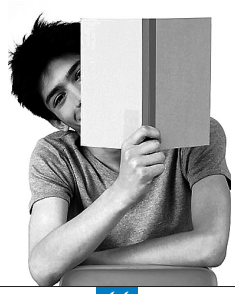

11

Sampling Outcomes

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This chapter reports on PISA sampling outcomes. Details of the sample design are given in Chapter 4.

Table 11.1 shows the various quality indicators for population coverage and the various pieces of information used to derive them. The following notes explain the meaning of each coverage index and how the data in each column of the table were used.

Indices 1, 2 and 3 are intended to measure PISA population coverage. Indices 4 and 5 are intended to be diagnostic in cases where indices 1, 2 or 3 have unexpected values. Many references are made in this chapter to the various sampling forms on which NPMs documented statistics and other information needed in undertaking the sampling.

Index 1: Coverage of the national population, calculated by $P/(P+E) \times 3[c]/3[a]$:

- The national population (NP), defined by sampling form 3 response box [a] and denoted here as 3[a] (and in Table 11.1 as target populationis the population that includes all enrolled 15-year-olds in grades 7 and above in each country (with the possibility of small levels of exclusions), based on national statistics. However, the final NP reflected on each country's school sampling frame might have had some school-level exclusions. The value that represents the population of enrolled 15-year-olds minus those in excluded schools is represented initially by response box [c] on sampling form 3. It is denoted here as 3[c]. As in PISA 2003, the procedure for PISA 2006 was that very small schools having only one or two eligible students could not be excluded from the school frame but could be excluded in the field if they still had exactly only one or two eligible students at the time of data collection. Therefore, what is noted in index 1 as 3[c] (and in Table 11.1 as target minus school level exclusions is a number that excludes schools excluded from the sampling frame in addition to those schools excluded in the field. Thus, the term 3[c]/3[a] provides the proportion of the NP covered in each country based on national statistics;
- The value ($P+E$) provides the weighted estimate from the student sample of all eligible 15-year-olds in each country, where P is the weighted estimate of eligible non-excluded 15-year-olds and E is the weighted estimate of eligible 15-year-olds that were excluded within schools. Therefore, the term $P/(P+E)$ provides an estimate, based on the student sample, of the proportion of the eligible 15-year-old population represented by the non-excluded eligible 15-year-olds;
- Thus the result of multiplying these two proportions together (3[c]/3[a] and $P/(P+E)$) indicates the overall proportion of the NP covered by the non-excluded portion of the student sample.

Index 2: Coverage of the national enrolled population, calculated by $P/(P+E) \times 3[c]/2[b]$:

- The national enrolled population (NEP), defined by sampling form 2 response box [b] and denoted here as 2[b] (and as enrolled 15-year-oldsin Table 11.1), is the population that includes all enrolled 15-year-olds in grades 7 and above in each country, based on national statistics. The final NP, denoted here as 3[c] as described above for coverage index 1, reflects the 15- year-old population after school-level and other small exclusions. This value represents the population of enrolled 15-year-olds less those in excluded schools;
- The value ($P+E$) provides the weighted estimate from the student sample of all eligible 15-year-olds in each country, where P is the weighted estimate of eligible non-excluded 15-year-olds and E is the weighted estimate of eligible 15-year-olds that were excluded within schools. Therefore, the term $P/(P+E)$ provides an estimate based on the student sample of the proportion of the eligible 15-year-old population that is represented by the non-excluded eligible 15-year-olds;
- Multiplying these two proportions together (3[c]/2[b] and $P/(P+E)$) gives the overall proportion of the NEP that is covered by the non-excluded portion of the student sample.

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Index 1 shows the extent to which the weighted participants cover the final target population after all school exclusions.

Index 2 shows the extent to which the weighted participants cover the target population of all enrolled students in grades 7 and above.

Index 1 and Index 2 will differ when countries have excluded geographical areas or language groups apart from other school level exclusions.

Index 3: Coverage of the national 15-year-old population, calculated by *P*/2[a]:

- The national population of 15-year-olds, defined by sampling form 2 response box [a] and denoted here as 2[a] (and called all 15-year-oldsin Table 11.1, is the entire population of 15-year-olds in each country (enrolled and not enrolled), based on national statistics. The value *P* is the weighted estimate of eligible non-excluded 15-year-olds from the student sample. Thus *P*/2[a] indicates the proportion of the national population of 15-year-olds covered by the non-excluded portion of the student sample;

Index 4: Coverage of the estimated school population, calculated by (*P*+*E*)/*S:*

- The value (*P*+*E*) provides the weighted estimate from the student sample of all eligible 15-year-olds in each country, where *P* is the weighted estimate of eligible non-excluded 15-year-olds and *E* is the weighted estimate of eligible 15-year-olds who were excluded within schools;
- The value *S* is an estimate of the 15-year-old school population in each country (called estimate of enrolled students on frame in Table 11.1). This is based on the actual or (more often) approximate number of 15-year-olds enrolled in each school in the sample, prior to contacting the school to conduct the assessment. The *S* value is calculated as the sum over all sampled schools of the product of each school's sampling weight and its number of 15-year-olds (*ENR*) as recorded on the school sampling frame. In the infrequent case where the *ENR* value was not available, the number of 15-year-olds from the student tracking form was used;
- Thus, (*P*+*E*)/*S* is the proportion of the estimated school 15-year-old population that is represented by the weighted estimate from the student sample of all eligible 15-year-olds. Its purpose is to check whether the student sampling has been carried out correctly, and to assess whether the value of *S* is a reliable measure of the number of enrolled 15-year-olds. This is important for interpreting Index 5.

Index 5: Coverage of the school sampling frame population, calculated by *S*/3[c]:

- The value *S*/3[c] is the ratio of the enrolled 15-year-old population, as estimated from data on the school sampling frame, to the size of the enrolled student population, as reported on sampling form 3 and adjusted by removing any additional excluded schools in the field. In some cases, this provides a check as to whether the data on the sampling frame give a reliable estimate of the number of 15-year-olds in each school. In other cases, however, it is evident that 3[c] has been derived using data from the sampling frame by the National Project Manager, so that this ratio may be close to 1.0 even if enrolment data on the school sampling frame are poor. Under such circumstances, Index 4 will differ noticeably from 1.0, and the figure for 3[c] will also be inaccurate.

Tables 11.2, 11.3, 11.4 present school and student-level response rates.

Table 11.2 indicates the rates calculated by using only original schools and no replacement schools. Table 11.3 indicates the improved response rates when first and second replacement schools were accounted for in the rates. Table 11.4 indicates the student response rates among the full set of participating schools.

Table 11.1 [Part 1/3]
Sampling and coverage rates

		All 15-year-olds	Enrolled 15-year-olds	Target population	School level exclusions	Target minus school level exclusions	% school level exclusions	Estimate of enrolled students on frame	Participants		Excluded	
									Actual	Weighted	Actual	Weighted
OECD	Australia	270 115	256 754	255 554	1 371	254 183	0.54	251 221.74	14 170	234 939.52	234	2 934.61
	Austria	97 337	92 149	92 149	401	91 748	0.43	92 606.34	4 927	89 925.11	94	1 585.63
	Belgium	124 943	124 557	124 216	2 957	121 259	2.38	123 596.62	8 857	123 161.45	28	401.21
	Belgium-Flanders	69 650	68 662	68 321	1 201	67 120	1.76	67 048.31	5 124	69 409.16	16	214.53
	Canada	426 967	428 876	424 238	5 141	419 097	1.21	418 565.11	22 646	370 879.36	1 681	20 339.28
	Czech Republic	127 748	124 764	124 764	1 124	123 640	0.90	125 258.79	5 932	128 827.19	8	202.51
	Denmark	66 989	65 984	65 984	1 871	64 113	2.84	57 156.10	4 532	57 012.63	170	1 960.32
	Finland	66 232	66 232	66 232	1 257	64 975	1.90	65 085.51	4 714	61 386.99	135	1 649.63
	France	809 375	809 375	777 194	19 397	757 797	2.50	757 511.93	4 716	739 428.06	28	3 876.20
	Germany	951 535	1 062 920	1 062 920	6 009	1 056 911	0.57	950 350.10	4 891	903 512.45	37	6 016.55
	Greece	107 505	110 663	110 663	640	110 023	0.58	104 827.25	4 873	96 411.69	65	1 396.91
	Hungary	124 444	120 061	120 061	3 230	116 831	2.69	114 424.54	4 490	106 010.05	31	1 103.26
	Ireland	58 667	57 648	57 510	50	57 460	0.09	57 245.39	4 585	55 114.26	93	937.20
	Italy	578 131	639 971	639 971	16	639 955	0.00	623 569.70	21 773	520 055.20	363	8 984.12
	Italy-Basilicata	7 071	8 404	8 404	0	8 404	0.00	7 736.12	1 507	6 422.46	9	41.91
	Italy-Bolzano	5 314	5 116	5 116	0	5 116	0.00	4 917.44	2 084	4 654.76	28	56.81
	Italy-Campania	76 596	80 108	80 108	0	80 108	0.00	79 658.99	1 406	67 443.20	9	323.03
	Italy-Emilia Romagna	31 879	35 926	35 926	0	35 926	0.00	35 160.37	1 531	29 500.54	34	569.50
	Italy-Friuli Venezia Giulia	9 312	10 277	10 277	0	10 277	0.00	10 123.28	1 578	8 534.10	15	84.38
	Italy-Liguria	11 739	13 839	13 839	16	13 823	0.12	13 061.63	1 753	11 747.49	45	222.09
	Italy-Lombardia	81 088	89 897	89 897	0	89 897	0.00	88 462.73	1 524	69 524.95	40	1 913.41
	Italy-Piemonte	35 309	39 070	39 070	0	39 070	0.00	38 250.67	1 478	34 069.59	31	717.74
	Italy-Puglia	48 518	50 168	50 168	0	50 168	0.00	48 922.23	1 540	45 333.52	10	351.27
	Italy-Sardegna	17 297	19 564	19 564	0	19 564	0.00	19 280.96	1 390	16 136.50	16	218.57
	Italy-Sicilia	63 369	68 146	68 146	0	68 146	0.00	66 178.54	1 354	54 116.13	28	1 135.19
	Italy-Trento	4 821	5 653	5 653	0	5 653	0.00	5 391.76	1 757	4 316.52	42	71.45
	Italy-Veneto	41 926	49 511	49 511	0	49 511	0.00	48 677.17	1 530	40 070.67	34	852.25
	Japan	1 246 207	1 222 171	1 222 171	16 604	1 205 567	1.36	1 182 687.63	5 952	1 113 700.93	0	0.00
	Korea	660 812	627 868	627 868	3 461	624 407	0.55	576 636.64	5 176	576 669.37	4	624.93
	Luxembourg	4 595	4 595	4 595	0	4 595	0.00	4 955.00	4 567	4 733.00	193	193.00
	Mexico	2 200 916	1 383 364	1 383 364	0	1 383 364	0.00	1 342 897.79	30 971	1 190 420.04	49	3 217.25
	Netherlands	197 046	193 769	193 769	57	193 712	0.03	199 533.05	4 871	189 575.82	7	226.95
	New Zealand	63 800	59 341	59 341	451	58 890	0.76	59 089.52	4 823	53 397.58	222	2 134.96
	Norway	61 708	61 449	61 373	412	60 961	0.67	60 368.65	4 692	59 884.49	156	1 764.49
	Poland	549 000	546 000	546 000	10 400	535 600	1.90	532 060.81	5 547	515 992.95	18	1 684.94
	Portugal	115 426	100 816	100 816	0	100 816	0.00	99 961.25	5 109	90 078.87	112	1 889.87
	Slovak Republic	79 989	78 427	78 427	1 355	77 072	1.73	76 671.38	4 731	76 200.83	11	193.02
	Spain	439 415	436 885	436 885	3 930	432 955	0.90	423 903.57	19 604	381 685.95	557	10 386.16
	Spain-La Rioja	2 737	2 619	2 619	11	2 608	0.42	2 641.00	1 333	2 494.35	56	107.08
	Spain-Basque Country	16 820	17 967	17 967	42	17 925	0.23	15 753.72	3 929	14 706.61	81	294.97
	Spain-Navarra	5 298	4 903	4 903	20	4 883	0.41	4 952.20	1 590	4 677.66	37	98.12
	Spain-Galicia	24 269	26 420	26 420	90	26 330	0.34	23 724.51	1 573	22 577.66	32	445.25
	Spain-Catalonia	63 240	61 491	61 491	683	60 808	1.11	61 213.50	1 527	56 987.17	62	2 147.44
	Spain-Castilla y Leon	22 011	24 089	24 089	111	23 978	0.46	21 852.57	1 512	19 697.15	64	784.65
	Spain-Cantabria	4 912	5 215	5 215	25	5 190	0.48	4 751.33	1 496	4 534.16	56	154.06
	Spain-Asturias	8 101	9 484	9 484	32	9 452	0.34	7 983.50	1 579	7 593.57	39	200.23
	Spain-Aragon	11 112	11 150	11 150	67	11 083	0.60	10 594.50	1 526	9 467.26	37	193.67
	Spain-Andalucia	93 709	93 188	93 188	335	92 853	0.36	90 552.40	1 463	81 437.14	29	1 444.61
	Sweden	129 734	127 036	127 036	2 330	124 706	1.83	127 133.27	4 443	126 392.73	122	3 470.95
	Switzerland	87 766	86 108	86 108	2 130	83 978	2.47	81 660.28	12 193	89 650.91	186	842.40
	Turkey	1 423 514	800 968	782 875	970	781 905	0.12	796 371.42	4 942	665 477.29	1	130.38
	United Kingdom	779 076	767 248	767 248	12 879	754 369	1.68	748 795.67	13 152	732 003.69	229	12 032.64
	United Kingdom-Scotland	63 245	63 087	63 087	867	62 220	1.37	63 655.81	2 444	57 332.35	95	1 691.42
	United States	4 192 939	4 192 939	4 192 939	19 710	4 173 229	0.47	3 901 130.57	5 611	3 578 039.60	254	142 517.21

