus	4062	499.825	6.945	0.397	7.342	2.710
Czech Republic	5358	535.596	4.791	4.138	8.928	2.988
Denmark	3693	534.842	3.508	3.744	7.253	2.693
England	3872	532.805	6.119	2.576	8.695	2.949
Finland	5397	563.107	6.158	5.935	12.093	3.478
France	4792	488.298	9.236	0.776	10.012	3.164
Georgia	4316	434.646	15.236	2.483	17.719	4.209
Germany	3933	508.928	5.505	10.538	16.043	4.005
Hong Kong SAR	3386	549.322	9.454	10.439	19.893	4.460
Hungary	5227	531.264	7.825	2.409	10.233	3.199
Iran, Islamic Rep. of	6010	438.022	15.497	1.835	17.331	4.163
Ireland	4582	536.223	9.872	4.856	14.729	3.838
Italy	4269	506.898	7.312	6.521	13.834	3.719
Japan	4196	559.222	3.602	0.175	3.776	1.943
Kazakhstan	4791	487.558	9.533	0.975	10.507	3.242
Korea, Rep. of	4448	586.934	4.573	3.629	8.202	2.864
Kosovo	4496	410.241	12.118	3.370	15.488	3.935
Kuwait	4437	–	–	–	–	–
Latvia	4481	535.307	7.600	5.912	13.512	3.676
Lithuania	4265	524.756	7.533	1.515	9.049	3.008
Malta	4154	491.459	1.839	2.410	4.248	2.061
Montenegro	5076	433.585	4.608	5.297	9.905	3.147
Morocco	7723	349.645	39.183	4.815	43.997	6.633
Netherlands	3831	520.962	9.917	2.496	12.413	3.523
New Zealand	5019	503.404	5.182	4.598	9.780	3.127
North Macedonia	3270	409.198	45.408	6.945	52.353	7.236
Northern Ireland	3497	524.625	3.572	3.375	6.947	2.636
Norway (5)	4527	546.773	4.305	3.843	8.148	2.854
Oman	6814	415.929	15.816	4.771	20.587	4.537
Pakistan	3980	–	–	–	–	–
Philippines	5515	–	–	–	–	–
Poland	4882	529.304	5.651	5.177	10.828	3.291
Portugal	4915	500.943	5.364	3.674	9.038	3.006
Qatar	5646	442.276	17.920	14.323	32.242	5.678
Russian Federation	4596	554.389	10.384	9.394	19.778	4.447

Summary Statistics and Standard Errors for Proficiency in Earth Science—Grade 4 (continued)

Country	Sample Size	Earth Science				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Saudi Arabia	5453	–	–	–	–	–
Serbia	4380	494.207	11.376	8.843	20.219	4.497
Singapore	6839	556.853	12.002	3.567	15.569	3.946
Slovak Republic	4862	513.026	13.831	5.525	19.356	4.400
South Africa (5)	11891	–	–	–	–	–
Spain	10946	518.068	3.132	2.789	5.922	2.433
Sweden	4535	546.607	10.093	4.151	14.243	3.774
Turkey (5)	4599	524.451	15.115	1.208	16.323	4.040
United Arab Emirates	29515	473.901	2.477	0.175	2.652	1.629
United States	10029	538.555	6.639	3.672	10.311	3.211
Benchmarking Participants						
Ontario, Canada	4360	518.094	9.690	1.805	11.495	3.390
Quebec, Canada	4384	518.638	5.573	4.402	9.975	3.158
Moscow City, Russian Fed.	4392	589.320	4.707	4.317	9.024	3.004
Madrid, Spain	3879	533.059	3.524	0.481	4.006	2.001
Abu Dhabi, UAE	10328	421.662	3.897	0.369	4.267	2.066
Dubai, UAE	8299	541.727	2.000	3.326	5.326	2.308

Summary Statistics and Standard Errors for Proficiency in Knowing in Science—Grade 4

Country	Sample Size	Science Knowing				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Albania	4426	493.520	15.190	0.095	15.285	3.910
Armenia	5399	463.452	8.847	2.897	11.744	3.427
Australia	5890	537.851	6.396	2.826	9.222	3.037
Austria	5097	522.948	4.913	4.963	9.876	3.143
Azerbaijan	5245	425.221	9.629	6.675	16.304	4.038
Bahrain	5762	496.453	12.074	1.267	13.341	3.653
Belgium (Flemish)	4655	493.254	3.748	3.447	7.196	2.683
Bosnia and Herzegovina	5617	451.232	6.924	3.607	10.531	3.245
Bulgaria	4268	526.484	27.340	1.409	28.749	5.362
Canada	15582	524.359	2.410	1.125	3.535	1.880
Chile	4775	472.679	6.354	7.642	13.996	3.741
Chinese Taipei	4295	560.459	2.572	1.055	3.628	1.905
Croatia	4335	526.477	3.679	1.919	5.598	2.366
Cyprus	4062	502.802	9.196	1.493	10.690	3.269
Czech Republic	5358	538.284	4.201	4.468	8.669	2.944
Denmark	3693	520.882	3.179	0.915	4.094	2.023
England	3872	543.531	7.029	3.920	10.949	3.309
Finland	5397	553.164	5.371	0.656	6.027	2.455
France	4792	485.417	8.070	5.122	13.192	3.632
Georgia	4316	451.581	14.805	0.468	15.274	3.908
Germany	3933	519.653	5.203	0.318	5.520	2.349
Hong Kong SAR	3386	537.079	9.815	0.556	10.371	3.220
Hungary	5227	533.444	6.781	0.329	7.110	2.666
Iran, Islamic Rep. of	6010	444.077	19.224	1.604	20.828	4.564
Ireland	4582	531.669	10.309	1.525	11.833	3.440
Italy	4269	514.558	6.983	2.098	9.081	3.013
Japan	4196	534.805	3.218	3.628	6.846	2.616
Kazakhstan	4791	488.507	7.698	0.685	8.383	2.895
Korea, Rep. of	4448	584.422	4.261	1.772	6.033	2.456
Kosovo	4496	419.297	13.257	6.842	20.099	4.483
Kuwait	4437	–	–	–	–	–
Latvia	4481	539.164	5.333	4.695	10.029	3.167
Lithuania	4265	539.375	5.624	4.055	9.678	3.111
Malta	4154	496.408	2.099	0.493	2.592	1.610
Montenegro	5076	451.058	4.275	5.767	10.042	3.169
Morocco	7723	362.055	32.135	5.560	37.695	6.140
Netherlands	3831	514.683	6.580	1.041	7.621	2.761
New Zealand	5019	504.910	4.333	2.690	7.024	2.650
North Macedonia	3270	422.905	43.112	4.163	47.275	6.876
Northern Ireland	3497	522.837	4.269	4.121	8.390	2.897
Norway (5)	4527	540.324	4.503	1.881	6.384	2.527
Oman	6814	432.373	18.347	2.677	21.024	4.585
Pakistan	3980	–	–	–	–	–
Philippines	5515	–	–	–	–	–
Poland	4882	524.361	5.964	1.037	7.001	2.646
Portugal	4915	502.347	3.756	3.891	7.647	2.765
Qatar	5646	454.610	16.662	2.396	19.058	4.366
Russian Federation	4596	562.018	10.081	0.652	10.733	3.276

Summary Statistics and Standard Errors for Proficiency in Knowing in Science—Grade 4 (continued)

Country	Sample Size	Science Knowing				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Saudi Arabia	5453	–	–	–	–	–
Serbia	4380	506.225	10.924	0.262	11.185	3.344
Singapore	6839	587.656	12.735	0.708	13.444	3.667
Slovak Republic	4862	527.135	12.786	2.312	15.099	3.886
South Africa (5)	11891	–	–	–	–	–
Spain	10946	514.045	3.435	1.409	4.844	2.201
Sweden	4535	540.293	9.282	2.498	11.780	3.432
Turkey (5)	4599	530.733	19.372	1.290	20.662	4.546
United Arab Emirates	29515	481.735	3.413	1.392	4.805	2.192
United States	10029	542.058	6.545	0.985	7.530	2.744
Benchmarking Participants						
Ontario, Canada	4360	524.869	8.615	0.841	9.455	3.075
Quebec, Canada	4384	522.978	4.614	3.195	7.808	2.794
Moscow City, Russian Fed.	4392	591.652	4.335	0.072	4.406	2.099
Madrid, Spain	3879	523.214	4.168	9.646	13.814	3.717
Abu Dhabi, UAE	10328	421.851	5.606	2.871	8.478	2.912
Dubai, UAE	8299	559.673	2.925	1.311	4.236	2.058

Summary Statistics and Standard Errors for Proficiency in Applying in Science—Grade 4

