CHAPTER 4

Estimating Standard Errors in the TIMSS 2015 Results

Pierre Foy
Sylvie LaRoche

To obtain estimates of students' proficiency in mathematics and science that are both accurate and cost-effective, TIMSS 2015 made extensive use of probability sampling techniques to sample students from 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 2015 international reports is accompanied by an estimate of its standard error. For statistics reporting student achievement, which are based on plausible values, standard errors have two components. The first reflects the uncertainty due to generalizing from student samples to the entire fourth or eighth grade student populations, referred to as sampling variance, and the second reflects uncertainty due to inferring students' performance on the entire assessment from their performance on the subset of items that they took, known as imputation variance. For parameter estimates of variables that are not plausible values, 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 easy 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 such as the balanced repeated replication and Jackknife techniques (Johnson & Rust, 1992; Wolter, 1985). TIMSS uses one variation of the Jackknife, the Jackknife Repeated Replication (JRR), to estimate sampling variances. JRR was chosen because it is computationally straightforward and provides approximately unbiased estimates of the sampling variances and sampling errors of means, total, and percentages.

At the core of the JRR technique is the grouping of sampling units into zones based on sample design conditions (e.g., strata) and subsequent repeated draws of subsamples from these zones, i.e., repeated replication. For TIMSS, the two main features of the TIMSS sample design that JRR incorporates in its repeated draws of subsamples are the stratification of schools and the clustering of students within schools. This is done by defining Jackknife sampling zones according to the stratification scheme in each zone and by pairing successive schools[1] to model the clustering from each national sample (see Chapter 3 for information on the Sample Design). Since most national samples consist of 150 schools, a total of 75 zones are created. If more than 150 schools are selected, then the additional zones are collapsed into the first 75 zones. The subsampling required by JRR is applied within each sampling zone.

Sampling zones are constructed within explicit strata. When an explicit stratum has an odd number of schools, either by design or because of school non-response, the students in the remaining school are randomly divided to make up two "quasi" schools for the purposes of calculating jackknife standard errors.[2] Each sampling zone then consists of a pair of schools or "quasi" schools.

Exhibit 4.1 lists the number of sampling zones for each TIMSS 2015 participating country.

1   When schools are sampled, schools are ordered within explicit strata by implicit stratification variables and the measure of size. Based on this sorting, successively sampled schools are matched and classified together in each sampling zone. More information can be found in Appendix 3A of Chapter 3.

2   If a remaining school consists of 2 sampled classrooms, each classroom becomes a "quasi" school.

Exhibit 4.1: Number of Sampling Zones for Each TIMSS 2015 Participating Country

Country	TIMSS 2015 Sampling Zones	
	Fourth Grade	**Eighth Grade**
Australia	75	75
Bahrain	75	75
Belgium (Flemish)	75	–
Botswana (9)	–	75
Bulgaria	75	–
Canada	75	75
Chile	75	75
Chinese Taipei	75	75
Croatia	75	–
Cyprus	75	–
Czech Republic	75	–
Denmark	75	–
Egypt	–	75
England	75	73
Finland	75	–
France	75	–
Georgia	75	75
Germany	75	–
Hong Kong SAR	67	68
Hungary	74	74
Indonesia	75	–
Iran, Islamic Rep. of	75	75
Ireland	75	75
Israel	–	75
Italy	75	75
Japan	75	74
Jordan	75	75
Kazakhstan	75	75
Korea, Rep. of	75	75
Kuwait	75	75
Lebanon	–	70
Lithuania	75	75
Malaysia	–	75
Malta	–	75
Morocco	75	75
Netherlands	68	–

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Exhibit 4.1: Number of Sampling Zones for Each TIMSS 2015 Participating Country (Continued)

Country	TIMSS 2015 Sampling Zones	
	Fourth Grade	**Eighth Grade**
New Zealand	75	74
Northern Ireland	62	–
Norway (5 and 9)	72	73
Oman	75	75
Poland	75	–
Portugal	75	–
Qatar	75	75
Russian Federation	61	59
Saudi Arabia	75	72
Serbia	75	–
Singapore	75	75
Slovak Republic	75	–
Slovenia	75	75
South Africa (5 and 9)	75	75
Spain	75	–
Sweden	73	75
Thailand	–	75
Turkey	75	75
United Arab Emirates	75	75
United States	75	75
Benchmarking Participants		
Buenos Aires, Argentina	70	66
Ontario, Canada	75	71
Quebec, Canada	61	63
Norway (4 and 8)	70	72
Abu Dhabi, UAE	72	75
Dubai, UAE	75	75
Florida, US	27	27

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 another subsample where the second school is included and the first school is removed.[3] When a school is removed from the sample, the weights of the remaining school are doubled to make up for the omitted school. In both subsamples,

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3   Prior to 2015, TIMSS used 75 subsamples and sets of replicate weights to calculate the JRR sampling variances. To provide more accurate estimates, starting in 2015 TIMSS uses 150 subsamples and sets of replicate weights to calculate the JRR sampling variances. Two subsamples are drawn from each sampling zone rather than one randomly selected subsample.

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all students in the other sampling zones are included. 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_{hj} as follows:

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

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

$$W_{hji} = k_{hj} \cdot W_{0i} \quad (2)$$

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

Exhibit 4.2 illustrates how the replicate factors, necessary to produce the replicate sampling weights, are derived. Within each sampling zone, each school is assigned randomly an indicator u_{hj}, 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 identify which schools within each zone will be successively included or removed. When a school is removed from a zone, the replicate factor is set to zero and the sampling weights of all students in that school are set to zero; when a school is included, the replicate factor is set to two and the sampling weights of all students in that school are doubled. The sampling weights of students in all other sampling zones remain unchanged.

For example, sampling zone 1 yields two sets of replicate sampling weights. 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 ($k_{hj} = 1$) for all students in the other sampling zones. The second set of replicate sampling weights 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 ($k_{hj} = 1$) for all students in the other sampling zones.

Exhibit 4.2: Construction of Replicate Factors Across Sampling Zones

Sample Zone	School Replicate Indicator (u_{hj})	Replicate Factors for Computing JRR Replicate Sampling Weights (k_{hj})											
		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

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 a statistic of interest 150 times. The variation across these 150 jackknife estimates determines the sampling variance.

Given a statistic t 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:

$$Var_{jrr}(t_0) = \frac{1}{2} \sum_{h=1}^{75} \sum_{j=1}^{2} (t_{hj} - t_0)^2 \qquad (3)$$

where the term t_0 denotes the statistic of interest estimated with the overall student sampling weights W_{0i} and the term t_{hj} denotes the same statistic computed using the set of replicate sampling weights W_{hji} obtained from sampling zone h ($h=1,...,75$), where the jth school (1st or 2nd) in the zone is included and the other removed.

The sampling variance estimated with the TIMSS JRR method properly measures the variation arising from having sampled students using the multi-stage stratified cluster sample design. Its square root is the standard error for any statistic derived from variables other than plausible values. Examples of such statistics include the mean age of students, the mean scale score on the TIMSS *Students Like Learning Mathematics* contextual scale, and the percentage of students with at least one parent with a university degree.

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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 for plausible values was more complicated. As described in Chapter 4 of the *TIMSS 2015 Assessment Frameworks*, the TIMSS item pool was far too extensive to be administered in its entirety to any one student, and so 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 for all of the booklets were then aggregated using item response theory to provide results for the entire assessment. Multiple imputation was used to derive reliable estimates of student performance (plausible values) on the assessment as a whole, even though each student responded to just a subset of the assessment items. Because every student proficiency estimate incorporates a random element, TIMSS 2015 followed the customary procedure of generating five estimates for each student and using the variability among them as a measure of the imputation uncertainty, or error.

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 et al., 1992). Thus, for any given achievement-based statistic t, estimating that statistic from each plausible value yields five estimates t_m, $m = 1, \ldots, 5$, all of them computed using the overall student sampling weights W_{0i}. The final estimate of that statistic, t_0, is the average of these five estimates:

$$t_0 = \frac{1}{5} \sum_{m=1}^{5} t_m \tag{4}$$

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

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

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

$$Var_{tot}(t_0) = Var_{jrr}(t_0) + Var_{imp}(t_0) \tag{6}$$

The sampling variance in this context is the average of the sampling variances from the five plausible values, as follows:

$$Var_{jrr}(t_0) = \frac{1}{5} \sum_{m=1}^{5} Var_{jrr}(t_m) \tag{7}$$

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where

$$Var_{jrr}(t_m) = \frac{1}{2} \sum_{h=1}^{75} \sum_{j=1}^{2} (t_{mhj} - t_m)^2 \tag{8}$$

and t_{mhj} is the appropriate JRR estimate based on plausible value computed using the set of replicate sampling weights from sampling zone h where school j 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 and the percentage of students who reach the TIMSS advanced international benchmark of mathematics achievement.

Appendices 4A-D 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.

Estimating Standard Errors for International Averages

Some exhibits in the TIMSS 2015 reports include international averages and their standard errors. For example, Exhibit 1.10 reports the international average for the percentages of girls and boys and their fourth grade mathematics and science achievement. International averages are computed using the data from the participating countries included in the main table of an exhibit. Data from the benchmarking participants is not included in the estimation of international averages.

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

$$t_{int} = \frac{1}{N} \sum_{i=1}^{N} t_{0i} \tag{9}$$

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

The variance of the international average t_{int} is given by:

$$Var(t_{int}) = \frac{1}{N^2} \sum_{i=1}^{N} Var_{tot}(t_{0i}) \tag{10}$$

where $Var_{tot}(t_{0i})$ is the total variance of our statistic of interest for the ith country, as given in equation (6) above. For statistics based on plausible values, the total variance includes the sampling variance and the imputation variance. For statistics not based on plausible values, such as percentages, the total variance is based entirely on the sampling variance, as shown in equation (3) above. The standard error of the international average is the square root of the total variance.

References

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Wolter, K. M. (1985). *Introduction to variance estimation*. New York: Springer-Verlag.

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Appendix 4A: Summary Statistics and Standard Errors for Proficiency in Mathematics at the Fourth Grade

Summary Statistics and Standard Errors for Proficiency in Overall Mathematics at the Fourth Grade

Country	Sample Size	Overall Mathematics				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	6057	517.227	9.180	0.174	9.354	3.058
Bahrain	8575	451.033	2.144	0.533	2.678	1.636
Belgium (Flemish)	5404	545.657	4.087	0.184	4.270	2.066
Bulgaria	4228	524.284	26.748	0.899	27.648	5.258
Canada	12283	510.556	5.420	0.066	5.486	2.342
Chile	4756	458.582	5.510	0.301	5.811	2.411
Chinese Taipei	4291	596.619	3.192	0.289	3.481	1.866
Croatia	3985	502.335	2.968	0.104	3.072	1.753
Cyprus	4125	523.026	6.540	0.599	7.139	2.672
Czech Republic	5202	528.138	4.982	0.004	4.985	2.233
Denmark	3710	538.653	6.661	0.791	7.452	2.730
England	4006	546.187	7.841	0.227	8.068	2.840
Finland	5015	535.288	3.854	0.232	4.086	2.021
France	4873	488.168	7.660	0.893	8.553	2.925
Georgia	3919	463.149	12.819	0.292	13.111	3.621
Germany	3948	521.634	3.927	0.221	4.148	2.037
Hong Kong SAR	3600	614.520	8.074	0.147	8.220	2.867
Hungary	5036	529.191	9.784	0.144	9.928	3.151
Indonesia	8319	397.463	12.752	1.024	13.777	3.712
Iran, Islamic Rep. of	7928	431.488	8.672	1.836	10.508	3.242
Ireland	4344	547.337	4.373	0.218	4.591	2.143
Italy	4373	506.848	5.650	0.863	6.513	2.552
Japan	4383	592.826	3.422	0.382	3.804	1.950
Jordan	7861	388.466	8.536	0.835	9.371	3.061
Kazakhstan	4702	544.420	19.711	0.530	20.241	4.499
Korea, Rep. of	4669	608.035	4.106	0.791	4.897	2.213
Kuwait	7296	353.064	19.132	2.303	21.435	4.630
Lithuania	4529	535.341	5.991	0.114	6.106	2.471
Morocco	10428	377.455	11.087	0.794	11.881	3.447
Netherlands	4515	529.819	2.564	0.345	2.910	1.706

Summary Statistics and Standard Errors for Proficiency in Overall Mathematics at the Fourth Grade (Continued)

Country	Sample Size	Overall Mathematics				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
New Zealand	6322	490.561	5.360	0.125	5.485	2.342
Northern Ireland	3116	570.261	8.349	0.321	8.669	2.944
Norway (5)	4329	549.080	5.657	0.474	6.131	2.476
Oman	9105	425.483	5.474	0.753	6.227	2.495
Poland	4747	534.773	4.367	0.157	4.523	2.127
Portugal	4693	541.200	4.494	0.496	4.989	2.234
Qatar	5194	438.996	11.187	0.580	11.767	3.430
Russian Federation	4921	563.922	11.152	0.544	11.696	3.420
Saudi Arabia	4337	383.489	13.929	2.566	16.495	4.061
Serbia	4036	517.998	11.696	0.809	12.505	3.536
Singapore	6517	617.671	14.631	0.074	14.705	3.835
Slovak Republic	5773	498.247	5.669	0.464	6.134	2.477
Slovenia	4445	519.875	3.164	0.398	3.561	1.887
South Africa (5)	10932	375.738	11.392	0.857	12.249	3.500
Spain	7764	505.095	5.641	0.380	6.021	2.454
Sweden	4142	518.647	7.233	0.666	7.899	2.811
Turkey	6456	483.150	9.202	0.170	9.371	3.061
United Arab Emirates	21177	451.582	5.550	0.183	5.733	2.394
United States	10029	539.156	4.810	0.283	5.094	2.257
Benchmarking Participants						
Buenos Aires, Argentina	6435	432.273	7.325	0.894	8.219	2.867
Ontario, Canada	4574	512.460	5.232	0.223	5.454	2.335
Quebec, Canada	2798	535.831	15.503	0.318	15.821	3.978
Norway (4)	4164	492.997	4.926	0.353	5.279	2.298
Abu Dhabi, UAE	5001	419.290	21.292	0.699	21.991	4.689
Dubai, UAE	7453	510.644	1.744	0.317	2.061	1.436
Florida, US	2025	546.136	21.622	0.774	22.396	4.732

Summary Statistics and Standard Errors for Proficiency in Number at the Fourth Grade

Country	Sample Size	Number				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	6057	508.851	9.611	0.280	9.891	3.145
Bahrain	8575	452.815	2.088	0.675	2.763	1.662
Belgium (Flemish)	5404	543.155	4.260	0.104	4.364	2.089
Bulgaria	4228	529.334	20.608	0.515	21.124	4.596
Canada	12283	502.819	5.198	0.441	5.639	2.375
Chile	4756	454.772	5.665	1.715	7.380	2.717
Chinese Taipei	4291	599.348	2.857	0.366	3.223	1.795
Croatia	3985	498.113	2.777	0.431	3.208	1.791
Cyprus	4125	528.457	5.996	0.446	6.443	2.538
Czech Republic	5202	527.843	4.840	0.701	5.541	2.354
Denmark	3710	534.889	6.540	0.798	7.338	2.709
England	4006	546.815	9.374	0.942	10.317	3.212
Finland	5015	531.763	4.039	0.360	4.400	2.098
France	4873	483.394	7.418	1.404	8.822	2.970
Georgia	3919	482.823	11.505	1.086	12.591	3.548
Germany	3948	514.912	3.557	0.650	4.207	2.051
Hong Kong SAR	3600	616.270	8.684	0.858	9.542	3.089
Hungary	5036	531.155	8.829	0.388	9.217	3.036
Indonesia	8319	399.062	12.209	0.683	12.893	3.591
Iran, Islamic Rep. of	7928	434.999	9.226	1.269	10.494	3.239
Ireland	4344	550.958	4.306	0.670	4.977	2.231
Italy	4373	509.849	5.341	0.412	5.752	2.398
Japan	4383	591.630	3.333	0.412	3.745	1.935
Jordan	7861	387.570	8.177	1.584	9.761	3.124
Kazakhstan	4702	551.851	15.616	0.384	16.001	4.000
Korea, Rep. of	4669	609.928	5.283	1.387	6.671	2.583
Kuwait	7296	356.452	19.530	1.197	20.728	4.553
Lithuania	4529	538.033	6.506	0.210	6.717	2.592
Morocco	10428	380.950	10.328	0.772	11.100	3.332
Netherlands	4515	531.301	2.924	1.719	4.643	2.155
New Zealand	6322	485.429	6.303	0.767	7.070	2.659
Northern Ireland	3116	574.436	9.277	0.317	9.594	3.097
Norway (5)	4329	541.911	5.620	0.282	5.902	2.429
Oman	9105	422.905	6.003	0.609	6.612	2.571