Table 11.1 [Part 2/3]
Sampling and coverage rates

		Ineligible		Eligible		Within school exclusions (%)[1]	Overall exclusions (%)	Ineligible (%)	Coverage Indices				
		Actual	Weighted	Actual	Weighted				1	2	3	4	5
OECD	Australia	877	9 737.48	17 062	237 874.13	1.23	1.76	4.09	0.98	0.98	0.87	0.95	0.99
	Austria	197	3 103.30	5 642	91 510.74	1.73	2.16	3.39	0.98	0.98	0.92	0.99	1.01
	Belgium	134	2 966.90	9 520	123 562.66	0.32	2.70	2.40	0.97	0.97	0.99	1.00	1.02
	Belgium-Flanders	64	813.51	5 429	69 623.69	0.31	2.06	1.17	0.98	0.97	1.00	1.04	1.00
	Canada	1 715	23 784.08	29 143	391 218.64	5.20	6.35	6.08	0.94	0.93	0.87	0.93	1.00
	Czech Republic	42	895.68	6 583	129 029.70	0.16	1.06	0.69	0.99	0.99	1.01	1.03	1.01
	Denmark	126	1 433.58	5 255	58 972.95	3.32	6.07	2.43	0.94	0.94	0.85	1.03	0.89
	Finland	48	588.79	5 217	63 036.62	2.62	4.47	0.93	0.96	0.96	0.93	0.97	1.00
	France	87	12 158.23	5 326	743 304.26	0.52	3.00	1.64	0.97	0.93	0.91	0.98	1.00
	Germany	65	10 781.53	5 353	909 529.01	0.66	1.22	1.19	0.99	0.99	0.95	0.96	0.90
	Greece	69	1 477.14	5 186	97 808.60	1.43	2.00	1.51	0.98	0.98	0.90	0.93	0.95
	Hungary	93	2 233.76	4 854	107 113.31	1.03	3.69	2.09	0.96	0.96	0.85	0.94	0.98
	Ireland	118	1 206.67	5 562	56 051.46	1.67	1.76	2.15	0.98	0.98	0.94	0.98	1.00
	Italy	814	20 363.44	23 874	529 039.32	1.70	1.70	3.85	0.98	0.98	0.90	0.85	0.97
	Italy-Basilicata	49	186.44	1 615	6 464.37	0.65	0.65	2.88	0.99	0.99	0.91	0.84	0.92
	Italy-Bolzano	48	109.53	2 244	4 711.57	1.21	1.21	2.32	0.99	0.99	0.88	0.96	0.96
	Italy-Campania	106	4 406.00	1 561	67 766.23	0.48	0.48	6.50	1.00	1.00	0.88	0.85	0.99
	Italy-Emilia Romagna	32	598.93	1 673	30 070.05	1.89	1.89	1.99	0.98	0.98	0.93	0.86	0.98
	Italy-Friuli Venezia Giulia	29	157.17	1 689	8 618.48	0.98	0.98	1.82	0.99	0.99	0.92	0.85	0.99
	Italy-Liguria	69	392.05	1 960	11 969.57	1.86	1.97	3.28	0.98	0.98	1.00	0.92	0.94
	Italy-Lombardia	49	1 768.57	1 681	71 438.37	2.68	2.68	2.48	0.97	0.97	0.86	0.81	0.98
	Italy-Piemonte	30	574.96	1 611	34 787.33	2.06	2.06	1.65	0.98	0.98	0.96	0.91	0.98
	Italy-Puglia	64	1 563.12	1 660	45 684.79	0.77	0.77	3.42	0.99	0.99	0.93	0.93	0.98
	Italy-Sardegna	69	710.73	1 585	16 355.07	1.34	1.34	4.35	0.99	0.99	0.93	0.85	0.99
	Italy-Sicilia	135	4 774.93	1 544	55 251.32	2.05	2.05	8.64	0.98	0.98	0.85	0.83	0.97
	Italy-Trento	52	104.17	1 913	4 387.97	1.63	1.63	2.37	0.98	0.98	0.90	0.81	0.95
	Italy-Veneto	47	1 448.70	1 638	40 922.92	2.08	2.08	3.54	0.98	0.98	0.96	0.84	0.98
	Japan	408	75 104.30	5 971	1 113 700.93	0.00	1.36	6.74	0.99	0.99	0.89	0.94	0.98
	Korea	44	4 915.09	5 233	577 294.30	0.11	0.66	0.85	0.99	0.99	0.87	1.00	0.92
	Luxembourg	29	29.00	4 926	4 926.00	3.92	3.92	0.59	0.96	0.96	1.03	0.99	1.08
	Mexico	4 623	166 614.35	32 409	1 193 637.29	0.27	0.27	13.96	1.00	1.00	0.54	0.89	0.97
	Netherlands	89	3 738.26	5 437	189 802.77	0.12	0.15	1.97	1.00	1.00	0.96	0.95	1.03
	New Zealand	299	2 847.56	5 757	55 532.54	3.84	4.58	5.13	0.95	0.95	0.84	0.94	1.00
	Norway	30	333.93	5 501	61 648.98	2.86	3.51	0.54	0.96	0.96	0.97	1.02	0.99
	Poland	20	1 568.40	6 092	517 677.89	0.33	2.22	0.30	0.98	0.98	0.94	0.97	0.99
	Portugal	362	5 696.82	6 013	91 968.74	2.05	2.05	6.19	0.98	0.98	0.78	0.92	0.99
	Slovak Republic	40	622.22	5 112	76 393.85	0.25	1.98	0.81	0.98	0.98	0.95	1.00	0.99
	Spain	273	4 821.40	21 885	392 072.12	2.65	3.52	1.23	0.96	0.96	0.87	0.92	0.98
	Spain-La Rioja	13	22.58	1 530	2 601.42	4.12	4.52	0.87	0.95	0.95	0.91	0.99	1.01
	Spain-Basque Country	77	286.27	4 164	15 001.58	1.97	2.20	1.91	0.98	0.98	0.87	0.95	0.88
	Spain-Navarra	14	43.20	1 734	4 775.78	2.05	2.45	0.90	0.98	0.98	0.88	0.96	1.01
	Spain-Galicia	24	328.18	1 704	23 022.91	1.93	2.27	1.43	0.98	0.98	0.93	0.97	0.90
	Spain-Catalonia	21	706.33	1 726	59 134.61	3.63	4.70	1.19	0.95	0.95	0.90	0.97	1.01
	Spain-Castilla y Leon	22	273.33	1 700	20 481.81	3.83	4.27	1.33	0.96	0.96	0.89	0.94	0.91
	Spain-Cantabria	26	72.12	1 692	4 688.22	3.29	3.75	1.54	0.96	0.96	0.92	0.99	0.92
	Spain-Asturias	18	83.33	1 747	7 793.80	2.57	2.90	1.07	0.97	0.97	0.94	0.98	0.84
	Spain-Aragon	13	71.65	1 695	9 660.93	2.00	2.59	0.74	0.97	0.97	0.85	0.91	0.96
	Spain-Andalucia	11	526.36	1 713	82 881.75	1.74	2.10	0.64	0.98	0.98	0.87	0.92	0.98
	Sweden	33	913.64	4 973	129 863.68	2.67	4.46	0.70	0.96	0.96	0.97	1.02	1.02
	Switzerland	217	1 679.68	12 966	90 493.30	0.93	3.38	1.86	0.97	0.97	1.02	1.11	0.97
	Turkey	216	33 457.71	5 058	665 607.67	0.02	0.14	5.03	1.00	0.98	0.47	0.84	1.02
	United Kingdom	712	31 732.72	15 668	744 036.34	1.62	3.27	4.26	0.97	0.97	0.94	0.99	0.99
	United Kingdom-Scotland	145	2 657.62	3 255	59 023.77	2.87	4.20	4.50	0.96	0.96	0.91	0.93	1.02
	United States	363	228 369.18	6 433	3 720 556.81	3.83	4.28	6.14	0.96	0.96	0.85	0.95	0.93

1. Code 4 within-school exclusion is defined as students with dyslexia in Greece, Ireland and Poland, as students with dyslexia/-calculi in Denmark, as students with partial skills deficiencies (dyslexia, dysgraphia, etc.) in Hungary, as Maori students in immersion or bilingual programs in New Zealand, and for Lithuania, it includes all exclusions that were not coded to a specific exclusion category.

Table 11.1 [Part 3/3]
Sampling and coverage rates

		All 15-year-olds	Enrolled 15-year-olds	Target population	School level exclusions	Target minus school level exclusions	% school level exclusions	Estimate of enrolled students on frame	Participants		Excluded	
									Actual	Weighted	Actual	Weighted
Partners	Argentina	662 686	579 222	579 222	2 393	576 829	0.41	576 124.51	4 339	523 047.82	4	635.69
	Azerbaijan	139 119	139 119	131 235	780	130 455	0.59	130 422.82	5 184	122 208.40	0	0.00
	Brazil	3 390 471	2 374 044	2 357 355	0	2 357 355	0.00	2 347 345.55	9 295	1 875 461.15	19	6 437.58
	Bulgaria	89 751	88 071	88 071	1 733	86 338	1.97	83 281.35	4 498	74 325.71	0	0.00
	Chile	299 426	255 459	255 393	2 284	253 109	0.89	249 370.28	5 235	233 526.11	28	1 259.24
	Colombia	897 477	543 630	543 630	2 814	540 816	0.52	535 165.71	4 478	537 262.21	2	185.59
	Croatia	54 500	51 318	51 318	548	50 770	1.07	48 768.42	5 213	46 522.57	38	381.58
	Estonia	19 871	19 623	19 623	569	19 054	2.90	19 267.17	4 865	18 662.26	50	208.37
	Hong Kong-China	77 398	75 542	75 542	678	74 864	0.90	76 956.04	4 645	75 144.65	1	20.89
	Indonesia	4 238 600	3 119 393	2 983 254	9 388	2 973 866	0.31	2 256 019.14	10 647	2 248 313.41	0	0.00
	Israel	122 626	109 370	109 370	1 770	107 600	1.62	105 941.21	4 584	93 346.84	72	1 338.74
	Jordan	138 026	126 708	126 708	0	126 708	0.00	99 088.50	6 509	90 266.78	73	1 041.92
	Kyrgyzstan	128 810	94 922	92 109	1 617	90 492	1.76	90 239.71	5 904	80 674.46	42	521.05
	Latvia	34 277	33 659	33 534	932	32 602	2.78	32 531.65	4 719	29 231.86	26	129.60
	Liechtenstein	422	362	362	0	362	0.00	362.00	339	353.00	3	3.00
	Lithuania	53 931	51 808	51 761	613	51 148	1.18	50 584.35	4 744	50 329.08	28	263.81
	Montenegro	9 190	8 973	8 973	155	8 818	1.72	7 780.00	4 455	7 733.55	0	0.00
	Qatar	8 053	7 865	7 865	0	7 865	0.00	7 407.00	6 265	7 271.34	3	3.13
	Romania	341 181	241 890	240 661	2 943	237 718	1.22	231 532.75	5 118	223 887.02	0	0.00
	Russian Federation	2 243 924	2 077 231	2 077 231	43 425	2 033 806	2.09	1 848 221.08	5 799	1 810 855.92	60	20 576.00
	Serbia	88 584	80 692	80 692	1 811	78 881	2.24	77 568.27	4 798	73 906.69	6	86.07
	Slovenia	23 431	23 018	23 018	228	22 790	0.99	22 565.26	6 595	20 595.17	45	98.43
	Thailand	895 924	727 860	727 860	7 234	720 626	0.99	721 962.51	6 192	644 124.69	5	352.67
	Tunisia	153 331	153 331	153 331	0	153 331	0.00	153 009.06	4 640	138 491.18	2	51.68
	Uruguay	52 119	40 815	40 815	97	40 718	0.24	39 854.48	4 839	36 011.48	5	38.90