Country	Sample Size	Science Applying				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Albania	4426	485.101	10.642	3.652	14.294	3.781
Armenia	5399	453.249	8.895	2.159	11.054	3.325
Australia	5890	523.645	6.218	3.930	10.148	3.186
Austria	5097	523.330	4.473	1.417	5.890	2.427
Azerbaijan	5245	418.971	10.559	9.524	20.083	4.481
Bahrain	5762	494.376	10.727	1.002	11.729	3.425
Belgium (Flemish)	4655	501.090	3.187	1.454	4.641	2.154
Bosnia and Herzegovina	5617	458.511	7.321	1.790	9.111	3.018
Bulgaria	4268	522.599	26.521	2.668	29.189	5.403
Canada	15582	519.564	2.235	1.718	3.953	1.988
Chile	4775	460.625	6.635	4.845	11.480	3.388
Chinese Taipei	4295	560.549	2.337	1.641	3.978	1.994
Croatia	4335	521.202	2.339	3.010	5.349	2.313
Cyprus	4062	519.222	7.550	1.288	8.838	2.973
Czech Republic	5358	526.297	4.752	1.261	6.013	2.452
Denmark	3693	519.113	3.383	2.785	6.168	2.483
England	3872	525.617	6.096	2.655	8.751	2.958
Finland	5397	550.927	5.432	1.047	6.479	2.545
France	4792	494.742	8.121	0.737	8.858	2.976
Georgia	4316	445.263	12.904	1.046	13.950	3.735
Germany	3933	515.952	4.637	1.862	6.499	2.549
Hong Kong SAR	3386	526.193	9.048	0.599	9.646	3.106
Hungary	5227	525.553	6.436	3.168	9.604	3.099
Iran, Islamic Rep. of	6010	440.479	15.754	3.147	18.901	4.347
Ireland	4582	525.392	8.565	0.354	8.919	2.986
Italy	4269	503.695	6.128	1.418	7.545	2.747
Japan	4196	576.340	2.626	2.417	5.044	2.246
Kazakhstan	4791	493.660	10.344	1.252	11.595	3.405
Korea, Rep. of	4448	596.002	4.948	1.582	6.530	2.555
Kosovo	4496	406.283	10.870	2.857	13.726	3.705
Kuwait	4437	–	–	–	–	–
Latvia	4481	540.032	6.380	0.465	6.846	2.616
Lithuania	4265	531.074	5.044	0.128	5.172	2.274
Malta	4154	496.039	1.494	6.059	7.553	2.748
Montenegro	5076	453.692	4.740	2.644	7.384	2.717
Morocco	7723	378.025	32.747	6.026	38.773	6.227
Netherlands	3831	517.129	6.855	2.687	9.542	3.089
New Zealand	5019	497.463	3.942	2.595	6.536	2.557
North Macedonia	3270	422.930	37.216	1.699	38.915	6.238
Northern Ireland	3497	514.108	2.963	2.367	5.330	2.309
Norway (5)	4527	536.815	4.354	1.509	5.863	2.421
Oman	6814	433.588	15.144	1.250	16.393	4.049
Pakistan	3980	–	–	–	–	–
Philippines	5515	–	–	–	–	–
Poland	4882	537.985	5.012	1.397	6.409	2.532
Portugal	4915	502.194	4.233	5.254	9.487	3.080
Qatar	5646	450.600	13.408	4.174	17.583	4.193
Russian Federation	4596	571.833	9.492	1.749	11.241	3.353

Summary Statistics and Standard Errors for Proficiency in Applying in Science—Grade 4 (continued)

Country	Sample Size	Science Applying				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Saudi Arabia	5453	–	–	–	–	–
Serbia	4380	525.707	11.839	3.545	15.384	3.922
Singapore	6839	595.084	11.510	2.194	13.704	3.702
Slovak Republic	4862	515.345	14.272	3.814	18.086	4.253
South Africa (5)	11891	–	–	–	–	–
Spain	10946	510.634	2.986	1.061	4.047	2.012
Sweden	4535	532.461	8.868	0.878	9.746	3.122
Turkey (5)	4599	528.137	16.898	1.302	18.200	4.266
United Arab Emirates	29515	469.974	2.669	1.699	4.368	2.090
United States	10029	535.051	6.543	3.291	9.835	3.136
Benchmarking Participants						
Ontario, Canada	4360	519.720	8.028	1.378	9.406	3.067
Quebec, Canada	4384	519.627	4.303	8.808	13.111	3.621
Moscow City, Russian Fed.	4392	602.505	4.702	0.916	5.618	2.370
Madrid, Spain	3879	521.469	3.949	10.752	14.701	3.834
Abu Dhabi, UAE	10328	415.135	4.373	4.343	8.716	2.952
Dubai, UAE	8299	540.986	2.081	3.002	5.083	2.255

Summary Statistics and Standard Errors for Proficiency in Reasoning in Science—Grade 4

Country	Sample Size	Science Reasoning				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Albania	4426	487.010	12.216	0.726	12.943	3.598
Armenia	5399	485.656	8.880	3.830	12.710	3.565
Australia	5890	537.743	5.627	3.096	8.723	2.954
Austria	5097	518.283	4.539	6.429	10.969	3.312
Azerbaijan	5245	429.553	10.824	1.269	12.092	3.477
Bahrain	5762	481.455	10.543	2.588	13.131	3.624
Belgium (Flemish)	4655	510.883	3.549	2.099	5.648	2.377
Bosnia and Herzegovina	5617	469.002	7.838	0.988	8.827	2.971
Bulgaria	4268	507.498	26.974	3.316	30.290	5.504
Canada	15582	525.462	2.235	0.962	3.196	1.788
Chile	4775	472.026	5.440	1.946	7.385	2.718
Chinese Taipei	4295	552.213	2.581	4.738	7.319	2.705
Croatia	4335	521.849	4.220	1.797	6.017	2.453
Cyprus	4062	510.740	6.372	3.831	10.203	3.194
Czech Republic	5358	538.648	4.274	5.729	10.003	3.163
Denmark	3693	527.333	3.486	4.070	7.556	2.749
England	3872	543.506	7.158	6.188	13.345	3.653
Finland	5397	562.640	4.779	0.841	5.620	2.371
France	4792	474.755	9.975	12.162	22.137	4.705
Georgia	4316	465.311	12.706	6.971	19.677	4.436
Germany	3933	518.469	5.974	2.386	8.360	2.891
Hong Kong SAR	3386	530.616	11.279	1.473	12.752	3.571
Hungary	5227	531.802	5.589	1.406	6.996	2.645
Iran, Islamic Rep. of	6010	432.459	14.476	9.066	23.542	4.852
Ireland	4582	525.444	8.616	6.097	14.713	3.836
Italy	4269	507.940	6.022	1.131	7.153	2.674
Japan	4196	579.490	3.107	2.523	5.630	2.373
Kazakhstan	4791	501.699	8.597	3.152	11.749	3.428
Korea, Rep. of	4448	581.415	3.681	1.866	5.547	2.355
Kosovo	4496	402.304	14.905	2.960	17.865	4.227
Kuwait	4437	–	–	–	–	–
Latvia	4481	546.550	6.258	0.223	6.481	2.546
Lithuania	4265	547.895	6.038	2.563	8.601	2.933
Malta	4154	490.053	1.445	12.695	14.140	3.760
Montenegro	5076	451.059	4.784	6.035	10.818	3.289
Morocco	7723	365.474	26.434	3.542	29.976	5.475
Netherlands	3831	523.318	7.593	2.688	10.280	3.206
New Zealand	5019	504.804	4.022	2.593	6.616	2.572
North Macedonia	3270	424.594	39.456	4.672	44.128	6.643
Northern Ireland	3497	519.104	4.677	5.286	9.963	3.156
Norway (5)	4527	539.855	4.768	1.498	6.266	2.503
Oman	6814	433.209	13.810	2.971	16.781	4.096
Pakistan	3980	–	–	–	–	–
Philippines	5515	–	–	–	–	–
Poland	4882	525.421	5.493	1.443	6.936	2.634
Portugal	4915	503.602	3.390	0.470	3.860	1.965
Qatar	5646	433.558	13.636	4.638	18.274	4.275
Russian Federation	4596	569.144	6.894	0.913	7.807	2.794

Summary Statistics and Standard Errors for Proficiency in Reasoning in Science—Grade 4 (continued)

Country	Sample Size	Science Reasoning				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Saudi Arabia	5453	–	–	–	–	–
Serbia	4380	517.777	9.896	5.498	15.394	3.924
Singapore	6839	603.828	10.360	1.765	12.125	3.482
Slovak Republic	4862	516.101	13.445	4.293	17.738	4.212
South Africa (5)	11891	–	–	–	–	–
Spain	10946	506.571	2.890	0.426	3.316	1.821
Sweden	4535	540.965	9.032	1.155	10.187	3.192
Turkey (5)	4599	520.490	13.996	3.153	17.149	4.141
United Arab Emirates	29515	461.474	2.626	1.021	3.647	1.910
United States	10029	538.423	5.025	2.413	7.437	2.727
Benchmarking Participants						
Ontario, Canada	4360	527.619	7.398	1.409	8.807	2.968
Quebec, Canada	4384	524.675	4.240	5.002	9.242	3.040
Moscow City, Russian Fed.	4392	591.683	4.531	3.720	8.251	2.872
Madrid, Spain	3879	519.623	3.179	10.664	13.843	3.721
Abu Dhabi, UAE	10328	411.117	4.174	3.338	7.511	2.741
Dubai, UAE	8299	531.291	1.875	2.410	4.285	2.070

Appendix 14C: Summary Statistics and Standard Errors for Proficiency in Grade 8 Mathematics

Summary Statistics and Standard Errors for Proficiency in Overall Mathematics—Grade 8

Country	Sample Size	Overall Mathematics				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	9060	517.277	14.044	0.177	14.221	3.771
Bahrain	5725	481.087	2.777	0.120	2.897	1.702
Chile	4694	440.607	7.581	0.478	8.059	2.839
Chinese Taipei	5610	612.495	5.826	1.531	7.357	2.712
Cyprus	3521	501.082	2.377	0.242	2.619	1.618
Egypt	7210	412.880	26.447	0.721	27.168	5.212
England	3858	514.927	27.251	0.384	27.634	5.257
Finland	5565	508.916	6.152	0.601	6.753	2.599
France	4426	482.608	5.397	0.624	6.020	2.454
Georgia	3788	461.303	17.386	1.425	18.811	4.337
Hong Kong SAR	3730	578.312	15.364	1.134	16.497	4.062
Hungary	5219	516.541	8.018	0.456	8.474	2.911
Iran, Islamic Rep. of	5980	446.169	13.413	0.473	13.885	3.726
Ireland	4118	523.731	6.474	0.530	7.004	2.646
Israel	4269	519.113	17.907	0.297	18.204	4.267
Italy	4138	497.483	5.975	1.464	7.440	2.728
Japan	4446	594.229	6.945	0.437	7.382	2.717
Jordan	7176	420.268	17.166	1.002	18.169	4.262
Kazakhstan	4453	487.562	10.735	0.141	10.876	3.298
Korea, Rep. of	4409	606.822	6.574	1.253	7.827	2.798
Kuwait	4574	402.747	23.747	1.289	25.036	5.004
Lebanon	4730	429.308	7.823	0.659	8.482	2.912
Lithuania	4366	520.432	8.063	0.582	8.645	2.940
Malaysia	8077	460.567	9.418	0.607	10.026	3.166
Morocco	8458	388.187	4.828	0.382	5.210	2.282
New Zealand	6051	481.592	10.452	0.870	11.322	3.365
Norway (9)	5215	502.871	5.576	0.292	5.868	2.422
Oman	6751	410.657	6.371	1.256	7.627	2.762
Portugal	3867	500.318	9.614	0.496	10.110	3.180
Qatar	4437	443.414	15.834	0.246	16.081	4.010
Romania	4494	478.985	17.801	0.425	18.227	4.269
Russian Federation	4456	543.492	20.307	0.378	20.686	4.548
Saudi Arabia	5680	393.770	4.959	1.512	6.471	2.544
Singapore	5546	615.766	15.176	0.636	15.812	3.976
South Africa (9)	20829	389.477	3.967	1.168	5.135	2.266
Sweden	4564	502.516	6.253	0.243	6.496	2.549
Turkey	4662	495.630	17.061	1.380	18.441	4.294
United Arab Emirates	25538	473.427	3.156	0.299	3.454	1.859
United States	9941	515.441	22.595	0.268	22.862	4.781
Benchmarking Participants						
Ontario, Canada	4329	529.753	17.543	0.599	18.143	4.259
Quebec, Canada	3636	543.210	13.241	0.258	13.499	3.674
Moscow City, Russian Fed.	4324	575.346	16.433	0.969	17.401	4.172
Gauteng, RSA (9)	5633	420.703	8.041	0.774	8.815	2.969
Western Cape, RSA (9)	5351	441.185	17.367	1.927	19.294	4.393
Abu Dhabi, UAE	9380	435.773	7.821	0.733	8.554	2.925
Dubai, UAE	6544	536.581	3.956	0.153	4.109	2.027