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Summary Statistics and Standard Errors for Proficiency in Number at the Fourth Grade (Continued)

Country	Sample Size	Number				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Poland	4747	534.465	4.758	0.366	5.125	2.264
Portugal	4693	540.532	4.466	0.144	4.610	2.147
Qatar	5194	446.286	10.509	0.729	11.238	3.352
Russian Federation	4921	566.810	10.385	0.589	10.974	3.313
Saudi Arabia	4337	383.836	14.210	2.737	16.947	4.117
Serbia	4036	524.028	10.989	0.428	11.417	3.379
Singapore	6517	629.864	16.408	0.852	17.260	4.154
Slovak Republic	5773	501.968	4.884	0.882	5.766	2.401
Slovenia	4445	511.296	3.299	0.076	3.376	1.837
South Africa (5)	10932	378.542	11.067	0.637	11.705	3.421
Spain	7764	504.283	5.160	0.969	6.129	2.476
Sweden	4142	513.920	6.836	0.203	7.039	2.653
Turkey	6456	488.944	9.248	0.941	10.188	3.192
United Arab Emirates	21177	455.060	5.181	0.417	5.598	2.366
United States	10029	545.596	4.707	0.244	4.951	2.225
Benchmarking Participants						
Buenos Aires, Argentina	6435	445.025	6.299	2.311	8.610	2.934
Ontario, Canada	4574	499.676	5.949	0.932	6.881	2.623
Quebec, Canada	2798	532.917	16.831	0.450	17.282	4.157
Norway (4)	4164	488.824	4.384	0.627	5.011	2.238
Abu Dhabi, UAE	5001	421.618	20.273	1.405	21.678	4.656
Dubai, UAE	7453	513.505	2.003	0.283	2.286	1.512
Florida, US	2025	556.001	22.518	1.137	23.654	4.864

Summary Statistics and Standard Errors for Proficiency in Geometric Shapes and Measures at the Fourth Grade

Country	Sample Size	Geometric Shapes and Measures				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	6057	527.101	9.110	1.914	11.024	3.320
Bahrain	8575	446.983	2.314	1.300	3.614	1.901
Belgium (Flemish)	5404	563.591	4.317	1.058	5.375	2.318
Bulgaria	4228	524.890	34.326	0.591	34.917	5.909
Canada	12283	517.057	6.077	0.302	6.379	2.526
Chile	4756	459.537	5.383	4.081	9.464	3.076
Chinese Taipei	4291	596.967	4.473	4.359	8.832	2.972
Croatia	3985	512.272	4.422	0.755	5.176	2.275
Cyprus	4125	523.627	7.200	0.890	8.091	2.844
Czech Republic	5202	531.037	6.058	0.257	6.315	2.513
Denmark	3710	555.111	9.843	0.523	10.365	3.220
England	4006	542.060	9.059	1.670	10.730	3.276
Finland	5015	539.141	3.892	2.302	6.194	2.489
France	4873	503.343	7.702	1.457	9.158	3.026
Georgia	3919	428.578	18.556	2.326	20.883	4.570
Germany	3948	530.795	5.253	0.902	6.156	2.481
Hong Kong SAR	3600	616.670	9.473	1.991	11.464	3.386
Hungary	5036	536.005	10.797	1.868	12.665	3.559
Indonesia	8319	394.241	15.327	2.728	18.056	4.249
Iran, Islamic Rep. of	7928	427.768	10.758	1.173	11.932	3.454
Ireland	4344	542.003	4.665	3.678	8.344	2.889
Italy	4373	503.387	7.163	0.633	7.796	2.792
Japan	4383	601.335	3.819	2.186	6.005	2.450
Jordan	7861	394.470	8.976	0.465	9.441	3.073
Kazakhstan	4702	539.582	32.419	0.921	33.340	5.774
Korea, Rep. of	4669	610.438	3.815	1.688	5.503	2.346
Kuwait	7296	337.682	21.996	2.311	24.307	4.930
Lithuania	4529	525.529	6.000	3.257	9.257	3.043
Morocco	10428	385.118	13.204	1.337	14.540	3.813
Netherlands	4515	521.792	2.791	0.962	3.754	1.937
New Zealand	6322	488.749	5.317	2.431	7.747	2.783
Northern Ireland	3116	566.094	9.539	1.619	11.158	3.340

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Summary Statistics and Standard Errors for Proficiency in Geometric Shapes and Measures at the Fourth Grade (Continued)

Country	Sample Size	Geometric Shapes and Measures				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Norway (5)	4329	558.861	8.875	3.278	12.152	3.486
Oman	9105	430.235	6.086	2.453	8.540	2.922
Poland	4747	533.610	4.413	1.732	6.144	2.479
Portugal	4693	539.254	6.458	0.264	6.721	2.593
Qatar	5194	423.214	13.913	5.875	19.789	4.448
Russian Federation	4921	556.973	16.603	2.392	18.994	4.358
Saudi Arabia	4337	381.087	17.154	7.893	25.047	5.005
Serbia	4036	502.682	13.408	1.200	14.608	3.822
Singapore	6517	607.494	15.372	2.286	17.658	4.202
Slovak Republic	5773	490.892	5.616	0.928	6.544	2.558
Slovenia	4445	529.762	3.715	0.589	4.304	2.075
South Africa (5)	10932	359.388	12.802	0.547	13.349	3.654
Spain	7764	502.674	6.329	1.336	7.664	2.768
Sweden	4142	522.628	9.932	0.821	10.753	3.279
Turkey	6456	474.829	8.771	0.298	9.069	3.011
United Arab Emirates	21177	441.624	6.742	0.369	7.112	2.667
United States	10029	525.279	6.031	0.487	6.518	2.553
Benchmarking Participants						
Buenos Aires, Argentina	6435	403.053	9.436	0.846	10.282	3.207
Ontario, Canada	4574	526.497	5.859	2.761	8.620	2.936
Quebec, Canada	2798	542.435	20.152	0.677	20.829	4.564
Norway (4)	4164	499.186	5.633	1.425	7.058	2.657
Abu Dhabi, UAE	5001	411.588	24.683	1.420	26.103	5.109
Dubai, UAE	7453	502.647	2.652	1.038	3.690	1.921
Florida, US	2025	529.244	22.829	8.499	31.328	5.597

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Summary Statistics and Standard Errors for Proficiency in Data Display at the Fourth Grade

Country	Sample Size	Data Display				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	6057	532.578	9.354	3.846	13.199	3.633
Bahrain	8575	454.062	2.661	2.803	5.465	2.338
Belgium (Flemish)	5404	523.374	4.798	4.496	9.294	3.049
Bulgaria	4228	504.335	51.096	6.259	57.355	7.573
Canada	12283	528.472	6.279	0.950	7.228	2.689
Chile	4756	463.111	7.268	2.768	10.035	3.168
Chinese Taipei	4291	591.358	3.331	1.410	4.741	2.177
Croatia	3985	498.227	4.723	4.156	8.879	2.980
Cyprus	4125	507.391	10.474	4.127	14.600	3.821
Czech Republic	5202	525.064	6.970	1.802	8.772	2.962
Denmark	3710	525.954	7.320	4.669	11.988	3.462
England	4006	552.256	7.784	2.772	10.557	3.249
Finland	5015	541.644	5.594	5.554	11.148	3.339
France	4873	475.753	8.918	0.752	9.670	3.110
Georgia	3919	434.659	18.764	0.754	19.518	4.418
Germany	3948	534.797	6.024	0.759	6.783	2.604
Hong Kong SAR	3600	610.889	8.863	5.787	14.650	3.827
Hungary	5036	512.546	12.580	0.434	13.014	3.607
Indonesia	8319	385.118	13.832	3.627	17.459	4.178
Iran, Islamic Rep. of	7928	415.758	9.111	1.007	10.118	3.181
Ireland	4344	547.754	6.014	8.741	14.755	3.841
Italy	4373	497.977	6.712	1.947	8.659	2.943
Japan	4383	593.359	4.935	1.934	6.870	2.621
Jordan	7861	381.471	10.249	1.001	11.250	3.354
Kazakhstan	4702	524.071	26.742	0.854	27.596	5.253
Korea, Rep. of	4669	606.756	3.950	2.841	6.791	2.606
Kuwait	7296	345.105	24.933	4.313	29.246	5.408
Lithuania	4529	540.017	8.618	4.594	13.212	3.635
Morocco	10428	350.616	16.215	1.644	17.859	4.226
Netherlands	4515	538.839	4.413	6.960	11.373	3.372
New Zealand	6322	506.203	5.888	2.367	8.255	2.873
Northern Ireland	3116	566.730	9.039	5.057	14.096	3.754
Norway (5)	4329	565.844	7.481	1.237	8.717	2.952
Oman	9105	413.710	5.692	0.866	6.559	2.561

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Summary Statistics and Standard Errors for Proficiency in Data Display at the Fourth Grade (Continued)

Country	Sample Size	Data Display				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Poland	4747	538.246	5.814	2.154	7.968	2.823
Portugal	4693	546.235	5.386	2.317	7.703	2.775
Qatar	5194	435.237	13.883	1.117	15.000	3.873
Russian Federation	4921	572.662	12.493	0.634	13.127	3.623
Saudi Arabia	4337	365.113	12.777	4.546	17.323	4.162
Serbia	4036	516.945	12.445	1.814	14.259	3.776
Singapore	6517	599.948	13.880	3.047	16.927	4.114
Slovak Republic	5773	496.056	8.627	5.847	14.475	3.805
Slovenia	4445	540.022	5.543	4.288	9.831	3.135
South Africa (5)	10932	380.579	11.780	3.945	15.725	3.965
Spain	7764	508.856	8.475	1.135	9.609	3.100
Sweden	4142	529.223	9.676	5.683	15.359	3.919
Turkey	6456	476.096	10.534	0.921	11.456	3.385
United Arab Emirates	21177	453.440	5.536	0.030	5.566	2.359
United States	10029	540.344	5.071	2.606	7.676	2.771

Benchmarking Participants

Country	Sample Size	Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Buenos Aires, Argentina	6435	410.788	10.496	0.968	11.464	3.386
Ontario, Canada	4574	535.797	6.359	0.451	6.810	2.610
Quebec, Canada	2798	541.230	19.117	6.137	25.254	5.025
Norway (4)	4164	495.169	6.841	1.565	8.406	2.899
Abu Dhabi, UAE	5001	423.176	21.837	1.531	23.369	4.834
Dubai, UAE	7453	516.651	2.235	0.762	2.997	1.731
Florida, US	2025	541.136	24.307	13.120	37.428	6.118

Summary Statistics and Standard Errors for Proficiency in Mathematics Knowing at the Fourth Grade

Country	Sample Size	Mathematics Knowing				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	6057	509.001	10.369	1.945	12.315	3.509
Bahrain	8575	453.014	2.633	0.441	3.074	1.753
Belgium (Flemish)	5404	553.714	4.509	0.719	5.228	2.286
Bulgaria	4228	527.190	23.256	2.451	25.707	5.070
Canada	12283	505.351	5.489	0.390	5.880	2.425
Chile	4756	448.738	6.021	1.636	7.657	2.767
Chinese Taipei	4291	620.476	3.286	2.072	5.358	2.315
Croatia	3985	502.195	2.791	0.687	3.478	1.865
Cyprus	4125	518.982	6.296	1.587	7.883	2.808
Czech Republic	5202	519.059	5.177	0.952	6.129	2.476
Denmark	3710	535.910	8.090	2.538	10.627	3.260
England	4006	553.983	10.043	0.722	10.765	3.281
Finland	5015	530.097	4.007	0.970	4.978	2.231
France	4873	484.283	7.325	0.797	8.122	2.850
Georgia	3919	465.674	11.893	3.878	15.772	3.971
Germany	3948	523.914	4.522	0.596	5.117	2.262
Hong Kong SAR	3600	618.027	8.644	1.146	9.790	3.129
Hungary	5036	532.267	8.664	0.848	9.513	3.084
Indonesia	8319	394.766	15.458	2.269	17.726	4.210
Iran, Islamic Rep. of	7928	428.977	9.924	0.461	10.385	3.223
Ireland	4344	554.444	4.818	3.426	8.244	2.871
Italy	4373	510.896	6.652	1.608	8.260	2.874
Japan	4383	601.392	3.620	2.047	5.668	2.381
Jordan	7861	389.412	8.708	0.858	9.566	3.093
Kazakhstan	4702	545.632	19.243	0.182	19.425	4.407
Korea, Rep. of	4669	627.078	6.374	2.016	8.390	2.897
Kuwait	7296	354.123	20.128	0.228	20.356	4.512
Lithuania	4529	532.496	5.615	0.882	6.497	2.549
Morocco	10428	376.760	11.706	2.291	13.997	3.741
Netherlands	4515	520.531	2.877	0.323	3.200	1.789
New Zealand	6322	475.455	6.271	0.658	6.929	2.632
Northern Ireland	3116	581.651	13.913	1.252	15.165	3.894

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Summary Statistics and Standard Errors for Proficiency in Mathematics Knowing at the Fourth Grade (Continued)

Country	Sample Size	Mathematics Knowing				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Norway (5)	4329	544.223	6.697	3.186	9.883	3.144
Oman	9105	422.256	6.603	0.841	7.444	2.728
Poland	4747	517.038	4.728	1.126	5.854	2.420
Portugal	4693	547.529	4.729	2.218	6.947	2.636
Qatar	5194	444.125	11.168	0.505	11.674	3.417
Russian Federation	4921	556.499	11.114	0.147	11.260	3.356
Saudi Arabia	4337	373.832	18.404	3.132	21.536	4.641
Serbia	4036	512.730	11.119	1.420	12.539	3.541
Singapore	6517	630.511	14.853	0.890	15.743	3.968
Slovak Republic	5773	490.692	4.757	0.986	5.743	2.396
Slovenia	4445	516.905	3.155	0.368	3.523	1.877
South Africa (5)	10932	377.569	12.337	0.742	13.079	3.616
Spain	7764	505.316	5.401	0.415	5.816	2.412
Sweden	4142	500.810	8.540	2.889	11.428	3.381
Turkey	6456	491.406	10.251	1.328	11.579	3.403
United Arab Emirates	21177	453.023	6.291	1.258	7.549	2.747
United States	10029	547.462	5.009	0.312	5.321	2.307
Benchmarking Participants						
Buenos Aires, Argentina	6435	432.045	7.197	1.144	8.341	2.888
Ontario, Canada	4574	504.923	5.806	0.374	6.180	2.486
Quebec, Canada	2798	541.835	15.931	2.815	18.746	4.330
Norway (4)	4164	479.479	5.992	0.672	6.664	2.582
Abu Dhabi, UAE	5001	417.859	23.227	2.361	25.587	5.058
Dubai, UAE	7453	513.624	2.636	1.172	3.807	1.951
Florida, US	2025	555.185	21.681	5.282	26.962	5.193

Summary Statistics and Standard Errors for Proficiency in Mathematics Applying at the Fourth Grade