		Ineligible		Eligible		Within school exclusions (%)[1]	Overall exclusions (%)	Ineligible (%)	Coverage Indices				
		Actual	Weighted	Actual	Weighted				1	2	3	4	5
Partners	Argentina	259	27 533.89	4 963	523 683.51	0.12	0.53	5.26	0.99	0.99	0.79	0.91	1.00
	Azerbaijan	27	766.03	5 284	122 208.40	0.00	0.59	0.63	0.99	0.94	0.88	0.94	1.00
	Brazil	1 108	216 215.00	10 554	1 881 898.74	0.34	0.34	11.49	1.00	0.99	0.55	0.80	1.00
	Bulgaria	157	2 786.41	4 768	74 325.71	0.00	1.97	3.75	0.98	0.98	0.83	0.89	0.96
	Chile	209	8 451.50	5 615	234 785.34	0.54	1.43	3.60	0.99	0.99	0.78	0.94	0.99
	Colombia	202	26 549.37	4 789	537 447.80	0.03	0.55	4.94	0.99	0.99	0.60	1.00	0.99
	Croatia	72	595.97	5 493	46 904.15	0.81	1.87	1.27	0.98	0.98	0.85	0.96	0.96
	Estonia	63	276.44	5 169	18 870.63	1.10	3.97	1.46	0.96	0.96	0.94	0.98	1.01
	Hong Kong-China	36	617.57	5 074	75 165.54	0.03	0.93	0.82	0.99	0.99	0.97	0.98	1.03
	Indonesia	324	57 333.01	10 918	2 248 313.41	0.00	0.31	2.55	1.00	0.95	0.53	1.00	0.76
	Israel	423	7 984.81	5 130	94 685.58	1.41	3.01	8.43	0.97	0.97	0.76	0.89	0.98
	Jordan	222	2 855.45	6 864	91 308.70	1.14	1.14	3.13	0.99	0.99	0.65	0.92	0.78
	Kyrgyzstan	197	2 439.28	6 116	81 195.51	0.64	2.39	3.00	0.98	0.95	0.63	0.90	1.00
	Latvia	261	1 622.62	4 911	29 361.46	0.44	3.21	5.53	0.97	0.96	0.85	0.90	1.00
	Liechtenstein	2	2.00	356	356.00	0.84	0.84	0.56	0.99	0.99	0.84	0.98	1.00
	Lithuania	63	592.92	5 089	50 592.89	0.52	1.70	1.17	0.98	0.98	0.93	1.00	0.99
	Montenegro	41	46.45	4 951	7 733.55	0.00	1.72	0.60	0.98	0.98	0.84	0.99	0.88
	Qatar	158	158.53	7 219	7 274.47	0.04	0.04	2.18	1.00	1.00	0.90	0.98	0.94
	Romania	49	3 950.23	5 129	223 887.02	0.00	1.22	1.76	0.99	0.98	0.66	0.97	0.97
	Russian Federation	57	14 435.05	6 096	1 831 431.92	1.12	3.19	0.79	0.97	0.97	0.81	0.99	0.91
	Serbia	204	2 944.59	5 118	73 992.75	0.12	2.36	3.98	0.98	0.98	0.83	0.95	0.98
	Slovenia	168	422.74	7 288	20 693.60	0.48	1.46	2.04	0.99	0.99	0.88	0.92	0.99
	Thailand	199	22 914.23	6 271	644 477.36	0.05	1.05	3.56	0.99	0.99	0.72	0.89	1.00
	Tunisia	249	6 567.81	4 907	138 542.86	0.04	0.04	4.74	1.00	1.00	0.90	0.91	1.00
	Uruguay	462	3 395.56	5 550	36 050.38	0.11	0.34	9.42	1.00	1.00	0.69	0.90	0.98

1. Code 4 within-school exclusion is defined as students with dyslexia in Greece, Ireland and Poland, as students with dyslexia/-calculi in Denmark, as students with partial skills deficiencies (dyslexia, dysgraphia, etc.) in Hungary, as Maori students in immersion or bilingual programs in New Zealand, and for Lithuania, it includes all exclusions that were not coded to a specific exclusion category.

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For calculating school response rates before replacement, the numerator consisted of all original sample schools with enrolled age-eligible students who participated (*i.e.*, assessed a sample of eligible students, and obtained a student response rate of at least 50%). The denominator consisted of all the schools in the numerator, plus those original sample schools with enrolled age-eligible students that either did not participate or failed to assess at least 50% of eligible sample students. Schools that were included in the sampling frame, but were found to have no age-eligible students, or which were excluded in the field were omitted from the calculation of response rates. Replacement schools do not figure in these calculations.

For calculating school response rates after replacement, the numerator consisted of all sampled schools (original plus replacement) with enrolled age-eligible students that participated (*i.e.* assessed a sample of eligible students and obtained a student response rate of at least 50%). The denominator consisted of all the schools in the numerator, plus those original sample schools that had age eligible students enrolled, but that failed to assess at least 50% of eligible sample students and for which no replacement school participated. Schools that were included in the sampling frame, but were found to contain no age-eligible students, were omitted from the calculation of response rates. Replacement schools were included in rates only when they participated, and were replacing a refusing school that had age-eligible students.

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

With the use of probability proportional-to-size sampling, in countries with few certainty school selections and no over-sampling or under-sampling of any explicit strata, weighted and unweighted rates are very similar. The weighted school response rate before replacement is given by the formula:

11.1

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

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

The weighted school response rate, after replacement, is given by the formula:

11.2

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

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

For unweighted student response rates, the numerator is the number of students for whom assessment data were included in the results less those in schools with between 25 and 50% student participation.

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Table 11.2 [Part 1/2]
School response rates before replacement

		Weighted school Participation Rate Before Replacement (%)	Weighted Number of Responding schools (Weighted also by enrolment)	Weighted Number of schools Sampled (responding + non-responding) (Weighted also by enrolment)	Unweighted school Participation Rate Before Replacement (%)	Number of Responding schools (Unweighted)	Number of Responding and Non-responding schools (Unweighted)
OECD	Australia	98.40	247 211.55	251 221.74	98.03	349	356
	Austria	98.77	91 471.27	92 606.34	97.04	197	203
	Belgium	81.54	100 784.59	123 596.62	81.94	236	288
	Belgium-Flanders	80.01	53 646.19	67 048.31	79.66	141	177
	Canada	83.20	348 247.71	418 565.11	90.33	850	941
	Czech Republic	72.87	91 280.51	125 258.79	75.00	198	264
	Denmark	87.24	49 864.90	57 156.10	86.70	189	218
	Finland	100.00	65 085.51	65 085.51	100.00	155	155
	France	96.68	732 365.76	757 511.93	95.72	179	187
	Germany	98.15	932 815.38	950 350.10	98.24	223	227
	Greece	92.51	96 973.38	104 827.25	91.67	176	192
	Hungary	94.70	108 354.48	114 424.54	95.24	180	189
	Iceland	98.35	4 819.00	4 900.00	89.40	135	151
	Ireland	100.00	57 245.39	57 245.39	100.00	164	164
	Italy	90.53	564 533.15	623 569.70	86.16	753	874
	Italy-Basilicata	99.61	7 706.00	7 736.12	93.22	55	59
	Italy-Bolzano	97.71	4 804.93	4 917.44	88.30	83	94
	Italy-Campania	89.21	71 059.88	79 658.99	84.21	48	57
	Italy-Emilia Romagna	96.32	33 865.72	35 160.37	86.21	50	58
	Italy-Friuli Venezia Giulia	86.80	8 786.77	10 123.28	76.81	53	69
	Italy-Liguria	91.84	11 995.37	13 061.63	93.33	70	75
	Italy-Lombardia	88.85	78 600.94	88 462.73	84.21	48	57
	Italy-Piemonte	89.19	34 117.12	38 250.67	81.03	47	58
	Italy-Puglia	91.40	44 715.50	48 922.23	90.57	48	53
	Italy-Sardegna	86.72	16 721.14	19 280.96	83.33	50	60
	Italy-Sicilia	84.93	56 204.80	66 178.54	83.05	49	59
	Italy-Trento	97.25	5 243.68	5 391.76	90.91	60	66
	Italy-Veneto	93.80	45 659.09	48 677.17	87.72	50	57
	Japan	87.27	1 032 151.56	1 182 687.63	87.24	171	196
	Korea	99.24	572 255.97	576 636.64	98.71	153	155
	Luxembourg	100.00	4 955.00	4 955.00	100.00	31	31
	Mexico	95.46	1 281 866.56	1 342 897.79	94.17	1115	1184
	Netherlands	75.70	151 038.94	199 533.05	75.26	146	194
	New Zealand	91.69	54 181.69	59 089.52	90.50	162	179
	Norway	90.47	54 613.10	60 368.65	90.61	193	213
	Poland	95.41	507 650.90	532 060.81	94.14	209	222
	Portugal	94.87	94 835.05	99 961.25	94.83	165	174
	Slovak Republic	92.42	70 860.20	76 671.38	89.47	170	190
	Spain	98.26	416 538.81	423 903.57	99.42	682	686
	Spain-La Rioja	100.00	2 641.00	2 641.00	100.00	45	45
	Spain-Basque Country	100.00	15 753.72	15 753.72	100.00	151	151
	Spain-Navarra	100.00	4 952.20	4 952.20	100.00	52	52
	Spain-Galicia	100.00	23 724.51	23 724.51	100.00	53	53
	Spain-Catalonia	95.99	58 759.14	61 213.50	96.08	49	51
	Spain-Castilla y Leon	100.00	21 852.57	21 852.57	100.00	52	52
	Spain-Cantabria	100.00	4 751.33	4 751.33	100.00	53	53
	Spain-Asturias	100.00	7 983.50	7 983.50	100.00	53	53
	Spain-Aragon	100.00	10 594.50	10 594.50	100.00	51	51
	Spain-Andalucia	100.00	90 552.40	90 552.40	100.00	51	51
	Sweden	99.59	126 611.35	127 133.27	99.00	197	199
	Switzerland	95.44	77 940.45	81 660.28	96.88	496	512
	Turkey	97.16	773 776.70	796 371.42	96.88	155	160
	United Kingdom	76.05	569 438.45	748 795.67	74.79	439	587
	United Kingdom-Scotland	63.61	40 491.76	63 655.81	63.63	70	110
	United States	68.95	2 689 741.31	3 901 130.57	69.38	145	209