Summary Statistics and Standard Errors for Proficiency in Number—Grade 8

Country	Sample Size	Number				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Australia	9060	521.707	15.336	0.127	15.463	3.932
Bahrain	5725	472.615	3.559	1.353	4.913	2.216
Chile	4694	441.937	6.977	3.364	10.340	3.216
Chinese Taipei	5610	613.141	6.559	0.978	7.537	2.745
Cyprus	3521	499.381	2.658	2.219	4.878	2.209
Egypt	7210	413.502	27.138	2.483	29.621	5.443
England	3858	519.081	26.841	1.954	28.794	5.366
Finland	5565	514.909	5.684	1.001	6.685	2.585
France	4426	476.842	5.169	1.470	6.640	2.577
Georgia	3788	466.287	19.842	2.494	22.336	4.726
Hong Kong SAR	3730	569.550	13.882	3.703	17.584	4.193
Hungary	5219	515.395	8.684	1.211	9.894	3.146
Iran, Islamic Rep. of	5980	441.773	15.892	1.911	17.803	4.219
Ireland	4118	540.940	6.383	2.546	8.929	2.988
Israel	4269	518.925	16.694	0.811	17.505	4.184
Italy	4138	494.874	5.749	0.218	5.967	2.443
Japan	4446	578.198	9.576	2.336	11.912	3.451
Jordan	7176	408.396	17.692	2.538	20.231	4.498
Kazakhstan	4453	482.079	10.829	0.904	11.733	3.425
Korea, Rep. of	4409	605.157	6.148	0.871	7.019	2.649
Kuwait	4574	–	–	–	–	–
Lebanon	4730	431.698	7.194	0.148	7.343	2.710
Lithuania	4366	514.059	8.634	0.217	8.852	2.975
Malaysia	8077	457.697	9.027	0.741	9.768	3.125
Morocco	8458	377.425	5.811	1.476	7.287	2.699
New Zealand	6051	483.246	12.022	0.816	12.837	3.583
Norway (9)	5215	507.398	4.965	0.301	5.266	2.295
Oman	6751	392.131	6.695	2.474	9.169	3.028
Portugal	3867	492.416	10.103	1.084	11.187	3.345
Qatar	4437	441.431	16.001	0.296	16.298	4.037
Romania	4494	477.886	17.501	2.325	19.826	4.453
Russian Federation	4456	541.156	20.577	0.908	21.485	4.635
Saudi Arabia	5680	–	–	–	–	–
Singapore	5546	611.096	14.347	2.252	16.598	4.074
South Africa (9)	20829	–	–	–	–	–
Sweden	4564	501.828	4.814	0.773	5.586	2.364
Turkey	4662	493.175	18.001	0.129	18.130	4.258
United Arab Emirates	25538	474.301	2.984	0.455	3.439	1.855
United States	9941	519.901	19.597	0.214	19.811	4.451
Benchmarking Participants						
Ontario, Canada	4329	530.292	17.155	1.497	18.651	4.319
Quebec, Canada	3636	543.711	14.190	1.180	15.370	3.920
Moscow City, Russian Fed.	4324	574.077	18.389	1.504	19.893	4.460
Gauteng, RSA (9)	5633	420.761	8.103	2.396	10.499	3.240
Western Cape, RSA (9)	5351	444.598	17.850	9.306	27.155	5.211
Abu Dhabi, UAE	9380	439.203	7.014	2.110	9.124	3.021
Dubai, UAE	6544	536.637	4.104	0.433	4.537	2.130

Summary Statistics and Standard Errors for Proficiency in Algebra—Grade 8

Country	Sample Size	Algebra				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Australia	9060	501.398	16.060	1.049	17.109	4.136
Bahrain	5725	485.039	2.928	1.373	4.302	2.074
Chile	4694	438.542	8.257	1.402	9.659	3.108
Chinese Taipei	5610	618.254	5.960	0.997	6.956	2.638
Cyprus	3521	514.814	2.635	3.930	6.565	2.562
Egypt	7210	412.860	33.009	2.550	35.560	5.963
England	3858	503.735	32.566	1.273	33.839	5.817
Finland	5565	488.887	7.326	1.096	8.422	2.902
France	4426	467.980	6.001	2.019	8.020	2.832
Georgia	3788	473.258	17.780	0.949	18.729	4.328
Hong Kong SAR	3730	583.623	13.252	2.024	15.276	3.908
Hungary	5219	508.619	8.639	0.133	8.772	2.962
Iran, Islamic Rep. of	5980	450.423	13.567	0.707	14.274	3.778
Ireland	4118	505.358	7.269	0.652	7.921	2.814
Israel	4269	527.828	24.003	0.854	24.857	4.986
Italy	4138	490.877	5.727	1.573	7.299	2.702
Japan	4446	602.110	8.091	1.948	10.039	3.169
Jordan	7176	441.794	22.402	0.524	22.926	4.788
Kazakhstan	4453	503.546	13.311	0.297	13.608	3.689
Korea, Rep. of	4409	609.097	9.620	2.393	12.013	3.466
Kuwait	4574	–	–	–	–	–
Lebanon	4730	451.905	8.212	0.746	8.957	2.993
Lithuania	4366	518.057	7.700	0.448	8.147	2.854
Malaysia	8077	456.274	9.312	1.586	10.897	3.301
Morocco	8458	370.444	7.942	1.644	9.586	3.096
New Zealand	6051	464.141	11.246	1.109	12.355	3.515
Norway (9)	5215	476.997	7.895	0.966	8.861	2.977
Oman	6751	426.669	7.525	1.769	9.294	3.049
Portugal	3867	498.813	11.156	0.021	11.177	3.343
Qatar	4437	453.550	14.632	1.756	16.389	4.048
Romania	4494	489.858	20.548	0.783	21.331	4.619
Russian Federation	4456	559.931	22.756	1.942	24.698	4.970
Saudi Arabia	5680	–	–	–	–	–
Singapore	5546	618.972	18.670	2.250	20.920	4.574
South Africa (9)	20829	–	–	–	–	–
Sweden	4564	495.883	6.490	2.209	8.699	2.949
Turkey	4662	492.814	20.209	1.121	21.330	4.618
United Arab Emirates	25538	485.853	3.383	1.020	4.403	2.098
United States	9941	519.854	28.422	0.210	28.632	5.351
Benchmarking Participants						
Ontario, Canada	4329	514.768	18.620	0.780	19.400	4.405
Quebec, Canada	3636	530.778	14.055	2.148	16.202	4.025
Moscow City, Russian Fed.	4324	592.353	17.460	0.142	17.602	4.196
Gauteng, RSA (9)	5633	431.329	9.242	4.323	13.564	3.683
Western Cape, RSA (9)	5351	451.381	20.608	3.293	23.901	4.889
Abu Dhabi, UAE	9380	448.054	8.502	1.742	10.244	3.201
Dubai, UAE	6544	547.066	3.731	1.860	5.590	2.364

Summary Statistics and Standard Errors for Proficiency in Geometry—Grade 8

Country	Sample Size	Geometry				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Australia	9060	513.265	15.234	0.959	16.193	4.024
Bahrain	5725	493.257	3.073	2.239	5.312	2.305
Chile	4694	434.459	7.426	10.850	18.276	4.275
Chinese Taipei	5610	623.173	6.427	0.950	7.377	2.716
Cyprus	3521	489.872	2.559	2.728	5.286	2.299
Egypt	7210	417.003	26.982	0.752	27.733	5.266
England	3858	508.636	27.562	0.849	28.412	5.330
Finland	5565	510.625	7.875	2.487	10.362	3.219
France	4426	493.173	6.033	1.397	7.430	2.726
Georgia	3788	448.845	17.643	1.836	19.479	4.413
Hong Kong SAR	3730	596.009	18.643	2.163	20.806	4.561
Hungary	5219	521.359	8.773	2.292	11.065	3.326
Iran, Islamic Rep. of	5980	441.513	16.060	3.684	19.744	4.443
Ireland	4118	506.181	6.978	0.779	7.757	2.785
Israel	4269	506.333	21.788	1.433	23.221	4.819
Italy	4138	509.750	7.832	5.724	13.556	3.682
Japan	4446	610.049	7.767	4.037	11.804	3.436
Jordan	7176	413.044	17.277	4.323	21.599	4.648
Kazakhstan	4453	486.047	13.153	1.426	14.579	3.818
Korea, Rep. of	4409	617.207	6.659	1.866	8.525	2.920
Kuwait	4574	–	–	–	–	–
Lebanon	4730	422.228	7.921	2.125	10.046	3.170
Lithuania	4366	529.409	8.990	0.212	9.202	3.034
Malaysia	8077	466.142	9.570	3.782	13.351	3.654
Morocco	8458	413.406	3.802	1.216	5.018	2.240
New Zealand	6051	476.769	10.827	0.704	11.531	3.396
Norway (9)	5215	501.938	4.891	0.265	5.157	2.271
Oman	6751	418.101	7.080	3.070	10.151	3.186
Portugal	3867	509.307	9.795	1.138	10.933	3.307
Qatar	4437	435.025	15.763	0.424	16.187	4.023
Romania	4494	472.008	21.499	0.414	21.913	4.681
Russian Federation	4456	540.349	26.078	1.142	27.219	5.217
Saudi Arabia	5680	–	–	–	–	–
Singapore	5546	618.882	14.866	0.509	15.375	3.921
South Africa (9)	20829	–	–	–	–	–
Sweden	4564	495.300	8.495	1.218	9.712	3.116
Turkey	4662	489.518	16.797	0.784	17.581	4.193
United Arab Emirates	25538	461.829	3.781	0.746	4.527	2.128
United States	9941	499.144	21.973	0.593	22.566	4.750
Benchmarking Participants						
Ontario, Canada	4329	535.681	19.355	3.935	23.290	4.826
Quebec, Canada	3636	549.050	15.176	4.456	19.632	4.431
Moscow City, Russian Fed.	4324	565.106	18.316	0.894	19.210	4.383
Gauteng, RSA (9)	5633	406.524	8.323	4.865	13.188	3.632
Western Cape, RSA (9)	5351	426.732	16.965	11.587	28.552	5.343
Abu Dhabi, UAE	9380	419.501	9.641	1.817	11.458	3.385
Dubai, UAE	6544	527.076	4.507	2.271	6.778	2.603