Country	Sample Size	Mathematics Applying				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	6057	521.341	7.657	1.391	9.048	3.008
Bahrain	8575	450.027	1.888	0.564	2.452	1.566
Belgium (Flemish)	5404	544.102	4.132	0.501	4.633	2.152
Bulgaria	4228	522.775	28.948	2.386	31.334	5.598
Canada	12283	510.107	5.155	0.187	5.341	2.311
Chile	4756	462.418	5.337	0.343	5.680	2.383
Chinese Taipei	4291	593.254	3.533	0.913	4.446	2.109
Croatia	3985	498.650	3.171	0.439	3.610	1.900
Cyprus	4125	528.734	7.312	0.811	8.122	2.850
Czech Republic	5202	528.127	5.088	0.448	5.537	2.353
Denmark	3710	537.878	6.952	0.668	7.620	2.760
England	4006	544.486	8.172	2.160	10.332	3.214
Finland	5015	536.064	3.703	0.630	4.333	2.082
France	4873	488.325	8.161	1.311	9.472	3.078
Georgia	3919	461.046	13.714	2.841	16.554	4.069
Germany	3948	515.154	4.046	0.890	4.936	2.222
Hong Kong SAR	3600	620.658	9.226	0.512	9.738	3.121
Hungary	5036	526.367	10.508	0.425	10.933	3.306
Indonesia	8319	397.075	12.539	0.358	12.896	3.591
Iran, Islamic Rep. of	7928	434.917	8.362	0.223	8.584	2.930
Ireland	4344	548.663	4.502	0.399	4.900	2.214
Italy	4373	504.010	5.586	0.714	6.299	2.510
Japan	4383	589.199	3.711	0.544	4.255	2.063
Jordan	7861	388.172	8.733	1.046	9.779	3.127
Kazakhstan	4702	540.891	22.856	1.215	24.071	4.906
Korea, Rep. of	4669	595.140	3.746	0.574	4.320	2.078
Kuwait	7296	347.885	21.050	1.522	22.572	4.751
Lithuania	4529	536.735	6.688	0.491	7.179	2.679
Morocco	10428	374.708	11.615	1.199	12.814	3.580
Netherlands	4515	530.504	2.431	0.610	3.041	1.744
New Zealand	6322	497.043	4.959	1.088	6.047	2.459
Northern Ireland	3116	575.489	8.716	1.299	10.016	3.165

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Summary Statistics and Standard Errors for Proficiency in Mathematics Applying at the Fourth Grade (Continued)

Country	Sample Size	Mathematics Applying				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Norway (5)	4329	549.799	6.162	0.515	6.677	2.584
Oman	9105	427.889	5.417	0.516	5.933	2.436
Poland	4747	541.019	4.235	0.151	4.386	2.094
Portugal	4693	539.635	5.366	0.450	5.816	2.412
Qatar	5194	434.311	12.135	0.448	12.583	3.547
Russian Federation	4921	566.471	12.319	1.040	13.359	3.655
Saudi Arabia	4337	381.686	14.575	5.896	20.472	4.525
Serbia	4036	521.042	10.525	0.934	11.459	3.385
Singapore	6517	619.284	14.828	1.123	15.951	3.994
Slovak Republic	5773	496.660	5.675	0.568	6.243	2.499
Slovenia	4445	521.018	3.836	0.497	4.333	2.082
South Africa (5)	10932	376.868	10.967	0.906	11.873	3.446
Spain	7764	504.817	5.388	0.279	5.667	2.381
Sweden	4142	521.218	7.024	0.370	7.394	2.719
Turkey	6456	482.096	9.389	2.809	12.198	3.493
United Arab Emirates	21177	452.290	5.703	0.386	6.089	2.468
United States	10029	537.119	5.420	0.219	5.639	2.375

Benchmarking Participants

Country	Sample Size	Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Buenos Aires, Argentina	6435	427.029	7.473	1.279	8.752	2.958
Ontario, Canada	4574	513.186	5.163	0.209	5.373	2.318
Quebec, Canada	2798	532.671	16.086	0.689	16.775	4.096
Norway (4)	4164	495.041	4.779	1.323	6.101	2.470
Abu Dhabi, UAE	5001	421.761	21.586	1.571	23.157	4.812
Dubai, UAE	7453	510.185	2.290	1.018	3.309	1.819
Florida, US	2025	544.583	24.128	0.245	24.373	4.937

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CHAPTER 4: ESTIMATING STANDARD ERRORS
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Summary Statistics and Standard Errors for Proficiency in Mathematics Reasoning at the Fourth Grade

Country	Sample Size	Mathematics Reasoning				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	6057	523.485	7.387	1.522	8.909	2.985
Bahrain	8575	446.748	2.961	0.996	3.958	1.989
Belgium (Flemish)	5404	535.988	5.161	1.995	7.156	2.675
Bulgaria	4228	520.712	30.653	3.072	33.725	5.807
Canada	12283	520.995	5.350	0.202	5.551	2.356
Chile	4756	465.738	4.721	0.497	5.217	2.284
Chinese Taipei	4291	575.575	4.943	4.461	9.404	3.067
Croatia	3985	507.223	4.376	0.243	4.619	2.149
Cyprus	4125	518.624	6.733	3.079	9.811	3.132
Czech Republic	5202	543.721	6.378	2.917	9.295	3.049
Denmark	3710	547.563	6.104	4.426	10.530	3.245
England	4006	539.830	8.679	1.857	10.536	3.246
Finland	5015	540.178	5.143	4.491	9.634	3.104
France	4873	491.320	8.583	3.120	11.703	3.421
Georgia	3919	451.760	16.130	2.866	18.996	4.358
Germany	3948	535.048	4.266	1.351	5.617	2.370
Hong Kong SAR	3600	599.877	9.193	1.220	10.412	3.227
Hungary	5036	529.205	11.562	1.314	12.876	3.588
Indonesia	8319	396.601	10.518	1.650	12.168	3.488
Iran, Islamic Rep. of	7928	426.464	8.743	2.238	10.981	3.314
Ireland	4344	535.295	4.532	2.674	7.205	2.684
Italy	4373	502.583	5.671	5.052	10.723	3.275
Japan	4383	595.017	4.625	2.782	7.407	2.722
Jordan	7861	384.970	8.749	1.824	10.573	3.252
Kazakhstan	4702	553.002	20.464	1.054	21.519	4.639
Korea, Rep. of	4669	618.664	5.072	1.145	6.218	2.494
Kuwait	7296	331.736	24.268	0.861	25.129	5.013
Lithuania	4529	534.260	7.367	0.725	8.092	2.845
Morocco	10428	378.988	11.329	1.916	13.245	3.639
Netherlands	4515	542.924	4.007	2.989	6.996	2.645
New Zealand	6322	503.504	6.516	0.558	7.074	2.660
Northern Ireland	3116	549.654	8.320	2.735	11.055	3.325

Summary Statistics and Standard Errors for Proficiency in Mathematics Reasoning at the Fourth Grade (Continued)

Country	Sample Size	Mathematics Reasoning				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Norway (5)	4329	555.694	6.008	2.479	8.487	2.913
Oman	9105	419.599	5.289	0.351	5.641	2.375
Poland	4747	546.251	4.720	0.599	5.319	2.306
Portugal	4693	531.561	4.571	0.502	5.073	2.252
Qatar	5194	430.897	12.360	7.255	19.614	4.429
Russian Federation	4921	569.990	14.775	0.900	15.675	3.959
Saudi Arabia	4337	382.899	11.746	7.123	18.869	4.344
Serbia	4036	516.704	13.682	0.421	14.103	3.755
Singapore	6517	602.576	18.648	1.570	20.218	4.496
Slovak Republic	5773	515.329	6.702	1.520	8.222	2.867
Slovenia	4445	523.999	4.016	0.894	4.910	2.216
South Africa (5)	10932	368.932	11.454	0.702	12.156	3.487
Spain	7764	501.795	5.844	0.170	6.013	2.452
Sweden	4142	541.537	8.465	2.183	10.649	3.263
Turkey	6456	466.329	9.257	2.879	12.136	3.484
United Arab Emirates	21177	445.104	4.841	0.914	5.756	2.399
United States	10029	530.631	4.800	1.390	6.190	2.488

Benchmarking Participants

Country	Sample Size	Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Buenos Aires, Argentina	6435	436.828	8.232	3.136	11.368	3.372
Ontario, Canada	4574	524.363	5.822	0.914	6.736	2.595
Quebec, Canada	2798	536.463	18.720	5.716	24.437	4.943
Norway (4)	4164	506.305	5.330	3.695	9.025	3.004
Abu Dhabi, UAE	5001	413.748	18.339	1.063	19.402	4.405
Dubai, UAE	7453	507.139	2.035	0.777	2.812	1.677
Florida, US	2025	534.291	27.655	10.492	38.146	6.176

Appendix 4B: Summary Statistics and Standard Errors for Proficiency in Science at the Fourth Grade

Summary Statistics and Standard Errors for Proficiency in Overall Science at the Fourth Grade

Country	Sample Size	Overall Science				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	6057	523.628	7.288	0.976	8.264	2.875
Bahrain	4146	458.812	4.238	2.273	6.511	2.552
Belgium (Flemish)	5404	511.508	4.281	0.991	5.272	2.296
Bulgaria	4228	535.704	34.479	0.602	35.082	5.923
Canada	12283	524.782	5.392	1.616	7.008	2.647
Chile	4756	477.710	5.487	1.998	7.485	2.736
Chinese Taipei	4291	555.282	2.666	0.534	3.200	1.789
Croatia	3985	533.442	3.082	1.136	4.218	2.054
Cyprus	4125	481.298	5.755	0.815	6.570	2.563
Czech Republic	5202	534.380	4.097	1.458	5.555	2.357
Denmark	3710	527.029	4.098	0.208	4.306	2.075
England	4006	535.825	5.349	0.519	5.868	2.422
Finland	5015	553.813	3.901	1.451	5.352	2.313
France	4873	487.401	6.580	0.890	7.470	2.733
Georgia	3919	451.245	11.977	2.034	14.010	3.743
Germany	3948	528.467	4.226	1.491	5.716	2.391
Hong Kong SAR	3600	556.547	7.958	0.654	8.612	2.935
Hungary	5036	541.978	10.113	1.056	11.169	3.342
Indonesia	4025	396.666	19.566	3.818	23.385	4.836
Iran, Islamic Rep. of	3823	421.009	14.192	1.978	16.170	4.021
Ireland	4344	528.876	4.841	0.704	5.545	2.355
Italy	4373	516.475	4.955	1.921	6.876	2.622
Japan	4383	569.013	2.515	0.633	3.147	1.774
Kazakhstan	4702	549.556	18.854	0.555	19.408	4.406
Korea, Rep. of	4669	589.320	2.547	1.379	3.926	1.981
Kuwait	3593	337.213	31.918	6.754	38.673	6.219
Lithuania	4529	527.667	4.796	1.497	6.293	2.509
Morocco	5068	352.207	18.127	3.626	21.753	4.664

Summary Statistics and Standard Errors for Proficiency in Overall Science at the Fourth Grade (Continued)

Country	Sample Size	Overall Science				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Netherlands	4515	517.120	4.484	2.550	7.035	2.652
New Zealand	6322	505.517	4.999	2.071	7.070	2.659
Northern Ireland	3116	519.768	4.421	0.562	4.983	2.232
Norway (5)	4329	537.598	5.276	1.736	7.012	2.648
Oman	9105	430.974	7.276	2.432	9.709	3.116
Poland	4747	547.190	3.995	1.842	5.838	2.416
Portugal	4693	508.056	2.168	2.675	4.843	2.201
Qatar	5194	436.258	15.259	1.275	16.534	4.066
Russian Federation	4921	567.196	8.992	1.178	10.170	3.189
Saudi Arabia	4337	390.329	19.728	4.629	24.357	4.935
Serbia	4036	524.509	11.993	1.609	13.602	3.688
Singapore	6517	590.478	12.749	0.944	13.693	3.700
Slovak Republic	5773	520.495	6.579	0.303	6.882	2.623
Slovenia	4445	542.573	4.132	1.824	5.956	2.441
Spain	7764	518.198	5.590	1.085	6.675	2.584
Sweden	4142	540.194	9.954	2.785	12.739	3.569
Turkey	6456	483.399	8.369	2.636	11.005	3.317
United Arab Emirates	21177	451.242	6.896	0.871	7.767	2.787
United States	10029	545.907	4.134	0.761	4.895	2.213
Benchmarking Participants						
Buenos Aires, Argentina	3104	417.835	13.566	8.083	21.649	4.653
Ontario, Canada	4574	530.370	4.419	2.060	6.480	2.545
Quebec, Canada	2798	524.509	14.884	1.856	16.740	4.091
Norway (4)	4164	493.003	4.262	0.456	4.717	2.172
Abu Dhabi, UAE	5001	414.711	30.060	1.035	31.096	5.576
Dubai, UAE	7453	517.936	2.708	0.368	3.076	1.754
Florida, US	2025	548.555	22.651	0.372	23.023	4.798

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Summary Statistics and Standard Errors for Proficiency in Life Science at the Fourth Grade

Country	Sample Size	Life Science				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	6057	531.143	8.195	1.095	9.291	3.048
Bahrain	4146	454.854	4.512	3.854	8.366	2.892
Belgium (Flemish)	5404	512.935	4.657	1.094	5.751	2.398
Bulgaria	4228	541.896	38.184	1.687	39.871	6.314
Canada	12283	535.654	5.603	2.240	7.843	2.801
Chile	4756	487.384	5.954	0.880	6.834	2.614
Chinese Taipei	4291	544.770	2.538	1.560	4.098	2.024
Croatia	3985	530.910	3.632	3.352	6.984	2.643
Cyprus	4125	480.827	6.248	1.771	8.020	2.832
Czech Republic	5202	538.053	3.598	0.597	4.195	2.048
Denmark	3710	534.224	3.410	2.521	5.931	2.435
England	4006	535.971	5.262	1.129	6.391	2.528
Finland	5015	555.849	4.092	2.636	6.729	2.594
France	4873	489.621	6.967	2.650	9.617	3.101
Georgia	3919	458.822	12.197	4.827	17.024	4.126
Germany	3948	527.937	3.786	0.322	4.108	2.027
Hong Kong SAR	3600	550.303	11.256	2.443	13.699	3.701
Hungary	5036	550.295	10.296	1.225	11.521	3.394
Indonesia	4025	386.792	20.415	5.631	26.046	5.104
Iran, Islamic Rep. of	3823	417.166	17.090	3.481	20.571	4.536
Ireland	4344	530.541	5.219	0.610	5.830	2.414
Italy	4373	519.045	5.993	1.248	7.240	2.691
Japan	4383	556.100	2.866	1.856	4.722	2.173
Kazakhstan	4702	544.921	16.613	0.543	17.156	4.142
Korea, Rep. of	4669	581.483	2.783	0.914	3.697	1.923
Kuwait	3593	331.391	36.354	7.136	43.490	6.595
Lithuania	4529	527.018	5.698	3.049	8.746	2.957
Morocco	5068	350.497	16.638	1.906	18.545	4.306
Netherlands	4515	525.290	4.721	2.593	7.314	2.704
New Zealand	6322	511.318	5.488	1.920	7.408	2.722
Northern Ireland	3116	521.251	5.785	1.341	7.125	2.669
Norway (5)	4329	545.871	5.289	1.244	6.534	2.556

Summary Statistics and Standard Errors for Proficiency in Life Science at the Fourth Grade (Continued)

Country	Sample Size	Life Science				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Oman	9105	426.230	7.772	2.695	10.466	3.235
Poland	4747	556.672	4.310	2.124	6.434	2.537
Portugal	4693	507.867	1.947	2.483	4.429	2.105
Qatar	5194	435.906	16.166	2.814	18.980	4.357
Russian Federation	4921	568.854	9.162	0.531	9.693	3.113
Saudi Arabia	4337	381.511	19.642	4.031	23.673	4.865
Serbia	4036	530.934	10.414	3.853	14.267	3.777
Singapore	6517	606.860	16.909	2.795	19.705	4.439
Slovak Republic	5773	517.451	6.540	2.128	8.668	2.944
Slovenia	4445	544.839	4.158	1.290	5.447	2.334
Spain	7764	522.877	4.949	2.021	6.970	2.640
Sweden	4142	539.708	9.463	1.585	11.048	3.324
Turkey	6456	472.466	7.690	3.447	11.138	3.337
United Arab Emirates	21177	449.061	7.190	3.653	10.842	3.293
United States	10029	555.412	4.171	0.999	5.170	2.274
Benchmarking Participants						
Buenos Aires, Argentina	3104	425.699	12.786	3.291	16.077	4.010
Ontario, Canada	4574	543.885	5.070	1.619	6.690	2.586
Quebec, Canada	2798	532.924	14.939	3.566	18.505	4.302
Norway (4)	4164	502.293	4.747	0.928	5.675	2.382
Abu Dhabi, UAE	5001	413.128	31.582	4.244	35.826	5.986
Dubai, UAE	7453	517.831	3.313	3.529	6.842	2.616
Florida, US	2025	558.311	25.028	1.283	26.311	5.129