Table 11.2 [Part 2/2]
School response rates before replacement

		Weighted school Participation Rate Before Replacement (%)	Weighted Number of Responding schools (Weighted also by enrolment)	Weighted Number of schools Sampled (responding + non-responding) (Weighted also by enrolment)	Unweighted school Participation Rate Before Replacement (%)	Number of Responding schools (Unweighted)	Number of Responding and Non-responding schools (Unweighted)
Partners	Argentina	95.08	547 775.36	576 124.51	93.85	168	179
	Azerbaijan	94.86	123 717.99	130 422.82	94.77	163	172
	Brazil	98.01	2 300 529.53	2 347 345.55	96.34	606	629
	Bulgaria	98.76	82 248.09	83 281.35	98.89	178	180
	Chile	83.08	207 182.85	249 370.28	82.14	161	196
	Colombia	93.53	500 566.82	535 165.71	92.22	154	167
	Croatia	98.59	48 080.63	48 768.42	97.55	159	163
	Estonia	98.98	19 070.50	19 267.17	98.82	167	169
	Hong Kong-China	68.57	52 768.08	76 956.04	67.95	106	156
	Indonesia	99.72	2 249 727.84	2 256 019.14	99.15	349	352
	Israel	89.89	95 231.11	105 941.21	83.23	139	167
	Jordan	100.00	99 088.50	99 088.50	100.00	210	210
	Kyrgyzstan	99.58	89 863.21	90 239.71	99.50	200	201
	Latvia	97.57	31 740.22	32 531.65	97.71	171	175
	Liechtenstein	100.00	362.00	362.00	100.00	12	12
	Lithuania	96.85	48 988.90	50 584.35	96.45	190	197
	Montenegro	94.64	7 363.00	7 780.00	96.08	49	51
	Qatar	98.02	7 260.00	7 407.00	93.43	128	137
	Romania	100.00	231 532.75	231 532.75	100.00	174	174
	Russian Federation	100.00	1 848 221.08	1 848 221.08	100.00	209	209
	Serbia	98.67	76 533.75	77 568.27	98.16	160	163
	Slovenia	97.42	21 983.00	22 565.26	97.26	355	365
	Thailand	97.70	705 352.94	721 962.51	98.11	208	212
	Tunisia	100.00	153 009.06	153 009.06	100.00	152	152
	Uruguay	96.30	38 377.90	39 854.48	96.43	270	280

The denominator is the number of sampled students who were age-eligible, and not explicitly excluded as student exclusions. The exception is cases where countries applied different sampling rates across explicit strata. In these cases, unweighted rates were calculated in each stratum, and then weighted together according to the relative population size of 15-year-olds in each stratum.

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

In countries with no over-sampling of any explicit strata, weighted and unweighted student participation rates are very similar.

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

Table 11.3 [Part 1/2]
School response rates after replacement

		Weighted school Participation Rate After all Replacement (%)	Weighted Number of Responding schools (Weighted also by enrolment)	Weighted Number of schools Sampled (responding + nonresponding) (Weighted also by enrolment)	Unweighted school Participation Rate after all Replacement (%)	Number of Responding schools (Unweighted)	Number of Responding and nonresponding schools (Unweighted)
OECD	Australia	98.85	248 320.55	251 221.74	98.31	350	356
	Austria	98.77	91 471.27	92 606.34	97.04	197	203
	Belgium	93.59	115 645.52	123 562.62	93.40	269	288
	Belgium-Flanders	91.78	61 503.35	67 014.31	91.53	162	177
	Canada	86.23	360 866.86	418 514.45	91.50	861	941
	Czech Republic	93.87	117 526.33	125 202.46	92.42	244	264
	Denmark	96.47	55 067.95	57 085.31	95.87	209	218
	Finland	100.00	65 085.51	65 085.51	100.00	155	155
	France	96.68	732 365.76	757 511.93	95.72	179	187
	Germany	99.05	941 355.81	950 350.10	99.12	225	227
	Greece	99.35	104 124.05	104 809.66	98.44	189	192
	Hungary	100.00	114 266.23	114 266.23	100.00	189	189
	Iceland	98.35	4 819.00	4 900.00	89.40	135	151
	Ireland	100.00	57 245.39	57 245.39	100.00	164	164
	Italy	97.47	607 859.64	623 618.70	91.08	796	874
	Italy-Basilicata	99.61	7 706.00	7 736.12	93.22	55	59
	Italy-Bolzano	97.71	4 804.93	4 917.44	88.30	83	94
	Italy-Campania	95.84	76 343.75	79 658.99	91.23	52	57
	Italy-Emilia Romagna	98.27	34 551.11	35 160.37	87.93	51	58
	Italy-Friuli Venezia Giulia	97.53	9 873.62	10 123.28	85.51	59	69
	Italy-Liguria	97.89	12 786.41	13 061.63	97.33	73	75
	Italy-Lombardia	99.32	87 860.16	88 462.73	94.74	54	57
	Italy-Piemonte	95.35	36 471.03	38 250.67	86.21	50	58
	Italy-Puglia	99.61	48 729.82	48 922.23	98.11	52	53
	Italy-Sardegna	96.51	18 607.86	19 280.96	91.67	55	60
	Italy-Sicilia	92.94	61 506.00	66 178.54	89.83	53	59
	Italy-Trento	97.25	5 243.68	5 391.76	90.91	60	66
	Italy-Veneto	99.15	48 310.68	48 726.17	92.98	53	57
	Japan	92.38	1 092 615.65	1 182 687.63	92.35	181	196
	Korea	99.89	575 983.97	576 636.64	99.35	154	155
	Luxembourg	100.00	4 955.00	4 955.00	100.00	31	31
	Mexico	96.20	1 291 872.06	1 342 897.79	95.27	1128	1184
	Netherlands	94.25	187 952.81	199 423.37	94.33	183	194
	New Zealand	96.06	56 761.97	59 089.52	94.97	170	179
	Norway	95.40	57 582.32	60 358.60	95.31	203	213
	Poland	99.99	532 149.94	532 197.11	99.55	221	222
	Portugal	98.73	98 593.06	99 862.92	98.85	172	174
	Slovak Republic	99.93	76 864.87	76 920.17	98.95	188	190
	Spain	100.00	424 620.57	424 620.57	100.00	686	686
	Spain-La Rioja	100.00	2 641.00	2 641.00	100.00	45	45
	Spain-Basque Country	100.00	15 753.72	15 753.72	100.00	151	151
	Spain-Navarra	100.00	4 952.20	4 952.20	100.00	52	52
	Spain-Galicia	100.00	23 724.51	23 724.51	100.00	53	53
	Spain-Catalonia	100.00	61 213.50	61 213.50	100.00	51	51
	Spain-Castilla y Leon	100.00	21 852.57	21 852.57	100.00	52	52
	Spain-Cantabria	100.00	4 751.33	4 751.33	100.00	53	53
	Spain-Asturias	100.00	7 983.50	7 983.50	100.00	53	53
	Spain-Aragon	100.00	10 594.50	10 594.50	100.00	51	51
	Spain-Andalucia	100.00	90 552.40	90 552.40	100.00	51	51
	Sweden	99.59	126 611.35	127 133.27	99.00	197	199
	Switzerland	99.09	81 345.26	82 094.93	99.41	509	512
	Turkey	100.00	794 825.58	794 825.58	100.00	160	160
	United Kingdom	88.15	660 502.84	749 269.55	84.16	494	587
	United Kingdom-Scotland	86.09	54 802.25	63 655.80	85.45	94	110
	United States	79.09	3 085 547.88	3 901 520.93	79.43	166	209

Table 11.3 [Part 2/2]
School response rates after replacement

		Weighted school Participation Rate After all Replacement (%)	Weighted Number of Responding schools (Weighted also by enrolment)	Weighted Number of schools Sampled (responding + nonresponding) (Weighted also by enrolment)	Unweighted school Participation Rate after all Replacement (%)	Number of Responding schools (Unweighted)	Number of Responding and nonresponding schools (Unweighted)
Partners	Argentina	96.19	554 186.35	576 124.51	95.53	171	179
	Azerbaijan	99.37	129 951.63	130 775.00	99.42	171	172
	Brazil	99.24	2 329 154.43	2 346 987.83	98.09	617	629
	Bulgaria	99.35	82 548.02	83 091.92	99.44	179	180
	Chile	87.89	219 082.48	249 282.99	88.27	173	196
	Colombia	99.22	530 584.59	534 764.00	98.80	165	167
	Croatia	99.80	48 727.00	48 823.00	98.77	161	163
	Estonia	100.00	19 260.50	19 260.50	100.00	169	169
	Hong Kong-China	93.76	72 564.37	77 392.26	93.59	146	156
	Indonesia	100.00	2 256 019.14	2 256 019.14	100.00	352	352
	Israel	93.45	99 541.35	106 519.85	89.22	149	167
	Jordan	100.00	99 088.50	99 088.50	100.00	210	210
	Kyrgyzstan	100.00	90 239.71	90 239.71	100.00	201	201
	Latvia	100.00	32 531.65	32 531.65	100.00	175	175
	Liechtenstein	100.00	362.00	362.00	100.00	12	12
	Lithuania	100.00	50 584.35	50 584.35	100.00	197	197
	Montenegro	94.64	7 363.00	7 780.00	96.08	49	51
	Qatar	98.02	7 260.00	7 407.00	93.43	128	137
	Romania	100.00	231 532.75	231 532.75	100.00	174	174
	Russian Federation	100.00	1 848 221.08	1 848 221.08	100.00	209	209
	Serbia	99.96	77 538.75	77 568.27	99.39	162	163
	Slovenia	97.71	22 048.86	22 565.26	97.53	356	365
	Thailand	100.00	721 551.81	721 551.81	100.00	212	212
	Tunisia	100.00	153 009.06	153 009.06	100.00	152	152
	Uruguay	96.30	38 377.90	39 854.48	96.43	270	280

Table 11.4 [Part 1/2]
Student response rates after replacement

		Weighted student Participation Rate after Second Replacement (%)	Number of students Assessed (Weighted)	Number of students Sampled (assessed + absent) (Weighted)	Unweighted student Participation Rate after Second Replacement (%)	Number of students Assessed (Unweighted)	Number of students Sampled (assessed + absent) (Unweighted)
OECD	Australia	86.30	200 410	232 221	84.82	14 071	16 590
	Austria	90.81	80 765	88 942	88.87	4 925	5 542
	Belgium	92.98	107 247	115 343	93.31	8 857	9 492
	Belgium-Flanders	94.66	60 343	63 749	94.66	5 124	5 413
	Canada	81.43	258 789	317 822	84.32	22 201	26 329
	Czech Republic	90.62	110 435	121 869	90.35	5 927	6 560
	Denmark	89.51	49 249	55 018	89.57	4 510	5 035
	Finland	92.78	56 954	61 387	92.76	4 714	5 082
	France	89.78	641 681	714 695	89.77	4 684	5 218
	Germany	92.26	825 350	894 612	92.26	4 884	5 294
	Greece	95.24	91 494	96 070	95.21	4 871	5 116
	Hungary	93.12	98 716	106 010	93.10	4 490	4 823
	Iceland	83.32	3 781	4 538	83.32	3 781	4 538
	Ireland	83.75	46 160	55 114	83.84	4 585	5 469
	Italy	92.30	467 291	506 270	92.70	21 753	23 465
	Italy-Basilicata	94.06	6 017	6 397	93.95	1 506	1 603
	Italy-Bolzano	93.58	4 263	4 556	94.04	2 084	2 216
	Italy-Campania	90.87	58 786	64 692	90.59	1 406	1 552
	Italy-Emilia Romagna	93.64	27 243	29 094	93.41	1 531	1 639
	Italy-Friuli Venezia Giulia	94.25	7 862	8 341	94.27	1 578	1 674
	Italy-Liguria	91.75	10 531	11 477	91.54	1 753	1 915
	Italy-Lombardia	93.12	64 328	69 083	92.87	1 524	1 641
	Italy-Piemonte	93.88	30 577	32 572	93.54	1 478	1 580
	Italy-Puglia	93.65	42 283	45 148	93.33	1 540	1 650
	Italy-Sardegna	87.74	13 644	15 550	88.59	1 390	1 569
	Italy-Sicilia	91.46	45 177	49 395	90.63	1 335	1 473
	Italy-Trento	95.28	3 994	4 191	93.91	1 757	1 871
	Italy-Veneto	95.47	37 958	39 761	95.39	1 530	1 604