Summary Statistics and Standard Errors for Proficiency in Data and Probability—Grade 8

Country	Sample Size	Data and Probability				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Australia	9060	532.746	13.573	1.314	14.888	3.858
Bahrain	5725	465.179	3.277	0.789	4.066	2.016
Chile	4694	434.424	8.324	2.062	10.386	3.223
Chinese Taipei	5610	593.234	5.644	0.844	6.488	2.547
Cyprus	3521	493.229	3.237	3.797	7.034	2.652
Egypt	7210	380.148	27.237	2.209	29.446	5.426
England	3858	523.446	36.522	1.678	38.200	6.181
Finland	5565	513.853	8.336	4.503	12.839	3.583
France	4426	495.500	5.916	1.067	6.982	2.642
Georgia	3788	429.485	18.013	8.267	26.279	5.126
Hong Kong SAR	3730	562.626	24.524	6.534	31.058	5.573
Hungary	5219	520.619	8.154	2.394	10.548	3.248
Iran, Islamic Rep. of	5980	435.406	13.982	1.910	15.892	3.986
Ireland	4118	540.628	9.156	2.516	11.672	3.416
Israel	4269	511.180	18.271	5.739	24.010	4.900
Italy	4138	493.873	6.943	3.831	10.774	3.282
Japan	4446	594.204	5.817	0.443	6.260	2.502
Jordan	7176	396.059	14.280	3.353	17.634	4.199
Kazakhstan	4453	462.561	9.716	1.307	11.023	3.320
Korea, Rep. of	4409	597.614	5.611	1.042	6.652	2.579
Kuwait	4574	–	–	–	–	–
Lebanon	4730	383.185	9.115	2.927	12.042	3.470
Lithuania	4366	522.383	8.474	0.871	9.345	3.057
Malaysia	8077	456.593	12.079	0.519	12.598	3.549
Morocco	8458	372.355	4.055	1.816	5.871	2.423
New Zealand	6051	495.868	11.422	2.248	13.671	3.697
Norway (9)	5215	518.124	7.704	1.158	8.863	2.977
Oman	6751	393.309	7.910	0.325	8.235	2.870
Portugal	3867	497.688	8.992	1.025	10.017	3.165
Qatar	4437	423.360	20.945	1.455	22.400	4.733
Romania	4494	457.526	18.614	1.395	20.009	4.473
Russian Federation	4456	517.118	18.875	3.294	22.170	4.708
Saudi Arabia	5680	–	–	–	–	–
Singapore	5546	620.001	16.790	6.767	23.557	4.854
South Africa (9)	20829	–	–	–	–	–
Sweden	4564	513.023	9.957	3.872	13.829	3.719
Turkey	4662	502.174	16.676	2.188	18.863	4.343
United Arab Emirates	25538	451.107	3.557	0.781	4.338	2.083
United States	9941	509.327	27.128	1.714	28.842	5.370
Benchmarking Participants						
Ontario, Canada	4329	541.614	22.310	4.911	27.220	5.217
Quebec, Canada	3636	554.380	14.887	5.644	20.530	4.531
Moscow City, Russian Fed.	4324	564.343	14.952	3.104	18.056	4.249
Gauteng, RSA (9)	5633	405.563	8.558	3.589	12.148	3.485
Western Cape, RSA (9)	5351	425.641	17.216	8.395	25.611	5.061
Abu Dhabi, UAE	9380	410.520	9.589	0.056	9.645	3.106
Dubai, UAE	6544	525.187	5.071	2.410	7.481	2.735

Summary Statistics and Standard Errors for Proficiency in Knowing in Mathematics—Grade 8

Country	Sample Size	Mathematics Knowing				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Australia	9060	510.615	14.671	0.990	15.660	3.957
Bahrain	5725	471.190	2.837	0.173	3.010	1.735
Chile	4694	433.956	8.561	0.238	8.799	2.966
Chinese Taipei	5610	615.928	6.952	2.024	8.976	2.996
Cyprus	3521	508.644	2.720	1.265	3.986	1.996
Egypt	7210	416.001	32.315	1.061	33.375	5.777
England	3858	510.217	26.475	3.759	30.234	5.499
Finland	5565	504.945	5.502	0.791	6.293	2.509
France	4426	473.161	6.168	1.457	7.625	2.761
Georgia	3788	458.037	20.764	4.010	24.774	4.977
Hong Kong SAR	3730	580.084	14.053	2.160	16.212	4.026
Hungary	5219	515.904	8.767	0.764	9.530	3.087
Iran, Islamic Rep. of	5980	440.556	17.321	0.552	17.873	4.228
Ireland	4118	530.358	6.078	1.837	7.915	2.813
Israel	4269	515.757	20.888	1.962	22.850	4.780
Italy	4138	492.290	6.640	1.355	7.995	2.828
Japan	4446	588.824	8.248	1.326	9.574	3.094
Jordan	7176	413.661	24.478	0.215	24.693	4.969
Kazakhstan	4453	488.320	12.849	1.179	14.028	3.745
Korea, Rep. of	4409	613.927	7.847	2.484	10.331	3.214
Kuwait	4574	–	–	–	–	–
Lebanon	4730	455.591	7.310	1.220	8.530	2.921
Lithuania	4366	518.403	7.458	0.649	8.108	2.847
Malaysia	8077	451.478	11.224	3.150	14.374	3.791
Morocco	8458	382.182	6.697	1.553	8.250	2.872
New Zealand	6051	467.666	9.762	2.376	12.138	3.484
Norway (9)	5215	498.962	4.689	0.769	5.459	2.336
Oman	6751	406.422	7.165	0.424	7.589	2.755
Portugal	3867	498.281	10.647	1.409	12.056	3.472
Qatar	4437	442.695	17.381	3.384	20.765	4.557
Romania	4494	482.304	22.864	2.439	25.303	5.030
Russian Federation	4456	549.698	25.475	1.443	26.918	5.188
Saudi Arabia	5680	–	–	–	–	–
Singapore	5546	614.343	17.230	1.208	18.439	4.294
South Africa (9)	20829	–	–	–	–	–
Sweden	4564	495.989	5.309	1.678	6.987	2.643
Turkey	4662	494.133	22.677	1.846	24.523	4.952
United Arab Emirates	25538	478.196	3.330	0.423	3.753	1.937
United States	9941	521.881	26.312	0.762	27.074	5.203
Benchmarking Participants						
Ontario, Canada	4329	517.976	15.002	2.500	17.502	4.184
Quebec, Canada	3636	545.692	11.497	2.613	14.111	3.756
Moscow City, Russian Fed.	4324	589.071	17.299	0.617	17.916	4.233
Gauteng, RSA (9)	5633	411.383	10.303	2.779	13.082	3.617
Western Cape, RSA (9)	5351	432.474	23.570	11.365	34.935	5.911
Abu Dhabi, UAE	9380	440.428	8.702	1.401	10.102	3.178
Dubai, UAE	6544	539.911	4.468	0.327	4.795	2.190

Summary Statistics and Standard Errors for Proficiency in Applying in Mathematics—Grade 8