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Summary Statistics and Standard Errors for Proficiency in Physical Science at the Fourth Grade

Country	Sample Size	Physical Science				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	6057	515.902	6.804	0.630	7.434	2.727
Bahrain	4146	464.861	5.810	4.634	10.444	3.232
Belgium (Flemish)	5404	505.943	4.365	5.846	10.211	3.195
Bulgaria	4228	529.444	38.458	4.402	42.859	6.547
Canada	12283	517.722	6.036	1.064	7.100	2.665
Chile	4756	466.022	6.930	1.257	8.187	2.861
Chinese Taipei	4291	568.490	2.596	1.212	3.809	1.952
Croatia	3985	535.403	3.593	4.757	8.350	2.890
Cyprus	4125	485.918	6.670	0.362	7.032	2.652
Czech Republic	5202	530.608	4.582	1.100	5.681	2.384
Denmark	3710	515.613	4.713	2.838	7.552	2.748
England	4006	539.948	5.121	2.312	7.433	2.726
Finland	5015	547.208	3.845	1.285	5.130	2.265
France	4873	481.723	6.191	1.038	7.230	2.689
Georgia	3919	437.794	17.228	4.747	21.974	4.688
Germany	3948	532.324	4.570	1.838	6.409	2.532
Hong Kong SAR	3600	554.683	7.980	4.173	12.153	3.486
Hungary	5036	533.663	11.028	1.535	12.563	3.544
Indonesia	4025	405.127	22.387	7.491	29.878	5.466
Iran, Islamic Rep. of	3823	423.346	17.813	7.339	25.151	5.015
Ireland	4344	523.949	4.951	3.061	8.013	2.831
Italy	4373	512.967	4.993	3.162	8.155	2.856
Japan	4383	587.004	2.251	4.536	6.787	2.605
Kazakhstan	4702	558.764	22.379	2.629	25.008	5.001
Korea, Rep. of	4669	597.496	2.549	1.605	4.154	2.038
Kuwait	3593	325.051	36.298	6.274	42.572	6.525
Lithuania	4529	535.089	5.012	1.298	6.309	2.512
Morocco	5068	356.866	20.419	14.175	34.594	5.882
Netherlands	4515	503.727	5.009	1.824	6.833	2.614
New Zealand	6322	497.224	5.451	1.005	6.456	2.541
Northern Ireland	3116	513.986	4.647	1.978	6.625	2.574
Norway (5)	4329	522.028	5.265	2.507	7.772	2.788

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Summary Statistics and Standard Errors for Proficiency in Physical Science at the Fourth Grade (Continued)

Country	Sample Size	Physical Science				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Oman	9105	435.117	9.280	2.572	11.852	3.443
Poland	4747	539.830	4.245	0.053	4.298	2.073
Portugal	4693	501.828	2.310	6.167	8.476	2.911
Qatar	5194	435.436	16.540	5.577	22.117	4.703
Russian Federation	4921	567.376	9.830	3.255	13.085	3.617
Saudi Arabia	4337	389.818	23.414	7.260	30.674	5.538
Serbia	4036	528.800	11.906	2.212	14.118	3.757
Singapore	6517	603.304	13.591	0.448	14.039	3.747
Slovak Republic	5773	525.851	7.807	3.841	11.648	3.413
Slovenia	4445	546.182	4.446	1.166	5.612	2.369
Spain	7764	506.946	7.744	0.740	8.484	2.913
Sweden	4142	534.231	11.702	1.113	12.816	3.580
Turkey	6456	495.817	10.077	0.982	11.059	3.325
United Arab Emirates	21177	453.273	7.706	1.073	8.779	2.963
United States	10029	537.443	4.166	2.641	6.808	2.609
Benchmarking Participants						
Buenos Aires, Argentina	3104	413.222	13.104	2.017	15.120	3.889
Ontario, Canada	4574	521.987	4.711	1.753	6.464	2.542
Quebec, Canada	2798	519.492	17.643	6.035	23.679	4.866
Norway (4)	4164	474.873	5.356	2.254	7.610	2.759
Abu Dhabi, UAE	5001	412.939	32.962	2.198	35.160	5.930
Dubai, UAE	7453	520.530	2.517	2.423	4.940	2.223
Florida, US	2025	541.778	26.449	1.103	27.552	5.249

Summary Statistics and Standard Errors for Proficiency in Earth Science at the Fourth Grade

Country	Sample Size	Earth Science				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	6057	519.888	8.899	2.119	11.018	3.319
Bahrain	4146	447.865	5.569	4.944	10.513	3.242
Belgium (Flemish)	5404	512.607	4.856	3.191	8.047	2.837
Bulgaria	4228	531.880	33.707	14.145	47.851	6.917
Canada	12283	512.850	6.630	2.862	9.491	3.081
Chile	4756	464.583	7.158	4.397	11.555	3.399
Chinese Taipei	4291	555.247	3.104	3.382	6.486	2.547
Croatia	3985	535.142	5.184	6.708	11.892	3.448
Cyprus	4125	462.731	8.610	3.587	12.197	3.492
Czech Republic	5202	531.418	6.092	2.852	8.944	2.991
Denmark	3710	530.527	4.867	4.117	8.984	2.997
England	4006	527.412	7.177	3.686	10.864	3.296
Finland	5015	560.232	4.577	2.340	6.917	2.630
France	4873	484.530	9.890	11.804	21.695	4.658
Georgia	3919	440.920	15.537	3.297	18.834	4.340
Germany	3948	518.851	5.799	10.043	15.842	3.980
Hong Kong SAR	3600	574.460	9.062	0.549	9.611	3.100
Hungary	5036	535.214	14.005	1.757	15.762	3.970
Indonesia	4025	383.565	17.661	14.026	31.688	5.629
Iran, Islamic Rep. of	3823	408.046	18.478	4.397	22.874	4.783
Ireland	4344	534.592	5.760	3.479	9.239	3.040
Italy	4373	510.286	8.669	3.701	12.370	3.517
Japan	4383	562.742	4.487	1.856	6.342	2.518
Kazakhstan	4702	541.894	22.305	6.477	28.782	5.365
Korea, Rep. of	4669	590.735	4.940	11.919	16.859	4.106
Kuwait	3593	333.047	26.362	14.028	40.390	6.355
Lithuania	4529	515.383	6.037	7.545	13.581	3.685
Morocco	5068	289.251	28.351	15.527	43.878	6.624
Netherlands	4515	520.226	6.698	2.172	8.870	2.978
New Zealand	6322	505.711	6.827	4.465	11.292	3.360
Northern Ireland	3116	521.971	7.290	1.654	8.944	2.991
Norway (5)	4329	549.166	8.619	5.732	14.351	3.788
Oman	9105	423.144	8.319	4.145	12.465	3.531
Poland	4747	540.431	5.435	1.444	6.879	2.623

Summary Statistics and Standard Errors for Proficiency in Earth Science at the Fourth Grade (Continued)

Country	Sample Size	Earth Science				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Portugal	4693	512.810	4.505	1.862	6.367	2.523
Qatar	5194	426.902	16.688	8.725	25.413	5.041
Russian Federation	4921	562.188	10.257	11.547	21.805	4.670
Saudi Arabia	4337	394.638	20.793	2.031	22.824	4.777
Serbia	4036	495.704	17.192	5.985	23.177	4.814
Singapore	6517	546.409	11.399	2.272	13.670	3.697
Slovak Republic	5773	513.703	7.995	0.753	8.748	2.958
Slovenia	4445	530.660	5.178	11.305	16.483	4.060
Spain	7764	519.759	6.248	2.992	9.240	3.040
Sweden	4142	551.752	13.803	3.180	16.983	4.121
Turkey	6456	479.811	10.043	0.690	10.732	3.276
United Arab Emirates	21177	447.864	7.760	4.146	11.905	3.450
United States	10029	539.282	5.420	0.292	5.712	2.390

Benchmarking Participants

Buenos Aires, Argentina	3104	390.719	16.845	15.791	32.636	5.713
Ontario, Canada	4574	514.845	6.255	7.132	13.386	3.659
Quebec, Canada	2798	515.031	17.944	1.191	19.136	4.374
Norway (4)	4164	497.894	5.913	7.553	13.467	3.670
Abu Dhabi, UAE	5001	407.997	33.798	13.519	47.317	6.879
Dubai, UAE	7453	510.420	2.476	5.875	8.351	2.890
Florida, US	2025	538.811	31.389	11.287	42.676	6.533

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Summary Statistics and Standard Errors for Proficiency in Science Knowing at the Fourth Grade

Country	Sample Size	Science Knowing				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	6057	522.769	8.763	2.158	10.922	3.305
Bahrain	4146	455.649	4.405	2.016	6.421	2.534
Belgium (Flemish)	5404	497.788	5.324	1.806	7.130	2.670
Bulgaria	4228	551.172	38.037	3.978	42.015	6.482
Canada	12283	522.576	5.654	4.088	9.742	3.121
Chile	4756	477.489	6.975	3.016	9.991	3.161
Chinese Taipei	4291	556.940	2.778	3.674	6.452	2.540
Croatia	3985	534.274	4.162	4.264	8.426	2.903
Cyprus	4125	467.490	5.558	4.599	10.157	3.187
Czech Republic	5202	544.539	4.102	5.110	9.213	3.035
Denmark	3710	524.043	3.918	3.006	6.924	2.631
England	4006	533.319	5.849	0.825	6.674	2.583
Finland	5015	555.944	5.027	4.439	9.466	3.077
France	4873	481.674	7.771	6.360	14.131	3.759
Georgia	3919	459.739	11.875	6.086	17.962	4.238
Germany	3948	527.430	5.592	2.518	8.110	2.848
Hong Kong SAR	3600	561.659	7.955	1.071	9.026	3.004
Hungary	5036	550.431	12.488	1.616	14.104	3.756
Indonesia	4025	397.426	21.475	2.078	23.553	4.853
Iran, Islamic Rep. of	3823	416.473	15.224	1.861	17.085	4.133
Ireland	4344	528.730	5.401	1.081	6.481	2.546
Italy	4373	520.605	5.980	3.765	9.744	3.122
Japan	4383	543.657	3.322	1.950	5.272	2.296
Kazakhstan	4702	550.595	19.865	4.929	24.794	4.979
Korea, Rep. of	4669	581.781	3.141	1.778	4.918	2.218
Kuwait	3593	343.421	31.410	9.347	40.757	6.384
Lithuania	4529	523.701	5.377	3.643	9.020	3.003
Morocco	5068	331.292	25.336	5.893	31.229	5.588
Netherlands	4515	508.459	5.184	0.542	5.726	2.393
New Zealand	6322	503.800	6.036	1.872	7.908	2.812
Northern Ireland	3116	518.335	5.212	3.283	8.496	2.915
Norway (5)	4329	532.526	5.989	2.948	8.937	2.989

Summary Statistics and Standard Errors for Proficiency in Science Knowing at the Fourth Grade (Continued)

Country	Sample Size	Science Knowing				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Oman	9105	421.587	8.956	1.562	10.518	3.243
Poland	4747	543.641	4.964	1.522	6.486	2.547
Portugal	4693	506.644	2.554	5.719	8.274	2.876
Qatar	5194	436.984	15.048	5.137	20.185	4.493
Russian Federation	4921	568.536	12.031	3.301	15.332	3.916
Saudi Arabia	4337	394.110	23.780	4.791	28.571	5.345
Serbia	4036	526.584	13.299	1.539	14.838	3.852
Singapore	6517	574.203	14.799	2.303	17.101	4.135
Slovak Republic	5773	529.604	8.353	2.533	10.885	3.299
Slovenia	4445	540.865	5.117	1.603	6.720	2.592
Spain	7764	522.242	7.003	3.856	10.859	3.295
Sweden	4142	538.420	9.647	4.427	14.074	3.752
Turkey	6456	477.707	7.926	0.807	8.733	2.955
United Arab Emirates	21177	453.267	8.926	1.944	10.870	3.297
United States	10029	548.331	5.299	0.844	6.143	2.479
Benchmarking Participants						
Buenos Aires, Argentina	3104	416.900	14.280	5.172	19.452	4.410
Ontario, Canada	4574	527.371	4.819	3.193	8.012	2.831
Quebec, Canada	2798	523.883	15.566	2.648	18.214	4.268
Norway (4)	4164	494.759	5.113	4.167	9.279	3.046
Abu Dhabi, UAE	5001	410.310	38.377	4.649	43.026	6.559
Dubai, UAE	7453	522.599	3.476	1.997	5.473	2.339
Florida, US	2025	553.462	28.309	4.674	32.983	5.743

Summary Statistics and Standard Errors for Proficiency in Science Applying at the Fourth Grade

Country	Sample Size	Science Applying				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	6057	522.276	7.226	0.207	7.433	2.726
Bahrain	4146	461.682	4.224	4.986	9.210	3.035
Belgium (Flemish)	5404	513.250	4.088	2.085	6.173	2.484
Bulgaria	4228	536.175	36.807	1.212	38.019	6.166
Canada	12283	527.648	5.834	0.718	6.552	2.560
Chile	4756	475.640	6.612	2.258	8.870	2.978
Chinese Taipei	4291	553.311	2.713	4.081	6.794	2.607
Croatia	3985	530.205	2.983	2.029	5.012	2.239
Cyprus	4125	488.924	6.395	4.988	11.383	3.374
Czech Republic	5202	528.242	4.402	0.219	4.621	2.150
Denmark	3710	529.189	4.516	1.153	5.669	2.381
England	4006	537.690	4.900	2.151	7.051	2.655
Finland	5015	552.840	4.064	1.607	5.672	2.382
France	4873	493.612	7.592	2.226	9.818	3.133
Georgia	3919	449.466	16.533	6.388	22.921	4.788
Germany	3948	528.765	4.406	1.372	5.778	2.404
Hong Kong SAR	3600	553.844	8.470	2.361	10.830	3.291
Hungary	5036	538.723	10.722	1.067	11.789	3.433
Indonesia	4025	391.567	17.217	10.551	27.768	5.270
Iran, Islamic Rep. of	3823	417.371	16.121	3.738	19.859	4.456
Ireland	4344	530.001	4.846	1.303	6.150	2.480
Italy	4373	513.396	5.862	3.838	9.700	3.114
Japan	4383	576.417	2.797	0.489	3.286	1.813
Kazakhstan	4702	546.956	19.056	2.529	21.585	4.646
Korea, Rep. of	4669	593.732	2.690	0.969	3.659	1.913
Kuwait	3593	324.108	36.201	16.438	52.640	7.255
Lithuania	4529	526.262	4.750	0.885	5.636	2.374
Morocco	5068	357.372	17.111	5.340	22.451	4.738
Netherlands	4515	518.865	4.356	1.555	5.911	2.431
New Zealand	6322	502.185	5.641	3.795	9.436	3.072
Northern Ireland	3116	518.628	4.959	3.256	8.216	2.866
Norway (5)	4329	541.578	5.879	2.568	8.447	2.906

Summary Statistics and Standard Errors for Proficiency in Science Applying at the Fourth Grade (Continued)