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Table 11.4 [Part 2/2]
Student response rates after replacement

		Weighted student Participation Rate after Second Replacement (%)	Number of students Assessed (Weighted)	Number of students Sampled (assessed + absent) (Weighted)	Unweighted student Participation Rate after Second Replacement (%)	Number of students Assessed (Unweighted)	Number of students Sampled (assessed + absent) (Unweighted)
OECD	Japan	99.55	1 028 039	1 032 727	99.68	5 952	5 971
	Korea	99.04	570 786	576 314	98.99	5 176	5 229
	Luxembourg	96.49	4 567	4 733	96.49	4 567	4 733
	Mexico	96.40	1 101 670	1 142 760	96.16	30 885	32 119
	Netherlands	90.15	161 900	179 592	90.20	4 848	5 375
	New Zealand	87.03	44 638	51 291	87.14	4 823	5 535
	Norway	87.81	50 232	57 205	87.78	4 692	5 345
	Poland	91.70	473 144	515 945	91.32	5 547	6 074
	Portugal	86.74	77 053	88 828	86.86	5 092	5 862
	Slovak Republic	93.19	70 837	76 011	92.82	4 729	5 095
	Spain	88.48	337 710	381 686	91.92	19 604	21 328
	Spain-Andalucia	86.94	70 803	81 437	86.88	1 463	1 684
	Spain-Aragon	91.71	8 682	9 467	92.04	1 526	1 658
	Spain-Asturias	92.33	7 011	7 594	92.45	1 579	1 708
	Spain-Basque Country	96.26	14 157	14 707	96.23	3 929	4 083
	Spain-Cantabria	91.36	4 142	4 534	91.44	1 496	1 636
	Spain-Castilla y Leon	92.31	18 183	19 697	92.42	1 512	1 636
	Spain-Catalonia	91.77	52 299	56 987	91.77	1 527	1 664
	Spain-Galicia	94.14	21 254	22 578	94.08	1 573	1 672
	Spain-La Rioja	89.77	2 239	2 494	90.43	1 333	1 474
	Spain-Navarra	93.38	4 368	4 678	93.69	1 590	1 697
	Sweden	91.37	115 210	126 095	91.59	4 443	4 851
	Switzerland	94.94	84 366	88 861	95.41	12 191	12 778
	Turkey	97.59	649 451	665 477	97.73	4 942	5 057
	United Kingdom	87.65	565 955	645 688	85.96	13 050	15 182
	United Kingdom-Scotland	78.57	38 688	49 237	78.78	2 384	3 026
	United States	91.00	2 589 680	2 845 841	90.81	5 611	6 179
Partners	Argentina	89.31	447 966	501 589	88.52	4 297	4 854
	Azerbaijan	98.02	119 024	121 433	98.11	5 184	5 284
	Brazil	90.83	1 692 354	1 863 114	88.84	9 246	10 408
	Bulgaria	94.47	69 821	73 907	94.34	4 498	4 768
	Chile	93.72	192 205	205 089	93.70	5 233	5 585
	Colombia	93.89	500 459	533 020	93.55	4 478	4 787
	Croatia	95.63	44 400	46 431	95.56	5 213	5 455
	Estonia	94.89	17 708	18 662	95.04	4 865	5 119
	Hong Kong-China	91.51	64 124	70 071	91.56	4 645	5 073
	Indonesia	97.81	2 199 184	2 248 313	97.52	10 647	10 918
	Israel	90.57	79 246	87 498	90.63	4 584	5 058
	Jordan	96.26	86 890	90 267	95.85	6 509	6 791
	Kyrgyzstan	97.08	78 319	80 674	97.20	5 904	6 074
	Latvia	96.66	28 255	29 232	96.60	4 719	4 885
	Liechtenstein	96.03	339	353	96.03	339	353
	Lithuania	93.76	47 189	50 329	93.74	4 744	5 061
	Macao-China	97.57	6 261	6 417	97.50	4 760	4 882
	Montenegro	93.23	6 821	7 317	93.29	4 367	4 681
	Qatar	87.34	6 224	7 126	87.34	6 224	7 126
	Romania	99.83	223 503	223 887	99.79	5 118	5 129
	Russian Federation	96.02	1 738 842	1 810 856	96.07	5 799	6 036
	Serbia	93.91	69 375	73 877	93.86	4 798	5 112
	Slovenia	91.50	18 489	20 206	91.41	6 576	7 194
	Chinese Taipei	97.75	283 168	289 675	98.08	8 815	8 988
	Thailand	98.74	636 028	644 125	98.82	6 192	6 266
	Tunisia	94.53	130 922	138 491	94.60	4 640	4 905
	Uruguay	88.24	30 693	34 784	88.83	4 779	5 380

DESIGN EFFECTS AND EFFECTIVE SAMPLE SIZES

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

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

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

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

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

11.3

$$\sigma_{(\hat{\mu})} = \sqrt{\frac{\sigma^2}{n}}$$

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

11.4

$$\sigma_{(\hat{\mu})} = \sqrt{\frac{\sigma^2_{schools}}{n_{schools}} + \frac{\sigma^2_{within}}{n_{schools}\, n_{students}}}$$

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

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

11.5

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

This index provides an indication of the percentage of variance that lies between schools.

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Figure 11.1 shows the standard errors of a mean for any standardized variable for a simple random sample of 5000 students and for cluster samples of 25 students per school, for different intraclass correlation coefficients. In the case of a sample of 25 students per school, this would mean that 200 schools participated.

Figure 11.1
Standard error on a mean estimate depending on the intraclass correlation

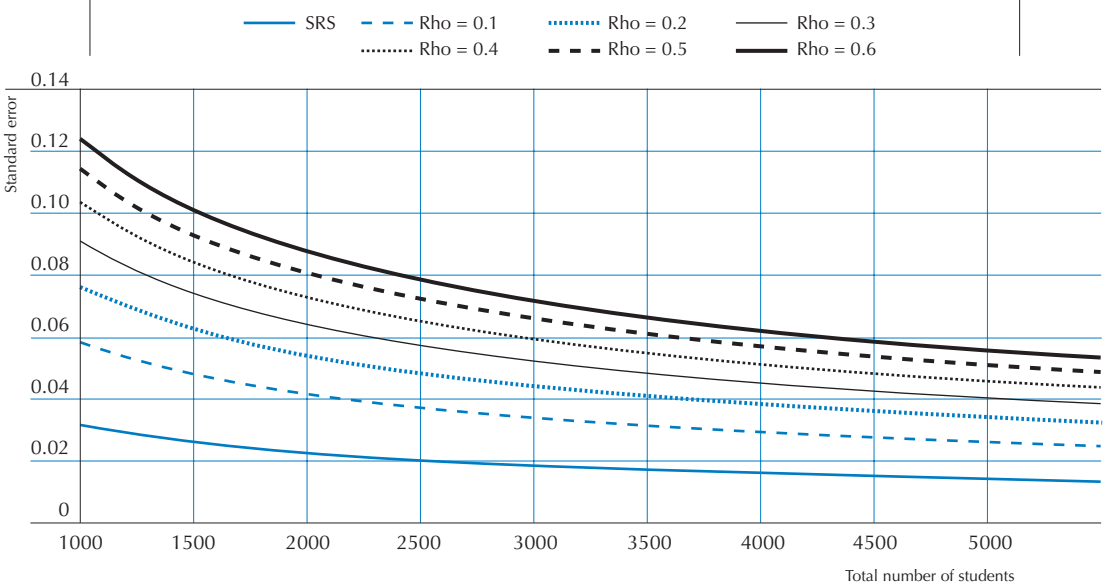

Figure 11.1 shows that the standard error on the mean is quite a lot larger for a cluster sample than it is for a simple random sample and also that the standard error is proportional of the intraclass correlation.

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

Table 11.5 provides the standard errors on the PISA 2006 combined science scale if the country sample was selected according to (i) a simple random sample; (ii) a multistage procedure without using complementary information and (iii) the BRR estimate for the actual PISA 2006 design, using the Fay's (BRR) replicates. It should be mentioned that the plausible value imputation variance was not included in these computations.

Note that the values in Table 11.5 for the standard errors for the unstratified design are overestimates for countries that had a school census (Iceland, Liechtenstein, Luxembourg, Macao - China, and Qatar) since these standard error estimates assume a simple random sample of schools.

Also note that in many of the countries where the unbiased values in Table 11.5 are greater than the values for the unstratified cluster sample, this is because of regional oversampling (Brazil, Canada, Indonesia, Mexico, Spain and Switzerland) or a three-stage design was used (Russian Federation).

Table 11.5
Standard errors for the PISA 2006 combined science scale

		Simple Random Sample	Unstratified Multi-stage Sample	BRR Estimate for PISA sample
OECD	Australia	0.84	2.47	2.26
	Austria	1.39	5.39	3.92
	Belgium	1.06	4.47	2.48
	Canada	0.63	1.64	2.03
	Czech Republic	1.28	4.95	3.48
	Denmark	1.38	2.90	3.11
	Finland	1.25	2.08	2.02
	France	1.48	5.59	3.36
	Germany	1.43	5.23	3.80
	Greece	1.32	4.95	3.23
	Hungary	1.32	5.51	2.68
	Iceland	1.57	3.26	1.64
	Ireland	1.39	3.31	3.19
	Italy	0.65	2.64	2.02
	Japan	1.30	5.23	3.37
	Korea	1.25	4.44	3.36
	Luxembourg	1.43	9.53	1.05
	Mexico	0.46	1.52	2.71
	Netherlands	1.37	5.47	2.74
	New Zealand	1.54	3.67	2.69
	Norway	1.40	2.58	3.11
	Poland	1.21	2.75	2.34
	Portugal	1.24	3.98	3.02
	Slovakia	1.35	4.56	2.59
	Spain	0.65	1.63	2.57
	Sweden	1.41	2.77	2.37
	Switzerland	0.90	2.79	3.16
	Turkey	1.18	4.88	3.84
	United Kingdom	0.93	2.50	2.29
	United States	1.42	4.19	4.22
Partners	Argentina	1.54	5.38	6.08
	Azerbaijan	0.77	3.13	2.75
	Brazil	0.93	2.69	2.79
	Bulgaria	1.59	6.03	6.11
	Chile	1.27	5.40	4.32
	Colombia	1.27	3.91	3.37
	Croatia	1.19	4.44	2.45
	Estonia	1.20	3.12	2.52
	Hong Kong-China	1.35	4.71	2.47
	Indonesia	0.68	2.37	5.73
	Israel	1.65	5.34	3.71
	Jordan	1.11	3.18	2.84
	Kyrgyzstan	1.09	3.84	2.93
	Latvia	1.23	2.99	2.97
	Liechtenstein	5.26	16.84	4.10
	Lithuania	1.31	3.64	2.76
	Macao-China	1.13	6.61	1.06
	Montenegro	1.20	6.24	1.06
	Qatar	1.06	5.86	0.86
	Romania	1.13	4.40	4.20
	Russian Federation	1.18	3.42	3.67
	Serbia	1.23	4.49	3.04
	Slovenia	1.21	4.21	1.11
	Chinese Taipei	1.01	4.27	3.57
	Thailand	0.98	3.58	2.14
	Tunisia	1.21	4.48	2.96
	Uruguay	1.36	3.77	2.75

The unbiased values in Table 11.5 are also greater than the values for the unstratified cluster sample for Argentina, Denmark and the United States. For Argentina and the United States, this may be caused by the small school strata. As described in the sampling design chapter, some countries have a substantial proportion of students attending schools with fewer than *TCS* PISA students. In such cases, to compensate the loss of assessed students, schools with fewer than *TCS* PISA students were placed in very small school strata, moderately small school strata or small school strata, depending on the percentage of students attending such schools. Schools in the very small school strata were undersampled while schools in all large school strata were slightly oversampled.