Country	Sample Size	Mathematics Applying				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Australia	9060	521.308	14.010	0.689	14.699	3.834
Bahrain	5725	478.923	2.651	0.314	2.965	1.722
Chile	4694	437.717	7.632	0.770	8.402	2.899
Chinese Taipei	5610	609.694	5.754	1.232	6.986	2.643
Cyprus	3521	495.993	2.150	0.823	2.972	1.724
Egypt	7210	405.486	24.557	3.752	28.309	5.321
England	3858	518.150	27.723	0.763	28.486	5.337
Finland	5565	510.446	6.808	0.386	7.194	2.682
France	4426	485.091	5.204	1.768	6.973	2.641
Georgia	3788	460.071	15.774	1.570	17.344	4.165
Hong Kong SAR	3730	575.390	15.337	0.930	16.267	4.033
Hungary	5219	516.847	8.390	0.581	8.971	2.995
Iran, Islamic Rep. of	5980	442.614	11.568	0.779	12.347	3.514
Ireland	4118	526.484	6.995	0.430	7.425	2.725
Israel	4269	518.697	17.501	0.351	17.851	4.225
Italy	4138	496.799	5.774	0.185	5.959	2.441
Japan	4446	596.085	7.018	1.007	8.025	2.833
Jordan	7176	415.300	15.724	0.094	15.819	3.977
Kazakhstan	4453	486.405	9.952	0.417	10.369	3.220
Korea, Rep. of	4409	604.305	6.551	0.703	7.254	2.693
Kuwait	4574	–	–	–	–	–
Lebanon	4730	411.745	8.469	3.837	12.306	3.508
Lithuania	4366	523.888	8.062	1.293	9.355	3.059
Malaysia	8077	463.518	9.704	0.129	9.833	3.136
Morocco	8458	388.654	4.268	1.699	5.966	2.443
New Zealand	6051	486.140	9.632	0.240	9.871	3.142
Norway (9)	5215	503.581	6.496	0.540	7.035	2.652
Oman	6751	409.018	5.953	0.202	6.154	2.481
Portugal	3867	496.611	9.806	1.250	11.056	3.325
Qatar	4437	437.580	16.918	0.302	17.220	4.150
Romania	4494	475.174	16.825	0.329	17.154	4.142
Russian Federation	4456	542.934	19.889	0.268	20.157	4.490
Saudi Arabia	5680	–	–	–	–	–
Singapore	5546	614.102	14.009	0.464	14.473	3.804
South Africa (9)	20829	–	–	–	–	–
Sweden	4564	501.081	6.230	0.739	6.968	2.640
Turkey	4662	491.310	14.805	1.108	15.913	3.989
United Arab Emirates	25538	465.758	3.279	0.109	3.388	1.841
United States	9941	515.001	23.455	0.525	23.979	4.897
Benchmarking Participants						
Ontario, Canada	4329	530.562	19.156	0.765	19.922	4.463
Quebec, Canada	3636	544.493	15.334	1.326	16.660	4.082
Moscow City, Russian Fed.	4324	573.951	17.944	0.523	18.467	4.297
Gauteng, RSA (9)	5633	422.600	7.152	4.062	11.214	3.349
Western Cape, RSA (9)	5351	442.022	15.948	0.785	16.733	4.091
Abu Dhabi, UAE	9380	427.967	8.102	0.344	8.445	2.906
Dubai, UAE	6544	532.163	4.493	0.520	5.013	2.239

Summary Statistics and Standard Errors for Proficiency in Reasoning in Mathematics—Grade 8

Country	Sample Size	Mathematics Reasoning				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Australia	9060	514.746	14.676	0.612	15.288	3.910
Bahrain	5725	489.441	3.510	0.738	4.248	2.061
Chile	4694	450.617	6.750	3.547	10.296	3.209
Chinese Taipei	5610	616.077	5.589	1.506	7.094	2.664
Cyprus	3521	504.638	2.640	1.948	4.587	2.142
Egypt	7210	411.012	31.147	0.278	31.425	5.606
England	3858	512.032	30.506	1.549	32.055	5.662
Finland	5565	506.284	6.748	1.655	8.404	2.899
France	4426	489.002	5.176	1.862	7.038	2.653
Georgia	3788	459.674	17.350	1.675	19.025	4.362
Hong Kong SAR	3730	581.964	17.189	1.880	19.069	4.367
Hungary	5219	512.398	8.000	1.013	9.013	3.002
Iran, Islamic Rep. of	5980	457.434	14.840	1.142	15.982	3.998
Ireland	4118	508.119	7.062	4.249	11.311	3.363
Israel	4269	524.958	19.719	2.643	22.363	4.729
Italy	4138	504.658	5.860	6.938	12.799	3.578
Japan	4446	598.864	7.213	2.812	10.024	3.166
Jordan	7176	431.144	17.653	1.930	19.583	4.425
Kazakhstan	4453	487.171	11.205	0.020	11.225	3.350
Korea, Rep. of	4409	608.986	5.765	3.126	8.892	2.982
Kuwait	4574	–	–	–	–	–
Lebanon	4730	406.844	9.989	3.840	13.829	3.719
Lithuania	4366	513.915	8.940	3.701	12.641	3.555
Malaysia	8077	461.703	7.904	1.925	9.829	3.135
Morocco	8458	381.036	5.081	3.290	8.371	2.893
New Zealand	6051	486.100	9.685	1.596	11.280	3.359
Norway (9)	5215	496.367	6.042	1.545	7.587	2.754
Oman	6751	412.153	6.895	0.755	7.649	2.766
Portugal	3867	507.758	8.659	2.378	11.036	3.322
Qatar	4437	447.563	14.233	0.466	14.699	3.834
Romania	4494	480.567	18.812	1.157	19.969	4.469
Russian Federation	4456	536.366	19.940	3.342	23.282	4.825
Saudi Arabia	5680	–	–	–	–	–
Singapore	5546	620.155	17.880	1.957	19.836	4.454
South Africa (9)	20829	–	–	–	–	–
Sweden	4564	513.563	7.000	1.635	8.636	2.939
Turkey	4662	503.856	16.548	0.298	16.846	4.104
United Arab Emirates	25538	478.954	2.972	0.786	3.758	1.939
United States	9941	507.342	19.328	1.449	20.777	4.558
Benchmarking Participants						
Ontario, Canada	4329	540.382	15.840	4.935	20.775	4.558
Quebec, Canada	3636	537.774	14.506	0.036	14.541	3.813
Moscow City, Russian Fed.	4324	567.658	16.698	1.225	17.923	4.234
Gauteng, RSA (9)	5633	426.782	7.104	4.470	11.574	3.402
Western Cape, RSA (9)	5351	444.480	15.998	6.991	22.989	4.795
Abu Dhabi, UAE	9380	441.348	6.935	1.131	8.065	2.840
Dubai, UAE	6544	541.314	3.978	0.486	4.464	2.113

Appendix 14D: Summary Statistics and Standard Errors for Proficiency in Grade 8 Science

Summary Statistics and Standard Errors for Proficiency in Overall Science—Grade 8

Country	Sample Size	Overall Science				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	9060	528.337	9.822	0.339	10.161	3.188
Bahrain	5725	486.036	2.538	1.142	3.679	1.918
Chile	4694	462.347	7.554	0.804	8.359	2.891
Chinese Taipei	5610	574.334	3.509	0.198	3.707	1.925
Cyprus	3521	483.555	3.225	0.428	3.653	1.911
Egypt	7210	389.328	28.050	1.595	29.645	5.445
England	3856	516.676	23.017	0.491	23.508	4.848
Finland	5565	542.585	9.162	0.716	9.877	3.143
France	4426	488.563	6.598	0.595	7.194	2.682
Georgia	3788	446.739	12.285	2.859	15.144	3.892
Hong Kong SAR	3730	503.515	26.307	0.834	27.141	5.210
Hungary	5217	529.755	6.278	0.539	6.817	2.611
Iran, Islamic Rep. of	5980	449.415	12.278	0.436	12.713	3.566
Ireland	4118	523.095	8.200	0.399	8.599	2.932
Israel	4268	513.305	17.175	0.449	17.624	4.198
Italy	4138	500.476	6.504	0.121	6.625	2.574
Japan	4446	569.506	4.363	0.208	4.571	2.138
Jordan	7176	452.010	20.906	0.885	21.790	4.668
Kazakhstan	4453	478.071	9.107	0.279	9.386	3.064
Korea, Rep. of	4409	560.680	4.232	0.270	4.502	2.122
Kuwait	4574	444.213	30.874	1.069	31.943	5.652
Lebanon	4730	376.883	16.615	4.994	21.609	4.649
Lithuania	4366	533.824	7.486	1.323	8.809	2.968
Malaysia	8077	460.237	11.635	0.506	12.141	3.484
Morocco	8458	394.100	5.580	1.478	7.057	2.657
New Zealand	6051	498.876	11.500	0.672	12.172	3.489
Norway (9)	5205	495.449	7.779	1.810	9.589	3.097
Oman	6751	457.184	7.284	1.032	8.316	2.884
Portugal	3867	518.738	8.000	0.355	8.355	2.891
Qatar	4436	474.528	18.268	0.752	19.020	4.361
Romania	4494	469.789	15.889	1.617	17.506	4.184
Russian Federation	4456	542.859	17.270	0.559	17.829	4.222
Saudi Arabia	5680	431.473	6.186	0.595	6.781	2.604
Singapore	5545	607.554	14.751	0.514	15.265	3.907
South Africa (9)	20829	369.972	6.717	2.887	9.604	3.099
Sweden	4556	521.393	9.877	0.345	10.223	3.197
Turkey	4662	515.488	13.137	0.474	13.611	3.689
United Arab Emirates	25539	472.983	4.170	0.816	4.986	2.233
United States	9942	522.341	21.733	0.042	21.775	4.666
Benchmarking Participants						
Ontario, Canada	4329	521.586	7.943	0.943	8.886	2.981
Quebec, Canada	3637	536.604	12.801	0.092	12.893	3.591
Moscow City, Russian Fed.	4323	566.525	8.303	0.304	8.608	2.934
Gauteng, RSA (9)	5633	422.150	12.150	2.836	14.986	3.871
Western Cape, RSA (9)	5351	439.280	23.053	2.970	26.023	5.101
Abu Dhabi, UAE	9380	420.055	11.268	1.834	13.102	3.620
Dubai, UAE	6544	547.816	3.599	0.464	4.063	2.016