Country	Sample Size	Science Applying				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Oman	9105	434.518	8.362	0.251	8.613	2.935
Poland	4747	554.100	4.059	3.643	7.702	2.775
Portugal	4693	508.312	2.688	0.861	3.550	1.884
Qatar	5194	430.333	16.965	4.687	21.652	4.653
Russian Federation	4921	568.380	8.576	2.109	10.685	3.269
Saudi Arabia	4337	387.652	20.328	1.637	21.965	4.687
Serbia	4036	521.795	14.031	5.873	19.903	4.461
Singapore	6517	599.080	14.060	1.919	15.979	3.997
Slovak Republic	5773	516.779	7.135	0.726	7.860	2.804
Slovenia	4445	546.046	5.124	3.005	8.129	2.851
Spain	7764	513.701	5.846	4.875	10.721	3.274
Sweden	4142	540.114	11.624	0.241	11.864	3.444
Turkey	6456	485.988	9.066	0.543	9.609	3.100
United Arab Emirates	21177	451.909	7.206	2.916	10.122	3.181
United States	10029	546.290	4.290	0.497	4.787	2.188

Benchmarking Participants

Country	Sample Size	Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Buenos Aires, Argentina	3104	416.424	13.836	7.316	21.152	4.599
Ontario, Canada	4574	534.352	4.948	1.130	6.079	2.466
Quebec, Canada	2798	525.340	17.300	2.808	20.108	4.484
Norway (4)	4164	494.057	5.164	0.775	5.940	2.437
Abu Dhabi, UAE	5001	416.710	30.147	4.551	34.698	5.891
Dubai, UAE	7453	517.381	2.638	5.029	7.667	2.769
Florida, US	2025	549.525	22.541	1.247	23.788	4.877

Summary Statistics and Standard Errors for Proficiency in Science Reasoning at the Fourth Grade

Country	Sample Size	Science Reasoning				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	6057	527.452	7.646	1.300	8.945	2.991
Bahrain	4146	455.186	4.336	4.637	8.973	2.995
Belgium (Flemish)	5404	525.755	4.903	3.462	8.364	2.892
Bulgaria	4228	506.718	39.583	1.150	40.733	6.382
Canada	12283	524.497	4.751	2.188	6.939	2.634
Chile	4756	476.894	4.798	1.635	6.432	2.536
Chinese Taipei	4291	557.882	3.957	5.673	9.630	3.103
Croatia	3985	535.684	3.376	2.617	5.993	2.448
Cyprus	4125	489.644	5.705	7.553	13.257	3.641
Czech Republic	5202	528.733	4.701	1.161	5.862	2.421
Denmark	3710	525.659	4.025	4.325	8.350	2.890
England	4006	538.615	5.145	2.287	7.432	2.726
Finland	5015	552.053	3.693	1.761	5.455	2.336
France	4873	481.178	6.237	1.527	7.764	2.786
Georgia	3919	425.614	14.835	1.161	15.996	3.999
Germany	3948	531.637	3.855	1.487	5.342	2.311
Hong Kong SAR	3600	552.253	12.313	4.102	16.415	4.052
Hungary	5036	532.736	10.248	5.147	15.395	3.924
Indonesia	4025	389.562	27.506	2.849	30.355	5.510
Iran, Islamic Rep. of	3823	422.020	19.077	4.974	24.051	4.904
Ireland	4344	525.845	5.604	3.013	8.617	2.936
Italy	4373	511.235	4.652	7.858	12.509	3.537
Japan	4383	594.389	2.009	1.279	3.288	1.813
Kazakhstan	4702	551.564	19.351	1.029	20.380	4.514
Korea, Rep. of	4669	594.102	2.718	2.183	4.901	2.214
Kuwait	3593	296.992	42.526	22.316	64.842	8.052
Lithuania	4529	537.877	6.044	2.830	8.874	2.979
Morocco	5068	353.794	16.272	6.187	22.459	4.739
Netherlands	4515	525.802	4.234	4.024	8.258	2.874
New Zealand	6322	513.774	4.910	0.773	5.684	2.384
Northern Ireland	3116	519.911	5.248	1.379	6.627	2.574
Norway (5)	4329	536.620	4.748	9.569	14.317	3.784

Summary Statistics and Standard Errors for Proficiency in Science Reasoning at the Fourth Grade (Continued)

Country	Sample Size	Science Reasoning				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Oman	9105	431.034	6.684	2.501	9.185	3.031
Poland	4747	542.020	4.231	6.143	10.374	3.221
Portugal	4693	505.642	2.578	1.087	3.664	1.914
Qatar	5194	433.193	15.679	3.786	19.465	4.412
Russian Federation	4921	560.506	9.429	4.647	14.075	3.752
Saudi Arabia	4337	364.906	21.501	8.013	29.514	5.433
Serbia	4036	520.594	11.389	4.012	15.402	3.924
Singapore	6517	605.115	10.618	2.477	13.095	3.619
Slovak Republic	5773	507.314	6.605	4.620	11.226	3.350
Slovenia	4445	538.302	3.549	3.745	7.295	2.701
Spain	7764	516.646	5.379	1.585	6.964	2.639
Sweden	4142	542.115	9.473	4.929	14.402	3.795
Turkey	6456	483.324	10.555	0.423	10.977	3.313
United Arab Emirates	21177	444.321	5.940	2.950	8.890	2.982
United States	10029	541.636	3.481	3.961	7.442	2.728
Benchmarking Participants						
Buenos Aires, Argentina	3104	416.191	13.192	12.177	25.369	5.037
Ontario, Canada	4574	528.998	4.161	3.401	7.563	2.750
Quebec, Canada	2798	526.174	12.937	7.878	20.815	4.562
Norway (4)	4164	482.447	6.069	4.397	10.467	3.235
Abu Dhabi, UAE	5001	411.754	25.664	2.854	28.518	5.340
Dubai, UAE	7453	510.072	2.608	5.593	8.201	2.864
Florida, US	2025	540.575	23.390	10.295	33.685	5.804

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Appendix 4C: Summary Statistics and Standard Errors for Proficiency in Mathematics at the Eighth Grade

Summary Statistics and Standard Errors for Proficiency in Overall Mathematics at the Eighth Grade

Country	Sample Size	Overall Mathematics				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	10338	504.958	8.854	0.810	9.664	3.109
Bahrain	4918	453.953	1.887	0.178	2.066	1.437
Botswana (9)	5964	390.835	3.528	0.650	4.178	2.044
Canada	8757	527.279	4.485	0.155	4.640	2.154
Chile	4849	427.426	8.530	1.825	10.354	3.218
Chinese Taipei	5711	599.105	5.636	0.232	5.869	2.423
Egypt	7822	392.227	15.262	1.752	17.014	4.125
England	4814	518.255	16.718	0.633	17.352	4.166
Georgia	4035	453.195	11.144	0.721	11.865	3.445
Hong Kong SAR	4155	594.253	20.803	0.519	21.323	4.618
Hungary	4893	514.414	13.953	0.321	14.274	3.778
Iran, Islamic Rep. of	6130	436.349	19.233	2.323	21.555	4.643
Ireland	4704	523.494	7.035	0.431	7.466	2.732
Israel	5512	510.899	16.592	0.226	16.818	4.101
Italy	4481	494.394	6.238	0.137	6.374	2.525
Japan	4745	586.469	4.966	0.186	5.152	2.270
Jordan	7865	385.551	9.941	0.494	10.435	3.230
Kazakhstan	4887	527.807	27.489	0.387	27.876	5.280
Korea, Rep. of	5309	605.742	6.105	0.674	6.779	2.604
Kuwait	4503	392.471	19.663	1.921	21.584	4.646
Lebanon	3873	442.425	12.780	0.424	13.204	3.634
Lithuania	4347	511.313	7.007	0.639	7.646	2.765
Malaysia	9726	465.313	12.350	0.381	12.731	3.568
Malta	3817	493.541	0.847	0.133	0.980	0.990
Morocco	13035	384.387	3.671	1.406	5.077	2.253
New Zealand	8142	492.720	10.499	0.766	11.266	3.356
Norway (9)	4697	511.542	4.699	0.364	5.063	2.250
Oman	8883	403.156	5.193	0.701	5.894	2.428

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Summary Statistics and Standard Errors for Proficiency in Overall Mathematics at the Eighth Grade (Continued)

Country	Sample Size	Overall Mathematics				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Qatar	5403	437.109	7.449	1.502	8.951	2.992
Russian Federation	4780	537.996	21.058	0.644	21.702	4.659
Saudi Arabia	3759	367.717	15.791	5.263	21.054	4.588
Singapore	6116	620.956	9.345	0.879	10.224	3.198
Slovenia	4257	516.341	4.241	0.112	4.353	2.086
South Africa (9)	12514	372.373	19.635	0.871	20.505	4.528
Sweden	4090	500.722	7.320	0.284	7.604	2.758
Thailand	6482	431.417	22.145	0.555	22.700	4.764
Turkey	6079	457.629	20.377	2.112	22.489	4.742
United Arab Emirates	18012	464.783	3.692	0.315	4.007	2.002
United States	10221	518.296	9.365	0.092	9.457	3.075

Benchmarking Participants

Buenos Aires, Argentina	3253	396.117	17.284	0.298	17.582	4.193
Ontario, Canada	4520	522.302	7.858	0.270	8.128	2.851
Quebec, Canada	3950	543.356	14.628	0.235	14.863	3.855
Norway (8)	4795	486.767	3.751	0.123	3.873	1.968
Abu Dhabi, UAE	4838	441.673	20.771	1.291	22.062	4.697
Dubai, UAE	6149	511.852	4.190	0.148	4.338	2.083
Florida, US	2074	493.464	41.455	0.100	41.556	6.446

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Summary Statistics and Standard Errors for Proficiency in Algebra at the Eighth Grade

Country	Sample Size	Algebra				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	10338	490.523	9.589	1.745	11.334	3.367
Bahrain	4918	482.761	1.961	2.404	4.365	2.089
Botswana (9)	5964	399.825	3.327	1.789	5.116	2.262
Canada	8757	513.149	4.630	0.245	4.875	2.208
Chile	4849	413.446	8.902	2.490	11.393	3.375
Chinese Taipei	5711	613.240	7.111	0.906	8.017	2.831
Egypt	7822	419.700	16.671	2.079	18.750	4.330
England	4814	492.424	20.357	1.609	21.966	4.687
Georgia	4035	468.702	13.696	0.573	14.268	3.777
Hong Kong SAR	4155	593.003	20.614	1.470	22.084	4.699
Hungary	4893	502.822	14.660	2.304	16.964	4.119
Iran, Islamic Rep. of	6130	437.363	22.725	3.604	26.329	5.131
Ireland	4704	500.995	7.448	0.458	7.906	2.812
Israel	5512	517.072	19.507	2.125	21.632	4.651
Italy	4481	481.338	7.275	1.594	8.869	2.978
Japan	4745	595.902	6.459	1.440	7.899	2.810
Jordan	7865	417.572	11.343	1.048	12.391	3.520
Kazakhstan	4887	554.755	31.008	0.759	31.767	5.636
Korea, Rep. of	5309	612.084	7.453	0.922	8.375	2.894
Kuwait	4503	384.030	20.301	2.407	22.708	4.765
Lebanon	3873	465.704	12.817	2.825	15.642	3.955
Lithuania	4347	497.342	10.371	0.254	10.625	3.260
Malaysia	9726	466.857	10.748	0.736	11.484	3.389
Malta	3817	492.445	0.987	2.260	3.247	1.802
Morocco	13035	372.068	4.994	0.510	5.504	2.346
New Zealand	8142	474.775	11.813	0.291	12.104	3.479
Norway (9)	4697	471.239	6.656	0.521	7.176	2.679
Oman	8883	426.333	6.471	1.003	7.473	2.734
Qatar	5403	452.126	6.336	0.439	6.775	2.603
Russian Federation	4780	558.163	25.377	1.245	26.621	5.160
Saudi Arabia	3759	390.954	14.991	4.160	19.151	4.376
Singapore	6116	622.539	10.608	1.138	11.746	3.427
Slovenia	4257	498.243	3.997	2.095	6.092	2.468
South Africa (9)	12514	393.739	17.553	0.786	18.339	4.282

Summary Statistics and Standard Errors for Proficiency in Algebra at the Eighth Grade (Continued)

Country	Sample Size	Algebra				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Sweden	4090	482.127	9.168	1.205	10.372	3.221
Thailand	6482	429.091	24.392	1.789	26.181	5.117
Turkey	6079	459.112	19.672	1.379	21.051	4.588
United Arab Emirates	18012	485.031	3.491	0.651	4.142	2.035
United States	10221	524.861	9.690	0.193	9.884	3.144
Benchmarking Participants						
Buenos Aires, Argentina	3253	370.845	24.589	1.737	26.326	5.131
Ontario, Canada	4520	507.420	8.400	0.575	8.975	2.996
Quebec, Canada	3950	530.393	13.896	5.064	18.960	4.354
Norway (8)	4795	423.282	5.623	1.669	7.292	2.700
Abu Dhabi, UAE	4838	462.161	19.838	0.738	20.576	4.536
Dubai, UAE	6149	528.476	3.921	3.275	7.196	2.683
Florida, US	2074	502.144	45.296	1.210	46.506	6.820

Summary Statistics and Standard Errors for Proficiency in Geometry at the Eighth Grade

Country	Sample Size	Geometry				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	10338	500.112	8.570	1.015	9.584	3.096
Bahrain	4918	449.266	2.737	3.336	6.073	2.464
Botswana (9)	5964	376.868	3.538	2.786	6.324	2.515
Canada	8757	526.593	5.469	1.003	6.472	2.544
Chile	4849	427.534	8.332	2.964	11.296	3.361
Chinese Taipei	5711	606.788	5.958	1.009	6.967	2.640
Egypt	7822	392.824	15.105	2.041	17.146	4.141
England	4814	514.222	16.574	0.353	16.927	4.114
Georgia	4035	440.545	14.942	0.192	15.134	3.890
Hong Kong SAR	4155	601.775	23.819	2.133	25.952	5.094
Hungary	4893	518.216	17.259	0.578	17.837	4.223
Iran, Islamic Rep. of	6130	447.776	20.127	2.409	22.536	4.747
Ireland	4704	503.478	7.666	2.027	9.693	3.113
Israel	5512	487.304	19.939	1.246	21.185	4.603
Italy	4481	503.944	9.966	2.635	12.601	3.550
Japan	4745	597.600	5.319	1.259	6.579	2.565
Jordan	7865	380.748	8.705	3.097	11.802	3.435
Kazakhstan	4887	529.265	39.595	1.143	40.738	6.383
Korea, Rep. of	5309	612.210	6.125	5.492	11.618	3.408
Kuwait	4503	381.922	23.397	4.734	28.131	5.304
Lebanon	3873	443.560	12.849	2.931	15.781	3.972
Lithuania	4347	514.657	9.170	0.301	9.471	3.078
Malaysia	9726	455.281	14.429	0.541	14.970	3.869
Malta	3817	484.018	0.996	1.818	2.814	1.678
Morocco	13035	410.001	2.837	5.990	8.827	2.971
New Zealand	8142	488.092	9.307	0.753	10.060	3.172
Norway (9)	4697	497.733	5.550	0.902	6.452	2.540
Oman	8883	414.633	5.508	2.537	8.045	2.836
Qatar	5403	432.771	7.437	1.392	8.829	2.971
Russian Federation	4780	535.564	30.109	1.338	31.448	5.608
Saudi Arabia	3759	342.398	16.103	11.912	28.015	5.293
Singapore	6116	616.974	9.985	2.540	12.525	3.539
Slovenia	4257	522.142	4.300	3.373	7.672	2.770
South Africa (9)	12514	363.807	18.173	2.126	20.299	4.505

Summary Statistics and Standard Errors for Proficiency in Geometry at the Eighth Grade (Continued)

Country	Sample Size	Geometry				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Sweden	4090	477.830	7.555	3.968	11.523	3.395
Thailand	6482	429.008	22.595	1.103	23.698	4.868
Turkey	6079	462.566	21.504	2.777	24.280	4.928
United Arab Emirates	18012	447.423	4.511	1.415	5.926	2.434
United States	10221	500.102	9.723	0.440	10.163	3.188
Benchmarking Participants						
Buenos Aires, Argentina	3253	358.491	23.897	0.933	24.830	4.983
Ontario, Canada	4520	523.817	9.085	2.825	11.909	3.451
Quebec, Canada	3950	540.202	18.078	0.201	18.279	4.275
Norway (8)	4795	477.270	4.543	1.155	5.697	2.387
Abu Dhabi, UAE	4838	425.275	25.757	3.197	28.955	5.381
Dubai, UAE	6149	496.292	5.624	1.355	6.979	2.642
Florida, US	2074	469.663	37.704	5.120	42.824	6.544