These small school strata appear, in some cases, to have an adverse impact on the standard errors. For instance, removing all small school strata in the United States reduces the standard error on the mean for the science performance estimate from 4.21 to 3.72. When a similar approach was taken for Argentina, the standard error was reduced from 6.08 to 4.61. Recall that removing schools from the sample should theoretically, all else equal, increase the standard error. This phenomenon might be due to the mixing of explicit strata in small school strata (small school strata were sorted by the explicit stratification variables).

For Denmark, there is no ready explanation as to why the unbiased estimate (3.11) is somewhat greater than that based on an unstratified design (2.90), except perhaps the fact that these estimates are based on samples and are therefore subject to random variation. However, this suggests that the stratification did not explain much between-school variance in Denmark.

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

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

11.6

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

where $Var_{BRR}(t)$ is the sampling variance for the statistic *t* computed by the *BRR* replication method, and $Var_{SRS}(t)$ is the sampling variance for the same statistic *t* on the same data base but considering the sample as a simple random sample.

Based on Table 11.5, the standard error on the mean estimate is science in Australia is equal to 2.26. As the standard deviation of the science performance is equal to 100.205, the design effect in Australia for the mean estimate in science is therefore equal to:

11.7

$$Deff(t) = \frac{Var_{BRR}(t)}{Var_{SRS}(t)} = \frac{(2.26)^2}{[(100.205)^2/14170]} = 7.21$$

The sampling variance on the science performance mean in Australia is about seven times larger than it would have been with a simple random sample of equal size.

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Another way to express the reduction of precision due to the complex sampling design is through the effective sample size, which expresses the simple random sample size that would give the same sampling variance as the one obtained from the actual complex sample design. The effective sample size for a statistic *t* is equal to:

11.8

$$Effn(t) = \frac{n}{Deff(t)} = \frac{n \times Var_{SRS}(t)}{Var_{Brr}(t)}$$

where n is equal to the actual number of units in the sample. The effective sample size in Australia for the science performance mean is equal to:

11.9

$$Effn(t) = \frac{n}{Deff(t)} = \frac{n \times Var_{SRS}(t)}{Var_{Brr}(t)} = \frac{(100.205)^2}{(2.26)^2} = 1965.9$$

In other words, a simple random sample of 1966 students in Australia would have been as precise as the actual PISA 2006 sample for the estimation of the science performance, for the national estimate of mean science proficiency.

Variability of the design effect

Neither the design effect nor the effective sample size are a definitive characteristic of a sample. They vary both with the variable and statistic of interest.

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

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

Design effects in PISA for performance variables

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

The total error computed for the international PISA initial report, *PISA 2006: Science Competencies for Tomorrow's World* (OECD, 2007) that involves performance variables (plausible values or proficiency levels) consist of two components: sampling variance and measurement variance. The standard error of proficiency estimates in PISA is inflated because the students were not sampled according to a simple random sample and also because the estimation of student proficiency includes some amount of random (measurement) error.

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For any statistic *t*, the population estimate and the sampling variance are computed for each plausible value (or each proficiency level) and then combined as described in Chapter 9.

The five design effects and their respective effective sample sizes are defined as follows:

11.10

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

where *MVar(t)* is the measurement error variance for the statistic *t*. This design effect shows the inflation of the total variance that would have occurred due to measurement error if in fact the samples were considered as a simple random sample. Table 11.6 provides, per domain and per cycle, the design effect 1 values, for any country that participated in at least one cycle. Table 11.7 provides the corresponding effective sample size.

11.11

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

shows the inflation of the *total* variance due only to the use of a complex sampling design. Table 11.8 provides, for each domain and PISA cycle, the design effect 2 values, for each country. Table 11.9 provides the corresponding effective sample size.

11.12

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

shows the inflation of the sampling variance due to the use of a complex design. Table 11.9 provides, for each domain and PISA cycle, the design effect 3 values, for each country. Table 11.10 provides the corresponding effective sample size.

11.13

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

shows the inflation of the total variance due to measurement error. Table 11.11 provides, for each domain and PISA cycle, the design effect 4 values, for each country. Table 11.12 provides the corresponding effective sample size.

11.14

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

shows the inflation of the *total* variance due to the measurement error and due to the complex sampling design. Table 11.12 provides, for each domain and PISA cycle, the design effect 5 values, for each country. Table 11.13 provides the corresponding effective sample size.

The product of the first and second design effects equals the product of the third and fourth design effects, and both products are equal to the fifth design effect.

Table 11.6
Design effect 1 by country, by domain and cycle

		PISA 2000			PISA 2003			PISA 2006		
		Reading	Mathematics	Science	Reading	Mathematics	Science	Reading	Mathematics	Science
OECD	Australia	1.30	1.49	1.20	1.22	1.11	1.14	1.16	1.10	1.12
	Austria	1.06	1.01	1.07	1.10	1.14	1.09	1.09	1.19	1.12
	Belgium	1.06	1.12	1.03	1.12	1.06	1.47	1.07	1.03	1.06
	Canada	1.09	1.12	1.10	1.49	1.51	1.82	1.30	1.08	1.13
	Czech Republic	1.07	1.03	1.08	1.35	1.21	1.58	1.10	1.14	1.06
	Denmark	1.08	1.23	1.04	1.39	1.24	1.29	1.16	1.19	1.17
	Finland	1.14	1.25	1.24	1.16	1.25	1.28	1.12	1.60	1.23
	France	1.12	1.21	1.25	1.16	1.12	1.26	1.05	1.20	1.02
	Germany	1.13	1.06	1.22	1.05	1.01	1.12	1.07	1.14	1.08
	Greece	1.19	1.24	1.02	1.52	1.10	1.96	1.08	1.09	1.40
	Hungary	1.03	1.04	1.05	1.12	1.20	1.45	1.25	1.27	1.10
	Iceland	1.11	1.25	1.03	1.14	1.06	1.05	1.62	1.56	1.12
	Ireland	1.11	1.07	1.02	1.13	1.11	1.25	1.30	1.21	1.30
	Italy	1.16	1.32	1.05	1.90	1.78	1.20	1.19	1.29	1.10
	Japan	1.11	1.10	1.17	1.31	1.09	1.10	1.17	1.03	1.05
	Korea	1.13	1.12	1.22	1.24	1.22	1.11	1.47	1.10	1.18
	Luxembourg	1.16	1.11	1.15	1.36	1.01	1.25	1.21	1.13	1.07
	Mexico	1.17	1.18	1.19	1.87	1.59	5.91	1.75	2.84	1.73
	Netherlands	1.06	1.08	1.02	1.29	1.09	1.29	1.36	1.19	1.18
	New Zealand	1.03	1.14	1.03	1.10	1.21	1.16	1.17	1.18	1.04
	Norway	1.06	1.24	1.06	1.26	1.03	1.14	1.10	1.13	1.06
	Poland	1.16	1.08	1.43	1.17	1.13	1.04	1.07	1.28	1.09
	Portugal	1.20	1.10	1.03	1.11	1.02	1.14	1.28	1.34	1.23
	Slovak Republic				1.03	1.14	1.02	1.13	1.43	1.13
	Spain	1.17	1.03	1.04	1.83	1.36	1.38	1.33	2.18	1.92
	Sweden	1.20	1.12	1.13	1.17	1.06	1.43	1.65	1.06	1.10
	Switzerland	1.05	1.20	1.29	1.22	1.28	1.20	1.31	1.44	1.14
	Turkey				1.24	1.24	1.26	1.25	1.33	1.03
	United Kingdom	1.09	1.17	1.26	1.47	1.26	1.20	1.21	1.19	1.41
	United States	1.10	1.10	1.12	1.48	1.36	1.32		1.15	1.03
Partners	Albania	1.07	1.17	1.34						
	Argentina	1.18	1.17	1.31				1.29	1.33	1.11
	Azerbaijan							1.58	1.27	1.21
	Brazil	1.19	1.25	1.63	1.37	1.22	1.87	1.60	1.21	1.39
	Bulgaria	1.13	1.03	1.36				1.09	1.22	1.16
	Chile	1.12	1.30	1.36				1.17	1.28	1.08
	Colombia							1.36	1.10	1.46
	Croatia							1.17	1.12	1.12
	Estonia							1.07	1.07	1.15
	Hong Kong-China	1.05	1.10	1.12	1.07	1.42	1.19	1.09	1.13	1.03
	Indonesia	1.48	1.24	1.29	1.98	1.46	1.70	1.29	1.94	1.16
	Israel	1.47	1.15	1.33				1.12	1.23	1.04
	Jordan							1.51	1.20	1.07
	Kyrgyzstan							1.17	1.16	1.03
	Latvia	1.20	1.18	1.05	1.20	1.18	1.15	1.14	1.05	1.08
	Liechtenstein	1.10	1.15	1.04	1.05	1.21	1.16	1.10	1.22	1.13
	Lithuania							1.11	1.29	1.05
	Macao-China				1.29	1.05	1.19	1.21	1.39	1.09
	Montenegro							1.09	1.25	1.10
	Peru	1.10	1.20	1.89						
	Qatar							1.25	1.30	1.13
	Romania							1.40	1.39	1.07
	Russian Federation	1.16	1.15	1.14	1.22	1.28	1.15	1.42	1.23	1.08
	Serbia				1.11	1.29	1.36	1.14	1.33	1.05
	Slovak Republic				1.03	1.14	1.02	1.13	1.43	1.13
	Slovenia							1.16	1.23	1.07
	Chinese Taipei							1.59	1.18	1.07
	Thailand	1.13	1.23	1.10	1.70	1.25	1.33	1.19	1.26	1.08
	Tunisia				1.48	1.05	1.10	1.10	1.19	1.03
	Uruguay				1.34	1.10	1.04	1.16	1.20	1.13

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Table 11.7
Effective sample size 1 by country, by domain and cycle