Summary Statistics and Standard Errors for Proficiency in Biology—Grade 8

Country	Sample Size	Biology				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	9060	530.890	9.911	1.004	10.915	3.304
Bahrain	5725	492.387	2.900	0.609	3.509	1.873
Chile	4694	471.236	8.463	0.770	9.233	3.039
Chinese Taipei	5610	576.165	3.372	1.531	4.903	2.214
Cyprus	3521	489.032	4.061	1.465	5.526	2.351
Egypt	7210	381.063	30.835	0.857	31.692	5.630
England	3856	515.790	22.998	3.779	26.777	5.175
Finland	5565	534.044	8.903	1.958	10.861	3.296
France	4426	488.240	7.024	1.244	8.268	2.875
Georgia	3788	447.049	11.122	1.005	12.127	3.482
Hong Kong SAR	3730	500.523	31.026	1.292	32.318	5.685
Hungary	5217	530.057	5.918	1.114	7.032	2.652
Iran, Islamic Rep. of	5980	447.731	11.603	2.317	13.921	3.731
Ireland	4118	521.489	7.220	2.884	10.104	3.179
Israel	4268	512.142	16.610	1.213	17.823	4.222
Italy	4138	508.176	6.805	0.470	7.275	2.697
Japan	4446	573.735	4.373	1.099	5.472	2.339
Jordan	7176	457.275	24.673	2.174	26.847	5.181
Kazakhstan	4453	476.447	8.856	1.422	10.278	3.206
Korea, Rep. of	4409	559.513	3.853	1.083	4.936	2.222
Kuwait	4574	–	–	–	–	–
Lebanon	4730	354.843	18.294	8.097	26.391	5.137
Lithuania	4366	534.595	8.140	1.011	9.151	3.025
Malaysia	8077	462.552	12.143	1.393	13.536	3.679
Morocco	8458	386.625	5.590	3.372	8.961	2.994
New Zealand	6051	498.024	12.134	1.248	13.382	3.658
Norway (9)	5205	485.525	7.388	0.195	7.583	2.754
Oman	6751	466.130	7.465	3.194	10.658	3.265
Portugal	3867	526.842	8.360	0.453	8.814	2.969
Qatar	4436	476.366	18.409	0.992	19.401	4.405
Romania	4494	479.139	16.990	2.122	19.112	4.372
Russian Federation	4456	543.277	18.242	1.663	19.904	4.461
Saudi Arabia	5680	–	–	–	–	–
Singapore	5545	621.685	15.150	2.460	17.610	4.196
South Africa (9)	20829	359.304	7.069	1.717	8.786	2.964
Sweden	4556	518.613	9.335	2.125	11.460	3.385
Turkey	4662	513.004	10.776	0.730	11.506	3.392
United Arab Emirates	25539	474.300	4.948	1.200	6.148	2.480
United States	9942	529.806	22.738	0.262	23.000	4.796
Benchmarking Participants						
Ontario, Canada	4329	534.194	8.234	1.981	10.215	3.196
Quebec, Canada	3637	530.791	12.539	2.095	14.634	3.825
Moscow City, Russian Fed.	4323	565.458	9.405	0.285	9.690	3.113
Gauteng, RSA (9)	5633	415.939	12.742	2.831	15.573	3.946
Western Cape, RSA (9)	5351	432.123	24.629	2.448	27.076	5.203
Abu Dhabi, UAE	9380	416.753	13.073	1.843	14.916	3.862
Dubai, UAE	6544	553.965	4.321	0.439	4.761	2.182

Summary Statistics and Standard Errors for Proficiency in Chemistry—Grade 8

Country	Sample Size	Chemistry				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Australia	9060	514.506	12.666	1.657	14.322	3.785
Bahrain	5725	480.402	2.890	2.902	5.791	2.407
Chile	4694	442.045	8.368	0.312	8.680	2.946
Chinese Taipei	5610	594.141	4.841	0.794	5.635	2.374
Cyprus	3521	478.263	3.482	0.862	4.344	2.084
Egypt	7210	397.186	32.980	1.716	34.697	5.890
England	3856	511.976	30.598	5.273	35.871	5.989
Finland	5565	545.296	12.485	1.776	14.262	3.776
France	4426	464.957	6.698	3.357	10.055	3.171
Georgia	3788	455.959	14.869	3.810	18.679	4.322
Hong Kong SAR	3730	484.988	28.086	2.570	30.656	5.537
Hungary	5217	527.441	6.799	5.486	12.284	3.505
Iran, Islamic Rep. of	5980	450.015	15.341	4.841	20.182	4.492
Ireland	4118	512.076	10.541	4.461	15.002	3.873
Israel	4268	518.484	20.026	0.974	20.999	4.583
Italy	4138	483.571	6.195	2.619	8.814	2.969
Japan	4446	560.362	4.542	2.917	7.459	2.731
Jordan	7176	454.397	24.938	2.873	27.811	5.274
Kazakhstan	4453	493.945	11.507	1.241	12.748	3.570
Korea, Rep. of	4409	550.703	4.256	1.929	6.185	2.487
Kuwait	4574	–	–	–	–	–
Lebanon	4730	412.428	15.729	5.397	21.126	4.596
Lithuania	4366	529.913	8.617	1.388	10.005	3.163
Malaysia	8077	434.060	14.491	3.287	17.778	4.216
Morocco	8458	402.319	6.530	2.696	9.226	3.037
New Zealand	6051	482.195	12.902	1.556	14.458	3.802
Norway (9)	5205	492.303	10.531	3.322	13.853	3.722
Oman	6751	443.230	8.173	1.675	9.847	3.138
Portugal	3867	512.342	10.020	2.485	12.505	3.536
Qatar	4436	474.420	17.492	1.616	19.108	4.371
Romania	4494	466.455	19.153	5.767	24.920	4.992
Russian Federation	4456	550.893	16.800	0.435	17.234	4.151
Saudi Arabia	5680	–	–	–	–	–
Singapore	5545	615.550	23.554	1.634	25.188	5.019
South Africa (9)	20829	371.508	7.764	9.825	17.589	4.194
Sweden	4556	508.858	12.530	1.115	13.644	3.694
Turkey	4662	515.692	18.874	4.148	23.022	4.798
United Arab Emirates	25539	475.265	4.816	1.151	5.967	2.443
United States	9942	508.918	23.437	3.593	27.030	5.199
Benchmarking Participants						
Ontario, Canada	4329	491.868	10.559	4.959	15.518	3.939
Quebec, Canada	3637	548.301	14.157	2.456	16.612	4.076
Moscow City, Russian Fed.	4323	561.054	7.224	1.303	8.527	2.920
Gauteng, RSA (9)	5633	422.547	14.015	3.242	17.258	4.154
Western Cape, RSA (9)	5351	441.693	27.272	24.978	52.250	7.228
Abu Dhabi, UAE	9380	420.980	13.472	3.504	16.976	4.120
Dubai, UAE	6544	554.126	4.168	0.526	4.693	2.166

Summary Statistics and Standard Errors for Proficiency in Physics—Grade 8

Country	Sample Size	Physics				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Australia	9060	528.683	11.315	1.974	13.289	3.645
Bahrain	5725	479.952	3.163	3.576	6.739	2.596
Chile	4694	450.055	8.608	5.055	13.663	3.696
Chinese Taipei	5610	555.076	4.016	3.238	7.253	2.693
Cyprus	3521	479.543	3.599	9.476	13.076	3.616
Egypt	7210	394.105	24.596	0.754	25.350	5.035
England	3856	516.447	24.600	1.310	25.910	5.090
Finland	5565	539.426	10.843	4.351	15.194	3.898
France	4426	490.825	7.823	4.803	12.626	3.553
Georgia	3788	435.833	14.107	10.606	24.713	4.971
Hong Kong SAR	3730	509.783	25.585	5.535	31.120	5.579
Hungary	5217	527.718	7.045	1.217	8.263	2.874
Iran, Islamic Rep. of	5980	453.440	12.741	4.504	17.245	4.153
Ireland	4118	518.631	10.408	4.007	14.415	3.797
Israel	4268	519.817	22.836	1.532	24.368	4.936
Italy	4138	486.616	7.142	12.932	20.074	4.480
Japan	4446	570.344	4.609	1.581	6.190	2.488
Jordan	7176	449.168	18.079	2.898	20.977	4.580
Kazakhstan	4453	475.513	10.332	4.549	14.882	3.858
Korea, Rep. of	4409	569.202	6.092	1.361	7.453	2.730
Kuwait	4574	–	–	–	–	–
Lebanon	4730	377.899	21.752	2.387	24.139	4.913
Lithuania	4366	528.559	8.214	3.751	11.965	3.459
Malaysia	8077	474.958	11.559	0.304	11.863	3.444
Morocco	8458	402.182	6.404	1.812	8.216	2.866
New Zealand	6051	501.682	13.169	0.957	14.126	3.758
Norway (9)	5205	492.837	9.868	3.137	13.005	3.606
Oman	6751	449.401	7.569	1.902	9.471	3.077
Portugal	3867	496.848	7.757	4.579	12.337	3.512
Qatar	4436	469.447	16.890	2.095	18.985	4.357
Romania	4494	457.739	16.655	1.480	18.135	4.259
Russian Federation	4456	540.401	18.605	3.415	22.020	4.693
Saudi Arabia	5680	–	–	–	–	–
Singapore	5545	619.173	15.833	1.010	16.843	4.104
South Africa (9)	20829	380.984	6.056	3.243	9.299	3.049
Sweden	4556	520.180	11.597	2.933	14.530	3.812
Turkey	4662	518.323	13.869	2.517	16.385	4.048
United Arab Emirates	25539	469.252	4.050	1.267	5.317	2.306
United States	9942	514.753	23.995	0.857	24.853	4.985
Benchmarking Participants						
Ontario, Canada	4329	519.644	9.247	3.221	12.469	3.531
Quebec, Canada	3637	520.620	13.913	4.020	17.933	4.235
Moscow City, Russian Fed.	4323	576.193	10.004	2.841	12.844	3.584
Gauteng, RSA (9)	5633	427.661	10.484	9.881	20.365	4.513
Western Cape, RSA (9)	5351	442.032	21.447	16.666	38.113	6.174
Abu Dhabi, UAE	9380	420.119	10.447	3.967	14.414	3.797
Dubai, UAE	6544	539.472	4.125	2.663	6.788	2.605