Summary Statistics and Standard Errors for Proficiency in Number at the Eighth Grade

Country	Sample Size	Number				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	10338	511.324	9.704	0.270	9.974	3.158
Bahrain	4918	435.770	2.223	1.828	4.051	2.013
Botswana (9)	5964	393.427	4.176	6.177	10.353	3.218
Canada	8757	536.811	5.294	0.580	5.874	2.424
Chile	4849	427.319	9.703	1.001	10.703	3.272
Chinese Taipei	5711	589.739	5.685	0.250	5.934	2.436
Egypt	7822	393.093	13.020	0.751	13.771	3.711
England	4814	527.575	19.606	0.876	20.482	4.526
Georgia	4035	456.827	11.443	0.137	11.580	3.403
Hong Kong SAR	4155	594.334	20.776	2.980	23.755	4.874
Hungary	4893	517.500	14.924	1.096	16.020	4.002
Iran, Islamic Rep. of	6130	431.704	19.727	2.504	22.230	4.715
Ireland	4704	544.482	8.608	2.545	11.153	3.340
Israel	5512	517.678	13.818	2.116	15.934	3.992
Italy	4481	493.925	6.318	0.807	7.125	2.669
Japan	4745	572.052	4.172	1.580	5.752	2.398
Jordan	7865	380.465	8.467	1.861	10.327	3.214
Kazakhstan	4887	516.401	25.458	0.822	26.281	5.126
Korea, Rep. of	5309	601.180	5.656	0.175	5.830	2.415
Kuwait	4503	394.823	18.738	4.011	22.749	4.770
Lebanon	3873	440.196	11.912	5.051	16.963	4.119
Lithuania	4347	510.970	7.041	1.011	8.052	2.838
Malaysia	9726	471.617	12.490	0.392	12.883	3.589
Malta	3817	500.625	1.036	1.668	2.704	1.644
Morocco	13035	382.389	3.719	0.750	4.469	2.114
New Zealand	8142	499.647	12.217	0.238	12.456	3.529
Norway (9)	4697	528.688	5.580	1.012	6.592	2.567
Oman	8883	388.968	4.655	2.277	6.933	2.633
Qatar	5403	435.139	7.655	1.041	8.696	2.949
Russian Federation	4780	533.008	19.522	0.471	19.994	4.471
Saudi Arabia	3759	352.028	16.851	3.042	19.892	4.460
Singapore	6116	628.949	9.511	0.702	10.213	3.196
Slovenia	4257	523.789	5.021	0.709	5.730	2.394
South Africa (9)	12514	368.479	20.486	1.258	21.745	4.663

Summary Statistics and Standard Errors for Proficiency in Number at the Eighth Grade (Continued)

Country	Sample Size	Number				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Sweden	4090	512.658	6.854	1.386	8.240	2.871
Thailand	6482	430.478	23.770	1.222	24.992	4.999
Turkey	6079	447.424	20.315	1.046	21.361	4.622
United Arab Emirates	18012	463.684	3.397	0.132	3.529	1.879
United States	10221	519.731	9.134	0.329	9.463	3.076
Benchmarking Participants						
Buenos Aires, Argentina	3253	414.676	15.691	2.055	17.746	4.213
Ontario, Canada	4520	529.695	8.952	0.185	9.137	3.023
Quebec, Canada	3950	556.967	17.179	1.490	18.669	4.321
Norway (8)	4795	503.787	4.258	0.750	5.008	2.238
Abu Dhabi, UAE	4838	442.576	18.278	0.683	18.961	4.354
Dubai, UAE	6149	508.555	4.916	1.316	6.233	2.497
Florida, US	2074	498.089	43.085	1.086	44.171	6.646

Summary Statistics and Standard Errors for Proficiency in Data and Chance at the Eighth Grade

Country	Sample Size	Data and Chance				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	10338	518.833	8.784	0.974	9.757	3.124
Bahrain	4918	452.908	2.411	2.643	5.054	2.248
Botswana (9)	5964	373.556	4.734	5.164	9.898	3.146
Canada	8757	533.838	6.184	2.102	8.286	2.879
Chile	4849	429.468	9.887	4.262	14.150	3.762
Chinese Taipei	5711	587.930	5.511	0.617	6.128	2.476
Egypt	7822	338.098	17.400	2.361	19.761	4.445
England	4814	541.417	18.576	3.065	21.641	4.652
Georgia	4035	421.394	12.064	1.478	13.541	3.680
Hong Kong SAR	4155	597.122	25.329	9.463	34.793	5.899
Hungary	4893	518.888	14.434	0.580	15.015	3.875
Iran, Islamic Rep. of	6130	417.001	23.788	1.546	25.333	5.033
Ireland	4704	533.814	11.407	3.310	14.717	3.836
Israel	5512	503.211	18.951	5.530	24.481	4.948
Italy	4481	496.317	6.177	1.024	7.201	2.683
Japan	4745	589.045	5.146	0.370	5.516	2.349
Jordan	7865	346.120	11.274	4.750	16.024	4.003
Kazakhstan	4887	492.125	27.906	2.114	30.020	5.479
Korea, Rep. of	5309	600.133	4.921	0.678	5.599	2.366
Kuwait	4503	377.071	22.396	3.030	25.426	5.042
Lebanon	3873	395.057	18.917	2.634	21.552	4.642
Lithuania	4347	521.495	6.625	0.734	7.359	2.713
Malaysia	9726	451.491	13.888	0.751	14.639	3.826
Malta	3817	486.607	1.226	5.564	6.790	2.606
Morocco	13035	353.269	3.543	4.768	8.311	2.883
New Zealand	8142	508.560	12.670	0.769	13.439	3.666
Norway (9)	4697	542.242	7.575	2.607	10.182	3.191
Oman	8883	376.220	6.447	2.762	9.208	3.035
Qatar	5403	416.941	9.593	5.617	15.210	3.900
Russian Federation	4780	507.042	18.385	6.224	24.608	4.961
Saudi Arabia	3759	361.268	17.906	6.251	24.157	4.915
Singapore	6116	617.045	11.039	0.420	11.459	3.385

Summary Statistics and Standard Errors for Proficiency in Data and Chance at the Eighth Grade (Continued)

Country	Sample Size	Data and Chance				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Slovenia	4257	524.614	5.406	1.808	7.215	2.686
South Africa (9)	12514	356.926	21.357	3.066	24.423	4.942
Sweden	4090	511.909	12.311	1.568	13.879	3.725
Thailand	6482	424.885	20.808	0.750	21.558	4.643
Turkey	6079	466.565	24.949	2.545	27.493	5.243
United Arab Emirates	18012	448.972	4.714	1.349	6.064	2.462
United States	10221	521.848	11.813	0.258	12.070	3.474

Benchmarking Participants

Country	Sample Size	Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Buenos Aires, Argentina	3253	372.981	26.761	1.325	28.085	5.300
Ontario, Canada	4520	531.233	10.643	4.281	14.924	3.863
Quebec, Canada	3950	546.109	22.834	2.509	25.343	5.034
Norway (8)	4795	519.419	6.831	2.181	9.012	3.002
Abu Dhabi, UAE	4838	425.722	25.981	3.930	29.910	5.469
Dubai, UAE	6149	503.513	5.444	3.692	9.135	3.022
Florida, US	2074	489.318	52.656	12.160	64.816	8.051

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CHAPTER 4: ESTIMATING STANDARD ERRORS
IN THE TIMSS 2015 RESULTS
METHODS AND PROCEDURES IN TIMSS 2015   4.47

Summary Statistics and Standard Errors for Proficiency in Mathematics Knowing at the Eighth Grade

Country	Sample Size	Mathematics Knowing				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	10338	504.368	8.165	1.309	9.474	3.078
Bahrain	4918	463.186	2.335	2.919	5.253	2.292
Botswana (9)	5964	393.558	4.056	4.688	8.745	2.957
Canada	8757	520.322	4.703	0.647	5.349	2.313
Chile	4849	422.594	8.385	3.375	11.760	3.429
Chinese Taipei	5711	598.180	6.609	1.855	8.464	2.909
Egypt	7822	399.144	18.123	0.393	18.516	4.303
England	4814	513.144	16.263	0.244	16.507	4.063
Georgia	4035	455.982	13.976	2.790	16.766	4.095
Hong Kong SAR	4155	599.748	22.422	3.871	26.293	5.128
Hungary	4893	511.208	14.605	0.912	15.517	3.939
Iran, Islamic Rep. of	6130	435.396	21.659	2.073	23.732	4.872
Ireland	4704	527.348	7.140	2.007	9.147	3.024
Israel	5512	511.124	17.102	0.875	17.977	4.240
Italy	4481	488.636	6.163	0.903	7.066	2.658
Japan	4745	577.630	5.434	1.424	6.857	2.619
Jordan	7865	390.547	9.725	0.372	10.097	3.178
Kazakhstan	4887	533.246	38.945	1.074	40.019	6.326
Korea, Rep. of	5309	606.806	7.154	0.621	7.776	2.788
Kuwait	4503	397.569	21.014	1.284	22.298	4.722
Lebanon	3873	455.722	13.690	0.567	14.258	3.776
Lithuania	4347	501.908	7.702	1.668	9.370	3.061
Malaysia	9726	472.252	14.094	0.514	14.608	3.822
Malta	3817	498.996	0.933	1.253	2.186	1.479
Morocco	13035	382.117	4.357	1.610	5.966	2.443
New Zealand	8142	487.658	9.952	1.326	11.278	3.358
Norway (9)	4697	500.370	4.240	1.166	5.406	2.325
Oman	8883	401.284	6.394	2.962	9.357	3.059
Qatar	5403	439.871	8.557	1.256	9.814	3.133
Russian Federation	4780	543.105	30.444	1.456	31.900	5.648
Saudi Arabia	3759	359.402	21.180	3.312	24.492	4.949
Singapore	6116	633.054	9.865	1.615	11.480	3.388

Summary Statistics and Standard Errors for Proficiency in Mathematics Knowing at the Eighth Grade (Continued)

| Country | Sample Size | Mathematics Knowing | | | | |
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Slovenia	4257	518.009	4.577	1.359	5.936	2.436
South Africa (9)	12514	371.225	24.887	2.573	27.459	5.240
Sweden	4090	484.301	6.875	1.165	8.040	2.835
Thailand	6482	425.315	25.000	1.032	26.031	5.102
Turkey	6079	447.118	22.774	1.171	23.944	4.893
United Arab Emirates	18012	475.660	3.940	0.749	4.689	2.165
United States	10221	527.972	10.425	1.478	11.903	3.450

Benchmarking Participants

Country	Sample Size	Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Buenos Aires, Argentina	3253	397.437	18.222	0.704	18.926	4.350
Ontario, Canada	4520	513.055	8.125	0.681	8.805	2.967
Quebec, Canada	3950	540.700	15.553	2.486	18.039	4.247
Norway (8)	4795	476.352	3.168	3.369	6.537	2.557
Abu Dhabi, UAE	4838	453.246	21.157	1.543	22.700	4.764
Dubai, UAE	6149	521.321	4.670	0.748	5.418	2.328
Florida, US	2074	501.238	48.357	5.511	53.868	7.339

Summary Statistics and Standard Errors for Proficiency in Mathematics Applying at the Eighth Grade

Country	Sample Size	Mathematics Applying				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	10338	502.031	9.145	0.121	9.266	3.044
Bahrain	4918	445.218	1.932	0.945	2.878	1.696
Botswana (9)	5964	385.384	3.996	1.522	5.518	2.349
Canada	8757	528.164	4.220	0.477	4.697	2.167
Chile	4849	426.649	9.123	1.808	10.932	3.306
Chinese Taipei	5711	602.105	5.787	0.705	6.492	2.548
Egypt	7822	384.985	14.494	0.653	15.148	3.892
England	4814	519.392	16.766	0.308	17.074	4.132
Georgia	4035	454.431	11.720	0.903	12.623	3.553
Hong Kong SAR	4155	595.227	19.220	1.137	20.357	4.512
Hungary	4893	515.986	13.993	0.701	14.693	3.833
Iran, Islamic Rep. of	6130	434.175	19.054	0.436	19.490	4.415
Ireland	4704	520.417	7.867	1.392	9.259	3.043
Israel	5512	511.867	15.709	0.411	16.119	4.015
Italy	4481	494.952	6.381	0.421	6.802	2.608
Japan	4745	591.560	4.748	0.573	5.321	2.307
Jordan	7865	378.362	9.829	0.387	10.216	3.196
Kazakhstan	4887	527.235	27.304	1.480	28.784	5.365
Korea, Rep. of	5309	606.193	6.573	1.416	7.988	2.826
Kuwait	4503	389.424	17.752	2.832	20.584	4.537
Lebanon	3873	438.615	13.450	2.128	15.577	3.947
Lithuania	4347	519.858	6.895	0.125	7.020	2.650
Malaysia	9726	463.043	11.934	0.986	12.919	3.594
Malta	3817	493.488	0.954	1.416	2.369	1.539
Morocco	13035	385.315	3.379	1.553	4.932	2.221
New Zealand	8142	493.100	10.345	0.704	11.049	3.324
Norway (9)	4697	516.316	4.744	0.557	5.301	2.302
Oman	8883	400.766	5.160	0.848	6.008	2.451
Qatar	5403	434.932	7.292	1.299	8.591	2.931
Russian Federation	4780	540.864	20.827	0.277	21.104	4.594
Saudi Arabia	3759	363.583	14.295	3.366	17.660	4.202
Singapore	6116	619.345	8.786	1.225	10.011	3.164

Summary Statistics and Standard Errors for Proficiency in Mathematics Applying at the Eighth Grade (Continued)

Country	Sample Size	Mathematics Applying				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Slovenia	4257	514.152	4.061	0.528	4.589	2.142
South Africa (9)	12514	362.243	20.678	0.593	21.271	4.612
Sweden	4090	506.669	6.963	0.630	7.592	2.755
Thailand	6482	431.459	21.691	0.708	22.399	4.733
Turkey	6079	459.544	18.267	0.302	18.569	4.309
United Arab Emirates	18012	457.307	3.715	0.621	4.336	2.082
United States	10221	514.657	10.137	0.127	10.263	3.204
Benchmarking Participants						
Buenos Aires, Argentina	3253	391.955	19.901	2.694	22.595	4.753
Ontario, Canada	4520	522.105	7.104	0.886	7.990	2.827
Quebec, Canada	3950	546.492	14.633	1.542	16.175	4.022
Norway (8)	4795	491.983	3.683	1.800	5.484	2.342
Abu Dhabi, UAE	4838	433.731	20.970	0.816	21.786	4.668
Dubai, UAE	6149	505.267	4.602	1.711	6.313	2.513
Florida, US	2074	488.443	43.976	1.571	45.547	6.749

Summary Statistics and Standard Errors for Proficiency in Mathematics Reasoning at the Eighth Grade