		PISA 2000			PISA 2003			PISA 2006		
		Reading	Mathematics	Science	Reading	Mathematics	Science	Reading	Mathematics	Science
OECD	Australia	3 983	1 923	2 374	10 328	11 335	11 055	12 176	12 841	12 654
	Austria	4 483	2 620	2 500	4 195	4 040	4 211	4 508	4 141	4 399
	Belgium	6 302	3 366	3 613	7 861	8 291	5 987	8 256	8 614	8 364
	Canada	27 294	14 682	15 047	18 723	18 559	15 320	17 465	21 011	20 048
	Czech Republic	5 019	2 964	2 841	4 681	5 221	4 006	5 377	5 195	5 604
	Denmark	3 924	1 936	2 256	3 032	3 402	3 259	3 892	3 810	3 877
	Finland	4 270	2 163	2 180	5 009	4 627	4 537	4 203	2 941	3 836
	France	4 189	2 153	2 080	3 707	3 851	3 404	4 470	3 923	4 617
	Germany	4 473	2 682	2 341	4 454	4 603	4 156	4 566	4 290	4 515
	Greece	3 930	2 108	2 553	3 054	4 192	2 366	4 497	4 459	3 485
	Hungary	4 743	2 701	2 678	4 272	3 978	3 278	3 603	3 543	4 089
	Iceland	3 045	1 505	1 804	2 940	3 164	3 179	2 341	2 421	3 387
	Ireland	3 474	1 984	2 097	3 434	3 483	3 096	3 528	3 804	3 530
	Italy	4 280	2 101	2 629	6 123	6 555	9 668	18 288	16 892	19 776
	Japan	4 753	2 655	2 489	3 595	4 308	4 296	5 086	5 774	5 680
	Korea	4 413	2 470	2 264	4 379	4 457	4 898	3 519	4 706	4 388
	Luxembourg	3 043	1 761	1 698	2 890	3 872	3 135	3 783	4 032	4 283
	Mexico	3 945	2 181	2 149	15 998	18 839	5 074	17 696	10 894	17 861
	Netherlands	2 369	1 280	1 364	3 103	3 676	3 093	3 583	4 106	4 142
	New Zealand	3 549	1 793	1 974	4 102	3 742	3 892	4 122	4 073	4 629
	Norway	3 895	1 857	2 181	3 215	3 946	3 570	4 253	4 153	4 439
	Poland	3 158	1 823	1 425	3 748	3 894	4 222	5 167	4 344	5 105
	Portugal	3 836	2 323	2 471	4 166	4 534	4 052	4 005	3 803	4 153
	Slovak Republic				7 111	6 466	7 183	4 183	3 306	4 194
	Spain	5 323	3 330	3 339	5 899	7 918	7 806	14 768	9 005	10 226
	Sweden	3 669	2 207	2 163	3 960	4 362	3 240	2 690	4 180	4 044
	Switzerland	5 798	2 841	2 626	6 883	6 596	7 033	9 335	8 456	10 732
	Turkey				3 901	3 905	3 864	3 959	3 729	4 789
	United Kingdom	8 552	4 450	4 099	6 489	7 588	7 964	10 845	11 047	9 297
	United States	3 500	1 950	1 894	3 682	4 015	4 139		4 899	5 426
Partners	Albania	4 653	2 379	2 063						
	Argentina	3 363	1 901	1 686				3 355	3 258	3 896
	Azerbaijan							3 278	4 075	4 288
	Brazil	4 112	2 175	1 660	3 244	3 639	2 381	5 804	7 668	6 672
	Bulgaria	4 128	2 538	1 879				4 114	3 688	3 873
	Chile	4 372	2 095	1 997				4 490	4 086	4 855
	Colombia							3 305	4 054	3 074
	Croatia							4 438	4 659	4 666
	Estonia							4 528	4 554	4 248
	Hong Kong-China	4 199	2 223	2 181	4 171	3 162	3 777	4 281	4 108	4 488
	Indonesia	4 980	3 304	3 153	5 436	7 375	6 340	8 244	5 500	9 191
	Israel	3 063	2 161	1 884				4 077	3 739	4 390
	Jordan							4 319	5 434	6 066
	Kyrgyzstan							5 031	5 095	5 706
	Latvia	3 240	1 826	2 059	3 851	3 920	4 026	4 136	4 481	4 368
	Liechtenstein	286	153	170	316	274	285	309	278	300
	Lithuania							4 255	3 675	4 535
	Macao-China				970	1 189	1 053	3 944	3 424	4 377
	Montenegro							4 102	3 570	4 039
	Peru	4 020	2 107	1 336						
	Qatar							5 030	4 814	5 548
	Romania							3 668	3 681	4 805
	Russian Federation	5 771	3 232	3 252	4 888	4 667	5 178	4 091	4 711	5 354
	Serbia				3 977	3 424	3 247	4 216	3 617	4 578
	Slovenia							5 693	5 373	6 146
	Chinese Taipei							5 535	7 448	8 270
	Thailand	4 726	2 406	2 698	3 073	4 177	3 934	5 193	4 898	5 721
	Tunisia				3 181	4 497	4 284	4 225	3 890	4 526
	Uruguay				4 344	5 308	5 608	4 175	4 049	4 293

Table 11.8
Design effect 2 by country, by domain and cycle

		PISA 2000			PISA 2003			PISA 2006		
		Reading	Mathematics	Science	Reading	Mathematics	Science	Reading	Mathematics	Science
OECD	Australia	4.77	2.89	3.22	4.92	5.75	4.69	5.89	8.32	6.44
	Austria	2.98	1.93	1.95	5.58	4.97	5.29	6.41	6.01	7.08
	Belgium	6.96	4.54	5.39	4.33	3.59	3.18	6.31	6.68	5.20
	Canada	7.41	4.05	4.70	7.29	8.08	6.34	11.21	11.04	9.33
	Czech Republic	3.04	2.46	1.90	6.15	7.13	4.51	7.59	6.15	6.99
	Denmark	2.26	1.53	1.67	3.09	3.07	2.78	4.93	3.63	4.32
	Finland	3.55	1.54	1.80	2.06	2.30	2.04	2.94	2.37	2.13
	France	3.70	1.99	2.01	2.83	2.87	2.48	6.83	4.32	5.05
	Germany	2.20	1.62	1.33	4.29	4.81	4.42	7.09	6.54	6.51
	Greece	10.29	5.60	6.51	4.70	7.24	3.41	6.98	4.61	4.28
	Hungary	8.41	4.53	4.42	3.08	3.66	2.66	4.36	3.56	3.77
	Iceland	0.75	1.06	1.10	0.74	0.78	0.75	0.94	1.02	0.97
	Ireland	4.16	2.09	2.52	3.16	2.87	2.59	5.16	4.38	4.02
	Italy	4.35	2.21	2.54	5.59	6.77	8.14	9.10	9.59	8.83
	Japan	17.53	10.60	9.12	4.97	6.87	6.16	6.46	7.78	6.45
	Korea	5.33	2.65	2.52	6.14	5.47	6.07	6.56	7.77	6.10
	Luxembourg	0.77	0.81	0.98	0.64	0.43	0.67	0.62	0.53	0.51
	Mexico	5.88	3.60	3.66	29.59	34.24	8.22	18.09	12.83	20.21
	Netherlands	3.39	2.17	2.32	3.51	4.21	3.15	3.28	3.50	3.40
	New Zealand	2.35	1.82	1.12	2.27	1.97	2.00	3.33	2.67	2.92
	Norway	2.85	1.70	1.81	2.36	2.63	2.74	3.89	3.45	4.65
	Poland	6.29	5.20	3.99	3.37	3.00	3.30	4.02	3.46	3.47
	Portugal	8.30	4.63	4.98	6.75	6.84	5.56	5.20	4.35	4.84
	Slovak Republic				8.09	8.32	9.47	3.54	2.95	3.23
	Spain	5.44	3.96	3.19	4.38	5.87	5.31	9.34	6.21	8.21
	Sweden	2.10	1.53	1.57	2.54	3.18	2.11	3.29	3.01	2.57
	Switzerland	10.04	5.49	5.18	8.23	7.80	8.26	9.88	8.86	10.88
	Turkey				14.39	16.15	14.55	8.11	10.30	10.19
	United Kingdom	5.55	3.31	3.07	4.46	5.25	4.81	5.31	6.41	4.27
	United States	15.82	11.77	9.91	3.73	3.85	3.80		9.83	8.61
Partners	Albania	5.10	1.97	1.94						
	Argentina	27.72	11.50	10.32				11.18	12.41	14.05
	Azerbaijan							6.48	9.03	10.49
	Brazil	5.32	3.14	2.16	5.49	8.54	4.65	7.75	7.79	6.50
	Bulgaria	9.54	6.78	4.39				14.20	13.56	12.70
	Chile	6.96	3.24	2.67				10.50	11.22	10.77
	Colombia							7.34	7.48	4.87
	Croatia							4.43	3.75	3.79
	Estonia							5.37	5.31	3.86
	Hong Kong-China	5.10	2.69	2.73	7.88	6.48	7.74	3.75	3.36	3.27
	Indonesia	15.08	9.47	8.71	10.69	17.38	14.12	51.68	27.19	61.43
	Israel	18.44	10.96	9.86				6.00	6.12	4.85
	Jordan							5.21	8.47	6.05
	Kyrgyzstan							5.83	7.83	6.98
	Latvia	8.62	3.40	6.80	6.34	6.90	7.08	6.99	5.99	5.42
	Liechtenstein	0.52	0.81	0.95	0.50	0.47	0.50	0.52	0.57	0.54
	Lithuania							4.15	3.90	4.25
	Macao-China				1.01	1.31	1.25	0.81	0.82	0.80
	Montenegro							0.75	0.92	0.72
	Peru	8.47	3.43	2.70						
	Qatar							0.61	0.61	0.58
	Romania							9.57	9.25	12.87
	Russian Federation	11.79	8.90	7.42	8.70	9.66	8.92	8.80	8.79	8.97
	Serbia				7.59	6.73	5.80	6.00	5.30	5.82
	Slovenia							0.71	0.73	0.79
	Chinese Taipei							8.86	11.79	11.80
	Thailand	8.44	4.57	4.27	3.97	5.59	4.34	5.21	4.03	4.41
	Tunisia				2.74	4.30	3.68	7.21	7.21	5.83
	Uruguay				3.47	5.76	3.95	3.35	2.79	3.64

Table 11.9
Effective sample size 2 by country, by domain and cycle

		PISA 2000			PISA 2003			PISA 2006		
		Reading	Mathematics	Science	Reading	Mathematics	Science	Reading	Mathematics	Science
OECD	Australia	1 085	991	889	2 549	2 184	2 675	2 406	1 703	2 201
	Austria	1 590	1 370	1 370	824	925	868	769	820	696
	Belgium	958	834	690	2 031	2 452	2 767	1 404	1 326	1 705
	Canada	4 009	4 072	3 506	3 834	3 458	4 407	2 020	2 052	2 428
	Czech Republic	1 766	1 246	1 611	1 027	887	1 400	781	964	848
	Denmark	1 875	1 556	1 405	1 367	1 374	1 520	919	1 249	1 049
	Finland	1 370	1 751	1 510	2 820	2 519	2 844	1 606	1 991	2 213
	France	1 262	1 305	1 290	1 522	1 498	1 733	690	1 093	934
	Germany	2 309	1 747	2 142	1 087	969	1 053	690	748	752
	Greece	454	466	398	985	639	1 356	698	1 058	1 138
	Hungary	581	618	633	1 549	1 301	1 791	1 031	1 261	1 192
	Iceland	4 470	1 768	1 684	4 538	4 268	4 470	4 028	3 717	3 917
	Ireland	927	1 016	847	1 228	1 352	1 498	888	1 046	1 140
	Italy	1 147	1 250	1 087	2 082	1 720	1 430	2 394	2 271	2 465
	Japan	300	276	320	947	685	764	921	765	923
	Korea	935	1 047	1 095	887	994	897	789	666	849
	Luxembourg	4 603	2 415	1 983	6 122	9 061	5 890	7 380	8 698	8 992
	Mexico	783	714	696	1 013	876	3 650	1 712	2 415	1 533
	Netherlands	739	636	601	1 137	949	1 267	1 484	1 393	1 431
	New Zealand	1 560	1 128	1 811	1 991	2 287	2 260	1 447	1 805	1 654
	Norway	1 457	1 357	1 279	1 723	1 545	1 486	1 205	1 359	1 008
	Poland	581	380	513	1 302	1 462	1 328	1 381	1 603	1 600
	Portugal	553	550	513	683	673	829	982	1 173	1 056
	Slovak Republic				908	883	776	1 338	1 605	1 465
	Sweden	2 106	1 609	1 558	1 821	1 454	2 191	1 350	1 475	1 730
	Switzerland	607	618	656	1 023	1 080	1 020	1 234	1 376	1 121
	Turkey				337	301	334	609	480	485
	United Kingdom	1 682	1 570	1 687	2 138	1 817	1 984	2 476	2 050	3 079
	United States	243	181	215	1 462	1 418	1 437		571	652
Partners	Albania	977	1 410	1 427						
	Argentina	144	194	214				388	350	309
	Azerbaijan							800	574	494
	Brazil	920	864	1 253	810	521	956	1 200	1 193	1 431
	Bulgaria	488	387	581				317	332	354
	Chile	702	844	1 020				498	467	486
	Colombia							610	598	920
	Croatia							1 177	1 389	1 374
	Estonia							907	917	1 259
	Hong Kong-China	863	907	893	568	691	578	1 237	1 384	1 422
	Indonesia	489	432	468	1 007	619	762	206	392	173
	Israel	244	227	255				764	749	944
	Jordan							1 249	769	1 076
	Kyrgyzstan							1 012	754	846
	Latvia	451	632	317	730	671	654	675	787	870
	Liechtenstein	600	216	185	664	700	666	649	593	630
	Lithuania							1 144	1 217	1 115
	Macao-China				1 239	956	1 002	5 857	5 820	5 947
	Montenegro							5 938	4 837	6 226
	Peru	523	738	937						
	Qatar							10 254	10 257	10 791
	Romania							535	553	398
	Russian Federation	568	418	501	687	618	670	659	660	647
	Serbia				580	654	759	800	906	824
	Slovenia							9 244	9 015	8 373
	Chinese Taipei							995	748	747
	Thailand	633	648	694	1 320	937	1 205	1 189	1 537	1 403
	Tunisia				1 725	1 097	1 282	643	643	795
	Uruguay				1 683	1 012	1 478	1 444	1 734	1 329