Summary Statistics and Standard Errors for Proficiency in Earth Science—Grade 8

Country	Sample Size	Earth Science				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Australia	9060	533.237	9.029	1.746	10.775	3.283
Bahrain	5725	475.399	3.212	4.544	7.756	2.785
Chile	4694	463.904	7.950	2.814	10.764	3.281
Chinese Taipei	5610	578.960	3.436	2.733	6.169	2.484
Cyprus	3521	472.965	3.805	3.154	6.959	2.638
Egypt	7210	366.965	28.926	1.731	30.657	5.537
England	3856	517.410	24.111	6.498	30.609	5.533
Finland	5565	558.354	8.022	4.033	12.054	3.472
France	4426	502.438	7.070	11.066	18.136	4.259
Georgia	3788	430.673	12.813	0.273	13.085	3.617
Hong Kong SAR	3730	511.648	27.205	4.483	31.688	5.629
Hungary	5217	534.533	8.234	6.956	15.190	3.897
Iran, Islamic Rep. of	5980	436.599	12.200	3.886	16.086	4.011
Ireland	4118	536.214	8.149	6.048	14.197	3.768
Israel	4268	495.001	19.745	2.780	22.525	4.746
Italy	4138	511.911	10.408	1.737	12.145	3.485
Japan	4446	571.658	5.488	4.938	10.426	3.229
Jordan	7176	427.790	18.879	2.787	21.666	4.655
Kazakhstan	4453	447.804	10.250	6.852	17.102	4.135
Korea, Rep. of	4409	561.780	6.155	4.372	10.527	3.245
Kuwait	4574	–	–	–	–	–
Lebanon	4730	337.152	22.864	3.231	26.095	5.108
Lithuania	4366	534.290	8.460	2.343	10.802	3.287
Malaysia	8077	451.624	14.389	4.105	18.493	4.300
Morocco	8458	356.995	6.791	3.887	10.678	3.268
New Zealand	6051	509.893	11.023	2.731	13.755	3.709
Norway (9)	5205	518.939	8.608	6.555	15.163	3.894
Oman	6751	448.638	8.353	0.753	9.106	3.018
Portugal	3867	530.868	8.940	2.433	11.373	3.372
Qatar	4436	464.897	17.171	7.688	24.859	4.986
Romania	4494	453.352	16.201	5.460	21.661	4.654
Russian Federation	4456	533.092	18.010	1.552	19.562	4.423
Saudi Arabia	5680	–	–	–	–	–
Singapore	5545	562.046	12.606	3.924	16.530	4.066
South Africa (9)	20829	366.122	7.113	3.051	10.164	3.188
Sweden	4556	530.078	9.728	0.292	10.020	3.165
Turkey	4662	509.225	13.614	1.141	14.755	3.841
United Arab Emirates	25539	465.275	4.367	1.189	5.555	2.357
United States	9942	529.535	25.115	0.862	25.977	5.097
Benchmarking Participants						
Ontario, Canada	4329	520.047	8.226	0.913	9.139	3.023
Quebec, Canada	3637	552.540	14.844	5.723	20.567	4.535
Moscow City, Russian Fed.	4323	564.850	11.372	1.569	12.941	3.597
Gauteng, RSA (9)	5633	418.724	13.926	3.015	16.941	4.116
Western Cape, RSA (9)	5351	442.016	25.595	19.063	44.658	6.683
Abu Dhabi, UAE	9380	412.635	10.134	6.623	16.756	4.093
Dubai, UAE	6544	538.338	4.359	1.113	5.472	2.339

Summary Statistics and Standard Errors for Proficiency in Knowing in Science—Grade 8

Country	Sample Size	Science Knowing				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Australia	9060	514.697	11.148	0.951	12.098	3.478
Bahrain	5725	492.769	3.174	0.684	3.858	1.964
Chile	4694	463.248	7.552	3.666	11.218	3.349
Chinese Taipei	5610	600.076	4.174	1.414	5.588	2.364
Cyprus	3521	482.286	3.331	5.775	9.106	3.018
Egypt	7210	395.965	32.821	2.189	35.010	5.917
England	3856	519.604	25.021	0.477	25.498	5.050
Finland	5565	544.527	8.459	1.915	10.375	3.221
France	4426	480.468	7.041	1.590	8.631	2.938
Georgia	3788	458.503	12.601	4.612	17.214	4.149
Hong Kong SAR	3730	501.163	30.959	1.888	32.847	5.731
Hungary	5217	537.353	6.982	1.787	8.769	2.961
Iran, Islamic Rep. of	5980	448.880	13.450	3.581	17.031	4.127
Ireland	4118	512.853	6.763	2.371	9.134	3.022
Israel	4268	513.698	20.479	0.544	21.023	4.585
Italy	4138	507.148	5.817	1.133	6.950	2.636
Japan	4446	562.869	4.561	1.068	5.628	2.372
Jordan	7176	455.300	26.009	2.159	28.169	5.307
Kazakhstan	4453	463.327	11.416	2.468	13.884	3.726
Korea, Rep. of	4409	557.989	5.697	1.145	6.842	2.616
Kuwait	4574	–	–	–	–	–
Lebanon	4730	388.268	15.482	3.765	19.247	4.387
Lithuania	4366	527.349	7.771	1.621	9.392	3.065
Malaysia	8077	442.024	13.821	1.370	15.191	3.898
Morocco	8458	379.809	6.225	3.120	9.345	3.057
New Zealand	6051	479.617	11.951	0.754	12.705	3.564
Norway (9)	5205	497.137	6.226	0.207	6.433	2.536
Oman	6751	461.169	8.702	2.388	11.090	3.330
Portugal	3867	520.448	8.066	1.294	9.360	3.059
Qatar	4436	486.718	16.437	0.890	17.327	4.163
Romania	4494	474.791	13.262	6.281	19.543	4.421
Russian Federation	4456	543.424	19.161	2.730	21.890	4.679
Saudi Arabia	5680	–	–	–	–	–
Singapore	5545	620.671	16.190	1.816	18.006	4.243
South Africa (9)	20829	361.083	7.229	3.021	10.249	3.201
Sweden	4556	521.312	9.650	0.561	10.212	3.196
Turkey	4662	506.090	15.617	2.189	17.806	4.220
United Arab Emirates	25539	481.967	5.356	2.076	7.432	2.726
United States	9942	514.747	20.210	0.986	21.196	4.604
Benchmarking Participants						
Ontario, Canada	4329	504.869	8.302	2.440	10.742	3.278
Quebec, Canada	3637	528.916	10.172	2.440	12.612	3.551
Moscow City, Russian Fed.	4323	570.337	8.671	0.318	8.989	2.998
Gauteng, RSA (9)	5633	413.035	14.295	9.255	23.550	4.853
Western Cape, RSA (9)	5351	427.052	26.167	9.477	35.643	5.970
Abu Dhabi, UAE	9380	421.520	13.781	4.531	18.312	4.279
Dubai, UAE	6544	560.429	4.194	0.987	5.181	2.276

Summary Statistics and Standard Errors for Proficiency in Applying in Science—Grade 8

Country	Sample Size	Science Applying				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Australia	9060	532.062	10.832	0.501	11.333	3.367
Bahrain	5725	480.744	2.327	4.659	6.986	2.643
Chile	4694	462.110	7.595	1.493	9.089	3.015
Chinese Taipei	5610	566.715	3.934	0.570	4.504	2.122
Cyprus	3521	477.274	3.532	0.083	3.615	1.901
Egypt	7210	383.807	29.476	3.244	32.720	5.720
England	3856	514.594	24.429	1.365	25.794	5.079
Finland	5565	536.516	9.724	0.993	10.717	3.274
France	4426	482.050	6.770	1.177	7.947	2.819
Georgia	3788	439.918	12.498	1.011	13.509	3.675
Hong Kong SAR	3730	501.484	26.043	1.264	27.306	5.226
Hungary	5217	528.071	6.543	3.065	9.608	3.100
Iran, Islamic Rep. of	5980	451.631	11.067	1.083	12.150	3.486
Ireland	4118	520.930	8.669	2.902	11.571	3.402
Israel	4268	509.029	16.149	2.549	18.698	4.324
Italy	4138	498.762	7.631	3.874	11.505	3.392
Japan	4446	575.729	5.300	0.184	5.484	2.342
Jordan	7176	453.120	21.217	2.457	23.675	4.866
Kazakhstan	4453	480.744	9.498	2.363	11.861	3.444
Korea, Rep. of	4409	560.072	4.389	1.522	5.911	2.431
Kuwait	4574	–	–	–	–	–
Lebanon	4730	375.493	18.175	8.935	27.110	5.207
Lithuania	4366	530.275	8.266	0.494	8.761	2.960
Malaysia	8077	473.026	11.239	0.554	11.793	3.434
Morocco	8458	393.257	6.044	2.538	8.582	2.930
New Zealand	6051	502.559	13.101	1.717	14.819	3.850
Norway (9)	5205	492.722	8.575	3.600	12.174	3.489
Oman	6751	456.420	7.941	3.445	11.386	3.374
Portugal	3867	514.456	8.510	1.330	9.839	3.137
Qatar	4436	469.461	19.769	0.780	20.549	4.533
Romania	4494	466.774	17.107	0.884	17.991	4.242
Russian Federation	4456	542.658	19.413	0.579	19.992	4.471
Saudi Arabia	5680	–	–	–	–	–
Singapore	5545	608.392	14.942	2.128	17.070	4.132
South Africa (9)	20829	377.249	6.356	2.226	8.582	2.930
Sweden	4556	518.079	10.366	0.457	10.823	3.290
Turkey	4662	514.607	12.038	3.101	15.139	3.891
United Arab Emirates	25539	472.285	4.106	0.759	4.865	2.206
United States	9942	523.273	22.961	0.509	23.471	4.845
Benchmarking Participants						
Ontario, Canada	4329	523.066	9.629	2.290	11.919	3.452
Quebec, Canada	3637	537.504	13.250	4.011	17.261	4.155
Moscow City, Russian Fed.	4323	561.854	9.341	4.456	13.797	3.714
Gauteng, RSA (9)	5633	428.295	11.867	2.169	14.036	3.746
Western Cape, RSA (9)	5351	446.415	22.504	2.318	24.822	4.982
Abu Dhabi, UAE	9380	420.513	11.783	0.487	12.270	3.503
Dubai, UAE	6544	544.602	3.706	2.390	6.096	2.469

Summary Statistics and Standard Errors for Proficiency in Reasoning in Science—Grade 8