Country	Sample Size	Mathematics Reasoning				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	10338	511.998	8.387	0.941	9.328	3.054
Bahrain	4918	451.902	2.400	2.552	4.951	2.225
Botswana (9)	5964	388.986	3.410	0.565	3.974	1.994
Canada	8757	533.893	4.801	0.763	5.564	2.359
Chile	4849	431.854	9.183	1.551	10.733	3.276
Chinese Taipei	5711	602.351	5.660	0.474	6.134	2.477
Egypt	7822	378.866	17.333	0.820	18.153	4.261
England	4814	522.146	16.723	2.299	19.022	4.361
Georgia	4035	440.652	14.320	5.880	20.199	4.494
Hong Kong SAR	4155	591.369	24.076	1.752	25.828	5.082
Hungary	4893	514.927	14.266	0.899	15.165	3.894
Iran, Islamic Rep. of	6130	436.194	21.057	0.700	21.757	4.664
Ireland	4704	521.380	7.245	2.528	9.774	3.126
Israel	5512	509.852	16.543	2.568	19.111	4.372
Italy	4481	500.040	7.342	0.623	7.965	2.822
Japan	4745	590.552	5.882	0.879	6.761	2.600
Jordan	7865	379.646	9.884	0.914	10.798	3.286
Kazakhstan	4887	524.604	28.566	1.600	30.166	5.492
Korea, Rep. of	5309	607.643	5.799	1.429	7.228	2.689
Kuwait	4503	373.908	17.342	2.889	20.232	4.498
Lebanon	3873	405.768	18.084	2.525	20.610	4.540
Lithuania	4347	501.380	8.383	0.690	9.074	3.012
Malaysia	9726	452.956	12.100	1.912	14.012	3.743
Malta	3817	484.406	1.080	3.634	4.715	2.171
Morocco	13035	373.931	2.898	4.990	7.888	2.809
New Zealand	8142	498.549	10.594	1.377	11.971	3.460
Norway (9)	4697	515.873	5.070	0.969	6.039	2.457
Oman	8883	402.412	5.536	3.994	9.530	3.087
Qatar	5403	431.367	7.221	0.551	7.773	2.788
Russian Federation	4780	527.568	22.772	1.785	24.557	4.956
Saudi Arabia	3759	374.162	14.027	2.136	16.163	4.020
Singapore	6116	616.228	11.376	2.204	13.580	3.685

Summary Statistics and Standard Errors for Proficiency in Mathematics Reasoning at the Eighth Grade (Continued)

Country	Sample Size	Mathematics Reasoning				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Slovenia	4257	515.899	5.075	2.368	7.443	2.728
South Africa (9)	12514	383.131	15.878	2.113	17.991	4.242
Sweden	4090	509.436	8.910	3.290	12.200	3.493
Thailand	6482	435.431	22.017	0.681	22.699	4.764
Turkey	6079	472.147	21.271	2.027	23.298	4.827
United Arab Emirates	18012	460.985	3.531	1.251	4.782	2.187
United States	10221	514.041	8.673	0.653	9.326	3.054

Benchmarking Participants

Country	Sample Size	Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Buenos Aires, Argentina	3253	382.562	23.511	4.958	28.469	5.336
Ontario, Canada	4520	534.384	8.452	1.438	9.890	3.145
Quebec, Canada	3950	538.211	15.665	2.147	17.812	4.220
Norway (8)	4795	487.809	4.740	0.737	5.477	2.340
Abu Dhabi, UAE	4838	440.120	20.646	1.908	22.554	4.749
Dubai, UAE	6149	509.373	4.057	3.587	7.644	2.765
Florida, US	2074	490.882	36.604	6.687	43.291	6.580

Appendix 4D: Summary Statistics and Standard Errors for Proficiency in Science at the Eighth Grade

Summary Statistics and Standard Errors for Proficiency in Overall Science at the Eighth Grade

Country	Sample Size	Overall Science				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	10338	511.987	6.728	0.432	7.160	2.676
Bahrain	4918	465.853	4.308	0.448	4.756	2.181
Botswana (9)	5964	391.801	5.505	2.040	7.545	2.747
Canada	8757	526.172	4.002	0.764	4.767	2.183
Chile	4849	453.969	8.466	1.069	9.534	3.088
Chinese Taipei	5711	569.474	3.731	0.542	4.273	2.067
Egypt	7822	370.777	17.335	1.168	18.503	4.301
England	4814	536.630	14.131	0.389	14.520	3.811
Georgia	4035	443.166	7.808	1.966	9.774	3.126
Hong Kong SAR	4155	545.760	15.258	0.130	15.389	3.923
Hungary	4893	527.260	10.452	0.965	11.417	3.379
Iran, Islamic Rep. of	6130	456.425	14.837	1.239	16.076	4.010
Ireland	4704	530.097	7.245	0.727	7.973	2.824
Israel	5512	506.731	14.900	0.345	15.245	3.905
Italy	4481	498.926	4.880	0.968	5.848	2.418
Japan	4745	570.900	2.987	0.236	3.222	1.795
Jordan	7865	426.164	9.748	1.583	11.332	3.366
Kazakhstan	4887	532.586	19.520	0.240	19.760	4.445
Korea, Rep. of	5309	555.597	4.475	0.404	4.879	2.209
Kuwait	4503	410.741	25.103	1.510	26.612	5.159
Lebanon	3873	398.157	26.410	2.176	28.586	5.347
Lithuania	4347	519.105	7.339	0.372	7.711	2.777
Malaysia	9726	470.822	16.672	0.396	17.068	4.131
Malta	3817	481.361	1.672	0.939	2.610	1.616
Morocco	13035	393.253	4.065	2.288	6.352	2.520
New Zealand	8142	512.681	9.397	0.218	9.615	3.101
Norway (9)	4697	508.826	7.211	0.595	7.806	2.794
Oman	8883	454.560	5.582	1.456	7.038	2.653

Summary Statistics and Standard Errors for Proficiency in Overall Science at the Eighth Grade (Continued)

Country	Sample Size	Overall Science				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Qatar	5403	456.516	8.021	1.224	9.245	3.041
Russian Federation	4780	544.116	17.005	0.722	17.727	4.210
Saudi Arabia	3759	396.420	18.673	1.389	20.062	4.479
Singapore	6116	596.644	9.827	0.290	10.117	3.181
Slovenia	4257	551.112	4.934	0.828	5.762	2.400
South Africa (9)	12514	357.742	30.162	1.593	31.755	5.635
Sweden	4090	522.269	10.848	0.998	11.846	3.442
Thailand	6482	455.845	16.978	0.990	17.967	4.239
Turkey	6079	493.396	15.523	0.625	16.148	4.018
United Arab Emirates	18012	476.646	4.718	0.496	5.213	2.283
United States	10221	529.996	7.545	0.528	8.073	2.841

Benchmarking Participants

Country	Sample Size	Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Buenos Aires, Argentina	3253	386.013	16.815	1.154	17.969	4.239
Ontario, Canada	4520	523.872	5.815	0.472	6.288	2.508
Quebec, Canada	3950	529.716	16.871	2.268	19.139	4.375
Norway (8)	4795	489.221	5.277	0.338	5.615	2.370
Abu Dhabi, UAE	4838	454.249	30.475	0.810	31.284	5.593
Dubai, UAE	6149	524.723	3.391	0.586	3.977	1.994
Florida, US	2074	508.280	33.126	2.615	35.741	5.978

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Summary Statistics and Standard Errors for Proficiency in Biology at the Eighth Grade

Country	Sample Size	Biology				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	10338	521.730	6.736	1.215	7.951	2.820
Bahrain	4918	468.749	4.789	1.882	6.670	2.583
Botswana (9)	5964	396.583	6.125	2.049	8.173	2.859
Canada	8757	534.272	4.097	1.470	5.568	2.360
Chile	4849	458.873	8.774	4.143	12.917	3.594
Chinese Taipei	5711	565.146	3.891	0.999	4.890	2.211
Egypt	7822	348.336	19.895	5.365	25.259	5.026
England	4814	542.025	14.369	1.598	15.967	3.996
Georgia	4035	446.708	7.853	1.709	9.563	3.092
Hong Kong SAR	4155	548.515	16.112	5.593	21.706	4.659
Hungary	4893	520.756	9.198	1.619	10.817	3.289
Iran, Islamic Rep. of	6130	448.333	13.477	1.315	14.793	3.846
Ireland	4704	534.167	7.099	1.331	8.430	2.903
Israel	5512	504.168	15.126	2.904	18.030	4.246
Italy	4481	495.540	5.377	1.425	6.802	2.608
Japan	4745	570.340	3.593	4.681	8.274	2.877
Jordan	7865	419.589	10.414	4.687	15.101	3.886
Kazakhstan	4887	520.484	21.324	0.211	21.535	4.641
Korea, Rep. of	5309	553.929	4.186	0.733	4.919	2.218
Kuwait	4503	401.813	32.176	2.053	34.229	5.851
Lebanon	3873	365.964	30.187	8.209	38.396	6.196
Lithuania	4347	520.981	8.524	1.097	9.622	3.102
Malaysia	9726	466.110	18.330	0.637	18.967	4.355
Malta	3817	472.755	2.262	4.969	7.231	2.689
Morocco	13035	379.543	4.263	2.133	6.397	2.529
New Zealand	8142	519.558	10.370	1.635	12.005	3.465
Norway (9)	4697	501.587	6.722	0.285	7.007	2.647
Oman	8883	454.310	5.895	1.393	7.289	2.700
Qatar	5403	454.416	8.577	0.393	8.971	2.995
Russian Federation	4780	539.000	17.210	2.196	19.407	4.405
Saudi Arabia	3759	397.238	20.255	5.740	25.995	5.099
Singapore	6116	609.090	11.646	0.409	12.055	3.472
Slovenia	4257	548.299	4.589	3.285	7.874	2.806
South Africa (9)	12514	356.375	32.590	1.692	34.282	5.855

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Summary Statistics and Standard Errors for Proficiency in Biology at the Eighth Grade (Continued)

| Country | Sample Size | Biology | | | | |
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Sweden	4090	519.866	12.056	1.015	13.071	3.615
Thailand	6482	465.849	16.671	0.128	16.799	4.099
Turkey	6079	490.902	14.873	1.612	16.485	4.060
United Arab Emirates	18012	474.639	5.433	0.242	5.675	2.382
United States	10221	540.366	7.913	0.311	8.224	2.868

Benchmarking Participants

Buenos Aires, Argentina	3253	391.315	18.919	3.621	22.540	4.748
Ontario, Canada	4520	537.624	6.084	2.169	8.253	2.873
Quebec, Canada	3950	527.043	17.592	0.992	18.584	4.311
Norway (8)	4795	485.645	5.238	3.317	8.555	2.925
Abu Dhabi, UAE	4838	452.247	34.637	2.190	36.827	6.069
Dubai, UAE	6149	524.797	4.340	1.417	5.757	2.399
Florida, US	2074	518.191	32.807	0.662	33.469	5.785

Summary Statistics and Standard Errors for Proficiency in Chemistry at the Eighth Grade

Country	Sample Size	Chemistry				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	10338	492.654	8.721	2.403	11.124	3.335
Bahrain	4918	462.318	5.963	1.744	7.707	2.776
Botswana (9)	5964	389.927	5.977	6.948	12.925	3.595
Canada	8757	512.409	4.202	0.590	4.792	2.189
Chile	4849	438.014	10.153	2.812	12.966	3.601
Chinese Taipei	5711	578.517	5.729	1.482	7.211	2.685
Egypt	7822	394.711	16.380	8.427	24.806	4.981
England	4814	528.555	16.319	3.669	19.988	4.471
Georgia	4035	455.951	8.337	5.187	13.524	3.677
Hong Kong SAR	4155	535.921	16.457	0.695	17.152	4.142
Hungary	4893	534.210	11.925	0.901	12.826	3.581
Iran, Islamic Rep. of	6130	457.557	19.754	1.802	21.556	4.643
Ireland	4704	517.110	9.879	2.777	12.657	3.558
Israel	5512	515.961	18.132	3.170	21.302	4.615
Italy	4481	487.227	5.704	0.233	5.937	2.437
Japan	4745	569.973	4.121	1.786	5.907	2.431
Jordan	7865	437.545	11.658	2.854	14.513	3.810
Kazakhstan	4887	553.558	23.993	3.325	27.319	5.227
Korea, Rep. of	5309	550.262	5.221	1.025	6.246	2.499
Kuwait	4503	412.793	25.033	7.155	32.188	5.673
Lebanon	3873	437.808	26.117	12.358	38.475	6.203
Lithuania	4347	517.160	7.143	3.161	10.304	3.210
Malaysia	9726	473.180	15.307	0.597	15.905	3.988
Malta	3817	481.346	2.276	2.271	4.548	2.133
Morocco	13035	399.663	4.744	4.060	8.803	2.967
New Zealand	8142	497.920	10.380	1.820	12.200	3.493
Norway (9)	4697	502.692	7.437	1.185	8.622	2.936
Oman	8883	452.446	6.647	0.515	7.162	2.676
Qatar	5403	454.980	11.016	1.793	12.809	3.579
Russian Federation	4780	558.033	20.485	3.576	24.061	4.905
Saudi Arabia	3759	377.330	21.369	4.080	25.448	5.045
Singapore	6116	593.179	12.246	0.894	13.140	3.625
Slovenia	4257	552.401	5.621	1.108	6.729	2.594
South Africa (9)	12514	368.749	25.950	11.069	37.018	6.084

Summary Statistics and Standard Errors for Proficiency in Chemistry at the Eighth Grade (Continued)

Country	Sample Size	Chemistry				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Sweden	4090	512.367	11.770	0.964	12.733	3.568
Thailand	6482	444.762	20.388	3.589	23.978	4.897
Turkey	6079	493.399	19.972	1.696	21.667	4.655
United Arab Emirates	18012	480.838	6.282	3.737	10.020	3.165
United States	10221	518.907	9.225	0.942	10.167	3.189
Benchmarking Participants						
Buenos Aires, Argentina	3253	353.645	16.427	11.323	27.750	5.268
Ontario, Canada	4520	502.972	6.410	0.681	7.091	2.663
Quebec, Canada	3950	530.532	19.065	2.438	21.503	4.637
Norway (8)	4795	479.355	6.522	6.032	12.554	3.543
Abu Dhabi, UAE	4838	459.049	40.095	5.298	45.393	6.737
Dubai, UAE	6149	528.151	5.301	0.968	6.270	2.504
Florida, US	2074	497.877	42.103	4.831	46.934	6.851

Summary Statistics and Standard Errors for Proficiency in Physics at the Eighth Grade

Country	Sample Size	Physics				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	10338	504.536	6.996	0.243	7.239	2.691
Bahrain	4918	461.198	4.680	1.920	6.600	2.569
Botswana (9)	5964	383.822	6.495	1.151	7.646	2.765
Canada	8757	520.592	4.290	0.678	4.968	2.229
Chile	4849	439.212	8.596	5.671	14.267	3.777
Chinese Taipei	5711	559.892	4.597	4.548	9.145	3.024
Egypt	7822	377.645	18.903	3.212	22.115	4.703
England	4814	535.260	14.424	0.863	15.287	3.910
Georgia	4035	429.363	9.164	12.174	21.338	4.619
Hong Kong SAR	4155	540.128	15.851	0.586	16.437	4.054
Hungary	4893	530.969	13.656	2.475	16.131	4.016
Iran, Islamic Rep. of	6130	475.162	17.469	1.815	19.284	4.391
Ireland	4704	524.915	7.690	2.389	10.079	3.175
Israel	5512	508.455	14.991	1.147	16.138	4.017
Italy	4481	496.322	4.978	1.134	6.113	2.472
Japan	4745	569.628	3.904	1.393	5.297	2.302
Jordan	7865	424.359	10.384	2.374	12.758	3.572
Kazakhstan	4887	543.080	23.166	1.436	24.601	4.960
Korea, Rep. of	5309	564.300	6.668	1.039	7.706	2.776
Kuwait	4503	411.414	23.741	1.955	25.697	5.069
Lebanon	3873	412.310	25.565	18.475	44.040	6.636
Lithuania	4347	512.538	8.246	4.484	12.730	3.568
Malaysia	9726	479.859	14.990	0.327	15.318	3.914
Malta	3817	490.172	1.387	1.867	3.254	1.804
Morocco	13035	395.381	4.725	3.658	8.383	2.895
New Zealand	8142	508.286	9.371	0.749	10.120	3.181
Norway (9)	4697	511.721	8.341	1.497	9.838	3.137
Oman	8883	448.825	6.037	2.924	8.961	2.993
Qatar	5403	459.268	10.325	1.190	11.515	3.393
Russian Federation	4780	547.673	16.731	1.070	17.801	4.219
Saudi Arabia	3759	385.479	21.224	7.083	28.307	5.320
Singapore	6116	608.331	9.081	0.604	9.685	3.112
Slovenia	4257	545.414	5.692	2.735	8.427	2.903
South Africa (9)	12514	359.161	28.369	1.617	29.986	5.476

Summary Statistics and Standard Errors for Proficiency in Physics at the Eighth Grade (Continued)

| Country | Sample Size | Physics | | | | |
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Sweden	4090	524.321	11.070	2.782	13.852	3.722
Thailand	6482	437.004	18.773	1.965	20.738	4.554
Turkey	6079	505.665	17.496	0.174	17.670	4.204
United Arab Emirates	18012	474.566	4.126	2.091	6.217	2.493
United States	10221	516.219	7.992	0.479	8.471	2.911

Benchmarking Participants

Buenos Aires, Argentina	3253	380.540	17.197	10.011	27.208	5.216
Ontario, Canada	4520	521.493	5.961	2.588	8.548	2.924
Quebec, Canada	3950	519.554	18.463	3.755	22.217	4.714
Norway (8)	4795	483.335	5.519	1.310	6.828	2.613
Abu Dhabi, UAE	4838	453.879	25.703	3.014	28.717	5.359
Dubai, UAE	6149	524.872	4.921	0.737	5.658	2.379
Florida, US	2074	497.758	29.588	3.928	33.515	5.789

Summary Statistics and Standard Errors for Proficiency in Earth Science at the Eighth Grade

Country	Sample Size	Earth Science				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	10338	521.842	6.480	1.705	8.185	2.861
Bahrain	4918	460.553	5.988	6.457	12.445	3.528
Botswana (9)	5964	368.400	6.179	3.490	9.669	3.110
Canada	8757	532.425	3.988	1.267	5.255	2.292
Chile	4849	464.041	9.049	1.369	10.418	3.228
Chinese Taipei	5711	580.830	3.804	3.398	7.202	2.684
Egypt	7822	351.216	16.086	4.741	20.827	4.564
England	4814	535.836	15.415	0.656	16.072	4.009
Georgia	4035	419.961	12.058	0.682	12.740	3.569
Hong Kong SAR	4155	557.851	17.518	0.710	18.228	4.269
Hungary	4893	521.301	12.880	2.130	15.010	3.874
Iran, Islamic Rep. of	6130	438.635	17.339	2.790	20.129	4.487
Ireland	4704	541.982	8.410	1.188	9.597	3.098
Israel	5512	492.638	13.934	1.893	15.827	3.978
Italy	4481	514.145	5.825	1.983	7.808	2.794
Japan	4745	573.941	3.372	0.702	4.073	2.018
Jordan	7865	415.842	8.334	0.872	9.206	3.034
Kazakhstan	4887	507.785	24.217	5.113	29.330	5.416
Korea, Rep. of	5309	554.368	4.424	3.073	7.496	2.738
Kuwait	4503	408.392	21.908	3.720	25.629	5.062
Lebanon	3873	365.366	28.284	13.261	41.545	6.446
Lithuania	4347	518.076	9.322	1.411	10.733	3.276
Malaysia	9726	460.456	19.807	0.750	20.557	4.534
Malta	3817	480.902	2.117	4.371	6.488	2.547
Morocco	13035	394.695	3.022	1.687	4.709	2.170
New Zealand	8142	516.666	11.422	1.603	13.025	3.609
Norway (9)	4697	522.678	9.026	2.129	11.155	3.340
Oman	8883	456.212	4.887	1.007	5.894	2.428
Qatar	5403	445.684	10.735	2.911	13.646	3.694
Russian Federation	4780	531.859	18.850	3.185	22.035	4.694
Saudi Arabia	3759	403.099	14.024	4.884	18.908	4.348
Singapore	6116	564.610	10.574	2.600	13.174	3.630
Slovenia	4257	564.497	5.897	2.322	8.219	2.867
South Africa (9)	12514	330.186	38.678	2.605	41.283	6.425

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Summary Statistics and Standard Errors for Proficiency in Earth Science at the Eighth Grade (Continued)

Country	Sample Size	Earth Science				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Sweden	4090	531.890	10.760	9.420	20.180	4.492
Thailand	6482	459.171	18.168	2.365	20.532	4.531
Turkey	6079	477.376	13.527	1.480	15.007	3.874
United Arab Emirates	18012	474.829	5.040	0.667	5.707	2.389
United States	10221	534.927	8.518	1.232	9.750	3.122
Benchmarking Participants						
Buenos Aires, Argentina	3253	388.266	23.945	6.267	30.212	5.497
Ontario, Canada	4520	526.285	5.892	4.097	9.989	3.161
Quebec, Canada	3950	542.238	15.380	1.856	17.236	4.152
Norway (8)	4795	505.612	7.364	3.095	10.459	3.234
Abu Dhabi, UAE	4838	453.136	32.202	1.645	33.848	5.818
Dubai, UAE	6149	518.058	4.084	1.030	5.114	2.261
Florida, US	2074	504.699	42.265	2.377	44.642	6.681

Summary Statistics and Standard Errors for Proficiency in Science Knowing at the Eighth Grade

Country	Sample Size	Science Knowing				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	10338	510.277	6.315	0.787	7.102	2.665
Bahrain	4918	461.543	4.330	1.941	6.271	2.504
Botswana (9)	5964	371.265	7.288	5.768	13.056	3.613
Canada	8757	518.051	4.019	1.284	5.303	2.303
Chile	4849	465.793	7.824	2.232	10.055	3.171
Chinese Taipei	5711	589.283	4.763	0.361	5.124	2.264
Egypt	7822	372.065	23.597	2.989	26.586	5.156
England	4814	522.604	14.362	2.327	16.689	4.085
Georgia	4035	452.299	7.787	3.418	11.204	3.347
Hong Kong SAR	4155	547.343	13.247	0.320	13.566	3.683
Hungary	4893	524.878	10.580	2.004	12.584	3.547
Iran, Islamic Rep. of	6130	455.479	17.562	5.058	22.620	4.756
Ireland	4704	523.041	8.089	2.111	10.200	3.194
Israel	5512	502.839	17.368	1.427	18.795	4.335
Italy	4481	504.522	4.440	2.339	6.779	2.604
Japan	4745	567.432	3.294	1.502	4.796	2.190
Jordan	7865	429.839	9.612	1.078	10.690	3.269
Kazakhstan	4887	528.643	29.684	4.466	34.150	5.844
Korea, Rep. of	5309	555.406	5.727	2.527	8.254	2.873
Kuwait	4503	414.748	24.732	2.649	27.381	5.233
Lebanon	3873	402.863	27.232	7.221	34.453	5.870
Lithuania	4347	513.288	6.658	3.025	9.683	3.112
Malaysia	9726	465.501	19.422	6.623	26.045	5.103
Malta	3817	467.620	1.906	2.697	4.603	2.145
Morocco	13035	395.053	4.443	0.832	5.274	2.297
New Zealand	8142	502.935	9.382	0.700	10.082	3.175
Norway (9)	4697	500.460	7.159	2.147	9.307	3.051
Oman	8883	454.641	6.733	1.772	8.505	2.916
Qatar	5403	447.927	9.836	3.404	13.240	3.639
Russian Federation	4780	557.704	21.680	5.756	27.436	5.238
Saudi Arabia	3759	394.906	16.147	8.517	24.665	4.966
Singapore	6116	593.708	10.867	0.531	11.398	3.376
Slovenia	4257	558.152	5.717	1.288	7.005	2.647

Summary Statistics and Standard Errors for Proficiency in Science Knowing at the Eighth Grade (Continued)

Country	Sample Size	Science Knowing				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
South Africa (9)	12514	337.332	36.168	8.084	44.253	6.652
Sweden	4090	519.440	10.338	0.221	10.559	3.249
Thailand	6482	469.375	18.163	0.267	18.430	4.293
Turkey	6079	489.160	18.151	1.736	19.887	4.459
United Arab Emirates	18012	477.869	5.243	1.008	6.250	2.500
United States	10221	531.693	8.558	2.977	11.536	3.396

Benchmarking Participants

Country	Sample Size	Science Knowing				
Buenos Aires, Argentina	3253	397.162	16.746	5.872	22.618	4.756
Ontario, Canada	4520	513.913	5.405	1.319	6.724	2.593
Quebec, Canada	3950	526.944	18.001	8.171	26.172	5.116
Norway (8)	4795	477.495	6.820	3.235	10.055	3.171
Abu Dhabi, UAE	4838	452.706	34.466	3.111	37.577	6.130
Dubai, UAE	6149	527.443	4.809	1.364	6.172	2.484
Florida, US	2074	510.677	39.222	8.212	47.434	6.887

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CHAPTER 4: ESTIMATING STANDARD ERRORS
IN THE TIMSS 2015 RESULTS
METHODS AND PROCEDURES IN TIMSS 2015   4.65

Summary Statistics and Standard Errors for Proficiency in Science Applying at the Eighth Grade

Country	Sample Size	Science Applying				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	10338	512.382	7.505	1.144	8.649	2.941
Bahrain	4918	464.206	4.518	1.026	5.544	2.355
Botswana (9)	5964	398.492	5.720	8.458	14.178	3.765
Canada	8757	525.506	3.963	0.657	4.619	2.149
Chile	4849	446.405	8.650	0.432	9.082	3.014
Chinese Taipei	5711	565.329	4.029	0.023	4.052	2.013
Egypt	7822	370.699	16.916	2.340	19.256	4.388
England	4814	538.348	14.569	0.839	15.408	3.925
Georgia	4035	442.193	7.451	2.371	9.822	3.134
Hong Kong SAR	4155	540.635	16.909	1.261	18.170	4.263
Hungary	4893	528.208	10.909	0.853	11.762	3.430
Iran, Islamic Rep. of	6130	457.321	15.148	1.079	16.227	4.028
Ireland	4704	532.615	8.398	0.803	9.201	3.033
Israel	5512	504.069	14.240	0.255	14.495	3.807
Italy	4481	496.404	4.708	0.992	5.700	2.387
Japan	4745	574.583	3.717	0.046	3.763	1.940
Jordan	7865	425.058	10.468	0.748	11.216	3.349
Kazakhstan	4887	535.440	19.436	0.711	20.147	4.489
Korea, Rep. of	5309	552.182	4.400	0.318	4.718	2.172
Kuwait	4503	406.171	26.442	0.836	27.278	5.223
Lebanon	3873	397.995	25.341	2.400	27.741	5.267
Lithuania	4347	516.603	8.238	3.277	11.515	3.393
Malaysia	9726	476.035	17.110	0.176	17.287	4.158
Malta	3817	488.950	1.817	1.291	3.107	1.763
Morocco	13035	391.251	4.479	3.213	7.693	2.774
New Zealand	8142	513.276	10.409	1.580	11.990	3.463
Norway (9)	4697	506.680	7.740	0.961	8.701	2.950
Oman	8883	453.715	6.145	2.510	8.654	2.942
Qatar	5403	459.776	9.241	3.665	12.905	3.592
Russian Federation	4780	538.399	18.675	2.313	20.988	4.581
Saudi Arabia	3759	382.860	22.347	1.825	24.172	4.917
Singapore	6116	599.992	10.857	0.450	11.307	3.363

Summary Statistics and Standard Errors for Proficiency in Science Applying at the Eighth Grade (Continued)

Country	Sample Size	Science Applying				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Slovenia	4257	547.132	4.731	0.355	5.086	2.255
South Africa (9)	12514	368.192	30.701	4.131	34.832	5.902
Sweden	4090	518.311	11.005	1.426	12.432	3.526
Thailand	6482	450.126	19.566	2.706	22.271	4.719
Turkey	6079	492.416	15.112	0.478	15.590	3.948
United Arab Emirates	18012	478.082	5.426	0.482	5.907	2.430
United States	10221	531.305	7.735	0.211	7.945	2.819
Benchmarking Participants						
Buenos Aires, Argentina	3253	379.487	16.323	4.076	20.399	4.517
Ontario, Canada	4520	525.284	5.553	0.241	5.794	2.407
Quebec, Canada	3950	524.383	18.436	2.737	21.173	4.601
Norway (8)	4795	488.010	5.551	1.389	6.940	2.634
Abu Dhabi, UAE	4838	456.756	34.141	0.713	34.854	5.904
Dubai, UAE	6149	525.103	4.064	0.966	5.030	2.243
Florida, US	2074	507.723	32.581	1.261	33.842	5.817

Summary Statistics and Standard Errors for Proficiency in Science Reasoning at the Eighth Grade

Country	Sample Size	Science Reasoning				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Australia	10338	512.502	6.782	1.036	7.818	2.796
Bahrain	4918	466.440	4.026	3.719	7.745	2.783
Botswana (9)	5964	389.532	6.022	0.803	6.826	2.613
Canada	8757	533.268	3.824	1.214	5.038	2.245
Chile	4849	448.496	10.340	2.692	13.032	3.610
Chinese Taipei	5711	560.304	3.352	0.524	3.876	1.969
Egypt	7822	358.937	17.228	6.029	23.257	4.823
England	4814	544.759	14.924	1.130	16.054	4.007
Georgia	4035	432.045	10.254	2.067	12.320	3.510
Hong Kong SAR	4155	550.173	17.366	2.012	19.378	4.402
Hungary	4893	523.833	13.016	1.629	14.644	3.827
Iran, Islamic Rep. of	6130	453.656	15.481	0.817	16.298	4.037
Ireland	4704	532.371	7.643	1.577	9.220	3.036
Israel	5512	510.667	15.799	3.362	19.161	4.377
Italy	4481	493.253	5.995	2.041	8.036	2.835
Japan	4745	570.297	3.800	0.795	4.595	2.144
Jordan	7865	419.446	10.097	2.784	12.881	3.589
Kazakhstan	4887	527.979	17.706	4.288	21.994	4.690
Korea, Rep. of	5309	560.369	4.944	2.857	7.801	2.793
Kuwait	4503	399.697	31.597	1.910	33.507	5.789
Lebanon	3873	381.408	31.156	8.538	39.694	6.300
Lithuania	4347	525.430	8.728	1.279	10.007	3.163
Malaysia	9726	467.218	14.268	0.966	15.233	3.903
Malta	3817	478.850	1.917	0.924	2.841	1.685
Morocco	13035	384.520	4.464	2.487	6.951	2.637
New Zealand	8142	519.563	8.972	1.691	10.663	3.265
Norway (9)	4697	518.288	7.859	1.243	9.101	3.017
Oman	8883	454.380	4.719	1.040	5.759	2.400
Qatar	5403	454.131	8.712	1.268	9.980	3.159
Russian Federation	4780	537.602	13.171	1.843	15.014	3.875
Saudi Arabia	3759	404.689	19.921	1.840	21.761	4.665
Singapore	6116	594.549	9.596	0.611	10.208	3.195

Summary Statistics and Standard Errors for Proficiency in Science Reasoning at the Eighth Grade (Continued)

Country	Sample Size	Science Reasoning				
		Mean Proficiency	Jackknife Sampling Variance	Imputation Variance	Total Variance	Overall Standard Error
Slovenia	4257	550.481	4.953	0.383	5.335	2.310
South Africa (9)	12514	350.432	28.924	2.520	31.444	5.607
Sweden	4090	526.400	13.981	1.822	15.804	3.975
Thailand	6482	447.305	15.927	0.466	16.393	4.049
Turkey	6079	495.298	15.803	2.014	17.817	4.221
United Arab Emirates	18012	473.129	4.836	1.051	5.887	2.426
United States	10221	526.422	7.294	0.494	7.787	2.791
Benchmarking Participants						
Buenos Aires, Argentina	3253	373.143	20.852	2.463	23.315	4.829
Ontario, Canada	4520	532.043	5.324	1.644	6.968	2.640
Quebec, Canada	3950	535.308	18.410	2.044	20.453	4.523
Norway (8)	4795	498.235	5.608	0.172	5.781	2.404
Abu Dhabi, UAE	4838	453.523	29.940	2.964	32.904	5.736
Dubai, UAE	6149	520.652	3.792	0.227	4.018	2.005
Florida, US	2074	505.606	34.480	6.416	40.896	6.395