Country	Sample Size	Science Reasoning				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Australia	9060	535.575	9.289	0.190	9.479	3.079
Bahrain	5725	482.162	2.446	3.294	5.740	2.396
Chile	4694	457.606	8.248	1.671	9.919	3.149
Chinese Taipei	5610	558.643	3.127	1.093	4.220	2.054
Cyprus	3521	487.781	4.028	1.152	5.180	2.276
Egypt	7210	377.907	25.829	6.100	31.930	5.651
England	3856	513.271	23.905	1.489	25.394	5.039
Finland	5565	547.770	10.519	1.122	11.641	3.412
France	4426	502.326	7.421	1.829	9.250	3.041
Georgia	3788	436.249	13.558	4.198	17.755	4.214
Hong Kong SAR	3730	503.506	25.436	1.514	26.950	5.191
Hungary	5217	524.255	7.440	1.885	9.326	3.054
Iran, Islamic Rep. of	5980	444.029	13.204	6.466	19.670	4.435
Ireland	4118	534.107	8.920	2.771	11.691	3.419
Israel	4268	517.949	16.588	4.423	21.010	4.584
Italy	4138	495.372	7.469	8.182	15.651	3.956
Japan	4446	570.443	4.205	1.918	6.123	2.474
Jordan	7176	442.586	20.331	2.687	23.018	4.798
Kazakhstan	4453	482.152	8.548	3.371	11.919	3.452
Korea, Rep. of	4409	564.013	3.962	1.526	5.487	2.343
Kuwait	4574	–	–	–	–	–
Lebanon	4730	345.754	23.437	3.160	26.597	5.157
Lithuania	4366	540.721	8.969	1.266	10.235	3.199
Malaysia	8077	458.723	11.291	2.402	13.692	3.700
Morocco	8458	397.680	6.474	1.112	7.586	2.754
New Zealand	6051	509.600	11.543	0.848	12.391	3.520
Norway (9)	5205	494.183	10.094	2.675	12.769	3.573
Oman	6751	450.090	6.947	2.020	8.968	2.995
Portugal	3867	519.458	9.190	3.064	12.254	3.501
Qatar	4436	463.967	19.180	1.577	20.756	4.556
Romania	4494	463.921	17.999	1.439	19.438	4.409
Russian Federation	4456	543.015	13.746	6.447	20.193	4.494
Saudi Arabia	5680	–	–	–	–	–
Singapore	5545	594.629	14.739	1.179	15.918	3.990
South Africa (9)	20829	361.576	6.774	2.116	8.890	2.982
Sweden	4556	523.709	10.507	3.874	14.381	3.792
Turkey	4662	523.927	14.025	2.132	16.156	4.019
United Arab Emirates	25539	461.215	3.755	1.131	4.886	2.210
United States	9942	528.228	20.069	1.577	21.646	4.653
Benchmarking Participants						
Ontario, Canada	4329	532.629	7.628	5.991	13.619	3.690
Quebec, Canada	3637	540.499	15.457	1.567	17.024	4.126
Moscow City, Russian Fed.	4323	568.117	8.595	1.201	9.796	3.130
Gauteng, RSA (9)	5633	416.823	12.674	2.033	14.707	3.835
Western Cape, RSA (9)	5351	438.071	23.783	10.218	34.000	5.831
Abu Dhabi, UAE	9380	411.626	10.930	1.937	12.866	3.587
Dubai, UAE	6544	538.236	3.449	1.959	5.408	2.325

Appendix 14E: Summary Statistics and Standard Errors for Proficiency in Mathematics and Science for the Grade 4 Bridge Samples

Summary Statistics and Standard Errors for Proficiency in Overall Mathematics—Grade 4 Bridge Samples

Country	Sample Size	Overall Mathematics				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Austria	1964	533.830	10.461	0.138	10.599	3.256
Canada	1604	511.587	14.238	0.516	14.754	3.841
Chile	1612	436.314	16.937	2.111	19.048	4.364
Chinese Taipei	1663	603.363	6.653	0.153	6.806	2.609
Croatia	1472	511.055	9.897	1.739	11.636	3.411
Czech Republic	2030	518.892	53.219	0.405	53.623	7.323
Denmark	1432	527.810	12.155	0.602	12.757	3.572
England	1242	552.941	23.439	1.932	25.371	5.037
Finland	1983	533.235	10.513	0.850	11.364	3.371
France	1948	480.785	12.746	1.224	13.971	3.738
Georgia	1632	504.578	60.780	2.669	63.449	7.965
Germany	1505	519.271	16.177	1.559	17.737	4.211
Hong Kong SAR	1329	607.214	56.466	5.437	61.904	7.868
Hungary	1778	530.046	25.864	0.456	26.320	5.130
Italy	1921	510.804	23.657	0.680	24.337	4.933
Korea, Rep. of	1541	594.732	6.069	0.146	6.215	2.493
Lithuania	1587	547.329	7.085	0.520	7.605	2.758
Netherlands	1295	528.108	14.844	2.041	16.884	4.109
Norway (5)	1899	540.210	14.867	0.160	15.027	3.876
Portugal	1612	536.042	19.543	1.058	20.601	4.539
Qatar	1486	449.663	35.778	4.669	40.447	6.360
Russian Federation	2128	558.896	14.818	0.142	14.959	3.868
Singapore	1881	631.356	30.425	1.101	31.526	5.615
Slovak Republic	1610	505.109	20.817	1.546	22.363	4.729
Spain	1670	501.836	22.202	0.671	22.873	4.783
Sweden	1697	516.572	32.608	0.942	33.550	5.792
United Arab Emirates	2243	495.741	61.636	0.866	62.502	7.906
United States	1652	536.716	24.934	0.815	25.748	5.074

Summary Statistics and Standard Errors for Proficiency in Overall Science—Grade 4 Bridge Samples

Country	Sample Size	Overall Science				Overall Standard Error
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	
Austria	1964	511.455	13.693	1.721	15.414	3.926
Canada	1604	512.234	18.296	1.829	20.124	4.486
Chile	1612	461.405	15.149	4.684	19.833	4.453
Chinese Taipei	1663	554.372	6.666	1.703	8.369	2.893
Croatia	1472	523.618	9.932	2.045	11.976	3.461
Czech Republic	2030	517.327	85.905	3.126	89.031	9.436
Denmark	1432	514.178	17.629	0.854	18.483	4.299
England	1242	542.768	20.677	1.224	21.901	4.680
Finland	1983	546.916	13.005	2.706	15.711	3.964
France	1948	478.221	14.022	1.591	15.613	3.951
Georgia	1632	476.959	64.134	1.311	65.445	8.090
Germany	1505	522.197	22.184	0.228	22.412	4.734
Hong Kong SAR	1329	542.344	52.295	0.818	53.112	7.288
Hungary	1778	532.838	39.090	0.089	39.179	6.259
Italy	1921	507.154	15.230	1.228	16.458	4.057
Korea, Rep. of	1541	588.049	5.571	1.274	6.845	2.616
Lithuania	1587	539.155	7.803	1.736	9.539	3.089
Netherlands	1295	510.988	19.207	0.937	20.144	4.488
Norway (5)	1899	535.958	10.133	1.776	11.909	3.451
Portugal	1612	508.763	9.556	2.595	12.150	3.486
Qatar	1486	463.042	71.953	2.215	74.168	8.612
Russian Federation	2128	567.273	16.354	1.026	17.380	4.169
Singapore	1881	599.129	26.139	0.209	26.348	5.133
Slovak Republic	1610	511.589	22.881	0.930	23.811	4.880
Spain	1670	514.435	18.437	0.418	18.855	4.342
Sweden	1697	522.709	40.072	1.384	41.455	6.439
United Arab Emirates	2243	484.822	71.684	1.845	73.529	8.575
United States	1652	535.459	28.397	0.828	29.224	5.406

Appendix 14F: Summary Statistics and Standard Errors for Proficiency in Mathematics and Science for the Grade 8 Bridge Samples

Summary Statistics and Standard Errors for Proficiency in Overall Mathematics—Grade 8 Bridge Samples

Country	Sample Size	Overall Mathematics				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Chile	1526	434.152	9.803	0.969	10.772	3.282
Chinese Taipei	1578	617.958	28.118	1.150	29.267	5.410
England	1592	525.666	36.296	0.134	36.430	6.036
Georgia	1314	452.235	46.725	3.380	50.105	7.078
Hong Kong SAR	1423	581.128	45.687	1.378	47.065	6.860
Hungary	1751	521.043	50.453	0.622	51.075	7.147
Israel	1863	511.454	48.390	1.688	50.078	7.077
Italy	2032	495.350	11.582	0.395	11.977	3.461
Korea, Rep. of	1693	613.440	12.601	0.315	12.917	3.594
Lithuania	1687	509.663	26.804	0.380	27.184	5.214
Malaysia	1560	473.342	95.148	3.416	98.565	9.928
Norway (9)	2018	509.421	14.338	0.741	15.079	3.883
Qatar	1490	452.250	33.261	6.955	40.216	6.342
Russian Federation	2083	542.804	55.946	0.125	56.071	7.488
Singapore	1871	630.347	41.455	1.303	42.758	6.539
Sweden	1582	513.370	22.833	0.604	23.437	4.841
Turkey	1819	486.938	49.058	1.597	50.654	7.117
United Arab Emirates	2089	481.636	74.089	0.733	74.822	8.650
United States	1484	511.773	40.469	0.422	40.892	6.395

Summary Statistics and Standard Errors for Proficiency in Overall Science—Grade 8 Bridge Samples

Country	Sample Size	Overall Science				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Chile	1526	458.329	11.511	2.527	14.038	3.747
Chinese Taipei	1578	584.185	20.317	4.531	24.849	4.985
England	1592	529.216	23.825	1.464	25.289	5.029
Georgia	1314	434.787	47.700	8.045	55.745	7.466
Hong Kong SAR	1423	530.579	25.505	2.365	27.870	5.279
Hungary	1751	523.286	40.031	1.998	42.029	6.483
Israel	1863	497.660	46.912	1.923	48.834	6.988
Italy	2032	487.430	17.480	0.908	18.389	4.288
Korea, Rep. of	1693	562.584	10.185	2.708	12.893	3.591
Lithuania	1687	522.169	17.423	2.561	19.984	4.470
Malaysia	1560	469.391	116.807	1.359	118.166	10.870
Norway (9)	2018	500.464	20.316	1.715	22.031	4.694
Qatar	1490	494.777	23.676	2.366	26.042	5.103
Russian Federation	2083	543.813	36.668	0.693	37.361	6.112
Singapore	1871	611.040	37.081	0.393	37.474	6.122
Sweden	1582	521.140	34.419	2.223	36.642	6.053
Turkey	1819	517.604	37.650	3.187	40.837	6.390
United Arab Emirates	2089	490.235	97.258	0.786	98.044	9.902
United States	1484	523.665	33.892	2.145	36.037	6.003