Table 11.10
Design effect 3 by country, by domain and by cycle

		PISA 2000			PISA 2003			PISA 2006		
		Reading	Mathematics	Science	Reading	Mathematics	Science	Reading	Mathematics	Science
OECD	Australia	5.90	3.81	3.67	5.77	6.25	5.19	6.69	9.08	7.09
	Austria	3.10	1.93	2.01	6.02	5.52	5.69	6.91	6.96	7.81
	Belgium	7.31	4.98	5.53	4.73	3.75	4.20	6.70	6.84	5.44
	Canada	7.97	4.42	5.06	10.39	11.67	10.75	14.24	11.82	10.40
	Czech Republic	3.18	2.51	1.97	7.96	8.42	6.54	8.27	6.88	7.34
	Denmark	2.36	1.65	1.70	3.90	3.57	3.30	5.58	4.12	4.88
	Finland	3.90	1.68	1.99	2.22	2.63	2.33	3.17	3.19	2.39
	France	4.02	2.19	2.26	3.12	3.09	2.87	7.15	4.99	5.14
	Germany	2.36	1.65	1.41	4.44	4.86	4.84	7.52	7.31	6.96
	Greece	12.04	6.68	6.60	6.60	7.89	5.72	7.48	4.94	5.59
	Hungary	8.64	4.66	4.58	3.32	4.19	3.41	5.18	4.24	4.04
	Iceland	0.73	1.08	1.11	0.70	0.77	0.74	0.90	1.03	0.96
	Ireland	4.50	2.17	2.55	3.44	3.08	2.99	6.41	5.08	4.92
	Italy	4.90	2.59	2.62	9.72	11.24	9.59	10.64	12.07	9.62
	Japan	19.28	11.57	10.50	6.20	7.42	6.66	7.39	7.99	6.71
	Korea	5.89	2.84	2.85	7.39	6.47	6.63	9.18	8.44	7.01
	Luxembourg	0.73	0.79	0.98	0.51	0.43	0.58	0.54	0.46	0.48
	Mexico	6.69	4.06	4.15	54.56	53.89	43.63	30.91	34.61	34.30
	Netherlands	3.52	2.27	2.35	4.23	4.48	3.78	4.10	3.96	3.83
	New Zealand	2.40	1.93	1.12	2.39	2.17	2.15	3.73	2.98	3.00
	Norway	2.97	1.87	1.85	2.72	2.68	2.98	4.19	3.77	4.86
	Poland	7.12	5.56	5.28	3.77	3.25	3.39	4.24	4.14	3.68
	Portugal	9.72	4.98	5.11	7.36	6.94	6.19	6.36	5.51	5.72
	Slovak Republic				8.33	9.31	9.66	3.87	3.79	3.52
	Spain	6.18	4.04	3.27	7.19	7.64	6.96	12.06	12.34	14.82
	Sweden	2.32	1.59	1.64	2.80	3.31	2.59	4.79	3.14	2.72
	Switzerland	10.52	6.37	6.40	9.85	9.68	9.69	12.60	12.33	12.22
	Turkey				17.67	19.84	18.03	9.88	13.33	10.49
	United Kingdom	5.97	3.70	3.61	6.08	6.34	5.56	6.23	7.45	5.63
	United States	17.29	12.79	11.01	5.05	4.87	4.69		11.11	8.87
Partners	Albania	5.38	2.14	2.27						
	Argentina	32.64	13.32	13.21				14.17	16.20	15.54
	Azerbaijan							9.66	11.22	12.47
	Brazil	6.14	3.68	2.90	7.17	10.23	7.83	11.80	9.23	8.66
	Bulgaria	10.63	6.96	5.61				15.44	16.32	14.58
	Chile	7.66	3.92	3.28				12.08	14.09	11.53
	Colombia							9.60	8.16	6.63
	Croatia							5.03	4.08	4.12
	Estonia							5.69	5.60	4.28
	Hong Kong-China	5.31	2.85	2.93	8.39	8.76	8.99	3.99	3.66	3.35
	Indonesia	21.83	11.49	10.96	20.17	24.89	23.28	66.45	51.69	71.00
	Israel	26.61	12.44	12.82				6.63	7.28	5.02
	Jordan							7.35	9.94	6.42
	Kyrgyzstan							6.67	8.91	7.19
	Latvia	10.16	3.83	7.08	7.42	7.96	7.98	7.84	6.26	5.78
	Liechtenstein	0.48	0.78	0.95	0.47	0.36	0.42	0.48	0.48	0.48
	Lithuania							4.51	4.74	4.40
	Macao-China				1.01	1.32	1.29	0.77	0.75	0.78
	Montenegro							0.73	0.90	0.69
	Peru	9.24	3.91	4.22						
	Qatar							0.52	0.49	0.53
	Romania							12.96	12.47	13.65
	Russian Federation	13.53	10.09	8.34	10.41	12.09	10.14	12.06	10.59	9.63
	Serbia				8.30	8.38	7.52	6.69	6.70	6.06
	Slovenia							0.67	0.67	0.77
	Chinese Taipei							13.51	13.77	12.52
	Thailand	9.40	5.39	4.60	6.06	6.75	5.45	6.02	4.83	4.69
	Tunisia				3.58	4.47	3.96	7.82	8.41	5.96
	Uruguay				4.31	6.24	4.07	3.73	3.14	3.98

Table 11.11
Effective sample size 3 by country, by domain and cycle

		PISA 2000			PISA 2003			PISA 2006		
		Reading	Mathematics	Science	Reading	Mathematics	Science	Reading	Mathematics	Science
OECD	Australia	877	751	779	2 176	2 007	2 417	2 118	1 560	1 999
	Austria	1 531	1 365	1 327	764	833	808	713	708	631
	Belgium	912	761	674	1 861	2 349	2 093	1 323	1 295	1 627
	Canada	3 726	3 726	3 260	2 690	2 396	2 601	1 591	1 916	2 176
	Czech Republic	1 688	1 221	1 554	794	751	966	717	862	808
	Denmark	1 796	1 440	1 383	1 081	1 182	1 279	812	1 099	929
	Finland	1 246	1 610	1 363	2 609	2 204	2 492	1 486	1 477	1 973
	France	1 164	1 184	1 148	1 380	1 393	1 498	659	946	918
	Germany	2 152	1 711	2 031	1 050	959	963	651	669	702
	Greece	388	390	393	701	586	810	652	986	872
	Hungary	566	601	612	1 437	1 138	1 395	866	1 058	1 112
	Iceland	4 633	1 741	1 679	4 774	4 338	4 552	4 191	3 677	3 933
	Ireland	856	979	838	1 128	1 258	1 296	715	903	931
	Italy	1 018	1 066	1 054	1 197	1 035	1 213	2 046	1 804	2 263
	Japan	273	253	277	759	635	707	805	745	887
	Korea	846	974	968	737	842	821	564	613	738
	Luxembourg	4 838	2 480	1 988	7 655	9 220	6 739	8 461	9 884	9 610
	Mexico	688	633	613	549	556	687	1 002	895	903
	Netherlands	711	610	593	944	891	1 057	1 187	1 229	1 273
	New Zealand	1 531	1 060	1 805	1 886	2 077	2 094	1 293	1 619	1 609
	Norway	1 398	1 234	1 246	1 495	1 517	1 366	1 119	1 244	965
	Poland	513	356	387	1 164	1 349	1 293	1 309	1 339	1 507
	Portugal	472	511	499	626	664	745	803	928	893
	Slovak Republic				882	789	761	1 223	1 249	1 346
	Spain	1 005	848	1 057	1 502	1 413	1 550	1 625	1 589	1 323
	Sweden	1 903	1 546	1 488	1 653	1 396	1 788	929	1 415	1 631
	Switzerland	580	533	531	855	870	869	968	989	997
	Turkey				275	245	269	500	371	471
	United Kingdom	1 564	1 406	1 433	1 567	1 504	1 716	2 112	1 766	2 337
	United States	222	167	193	1 081	1 120	1 164		505	633
Partners	Albania	925	1 301	1 224						
	Argentina	122	167	167				306	268	279
	Azerbaijan							537	462	416
	Brazil	797	739	935	621	435	569	788	1 007	1 074
	Bulgaria	438	376	455				291	276	308
	Chile	638	697	831				433	372	454
	Colombia							467	549	675
	Croatia							1 037	1 278	1 265
	Estonia							855	869	1 137
	Hong Kong-China	830	855	831	534	511	498	1 164	1 268	1 389
	Indonesia	337	356	372	533	432	462	160	206	150
	Israel	169	200	196				692	630	912
	Jordan							886	655	1 014
	Kyrgyzstan							885	662	821
	Latvia	383	562	305	624	581	580	602	754	817
	Liechtenstein	658	224	185	699	911	798	713	710	709
	Lithuania							1 052	1 001	1 077
	Macao-China				1 236	945	967	6 151	6 374	6 079
	Montenegro							6 114	4 943	6 492
	Peru	480	647	600						
	Qatar							12 151	12 697	11 900
	Romania							395	410	375
	Russian Federation	495	369	446	574	494	589	481	547	602
	Serbia				530	526	586	718	716	792
	Slovenia							9 872	9 837	8 541
	Chinese Taipei							653	640	704
	Thailand	568	549	645	865	775	961	1 029	1 282	1 319
	Tunisia				1 320	1 057	1 193	593	552	779
	Uruguay				1 353	935	1 435	1 299	1 541	1 217

Table 11.12
Design effect 4 by country, by domain and cycle

		PISA 2000			PISA 2003			PISA 2006		
		Reading	Mathematics	Science	Reading	Mathematics	Science	Reading	Mathematics	Science
OECD	Australia	1.05	1.13	1.06	1.04	1.02	1.03	1.02	1.01	1.02
	Austria	1.02	1.00	1.03	1.02	1.03	1.02	1.01	1.03	1.02
	Belgium	1.01	1.03	1.01	1.03	1.02	1.11	1.01	1.00	1.01
	Canada	1.01	1.03	1.02	1.05	1.04	1.08	1.02	1.01	1.01
	Czech Republic	1.02	1.01	1.04	1.04	1.03	1.09	1.01	1.02	1.01
	Denmark	1.03	1.14	1.02	1.10	1.07	1.09	1.03	1.05	1.03
	Finland	1.04	1.15	1.12	1.07	1.10	1.12	1.04	1.19	1.10
	France	1.03	1.09	1.11	1.05	1.04	1.09	1.01	1.04	1.00
	Germany	1.06	1.03	1.16	1.01	1.00	1.03	1.01	1.02	1.01
	Greece	1.02	1.04	1.00	1.08	1.01	1.17	1.01	1.02	1.07
	Hungary	1.00	1.01	1.01	1.03	1.05	1.13	1.05	1.06	1.02
	Iceland	1.15	1.23	1.03	1.20	1.08	1.07	1.69	1.55	1.12
	Ireland	1.02	1.03	1.01	1.04	1.04	1.08	1.05	1.04	1.06
	Italy	1.03	1.12	1.02	1.09	1.07	1.02	1.02	1.02	1.01
	Japan	1.01	1.01	1.02	1.05	1.01	1.01	1.02	1.00	1.01
	Korea	1.02	1.04	1.08	1.03	1.03	1.02	1.05	1.01	1.03
	Luxembourg	1.22	1.14	1.15	1.71	1.03	1.44	1.39	1.29	1.14
	Mexico	1.02	1.04	1.04	1.02	1.01	1.11	1.02	1.05	1.02
	Netherlands	1.02	1.04	1.01	1.07	1.02	1.08	1.09	1.05	1.05
	New Zealand	1.01	1.07	1.02	1.04	1.09	1.07	1.05	1.06	1.01
	Norway	1.02	1.13	1.03	1.10	1.01	1.05	1.02	1.03	1.01
	Poland	1.02	1.02	1.08	1.05	1.04	1.01	1.02	1.07	1.02
	Portugal	1.02	1.02	1.01	1.01	1.00	1.02	1.04	1.06	1.04
	Slovak Republic				1.00	1.01	1.00	1.03	1.11	1.04
	Spain	1.03	1.01	1.01	1.12	1.05	1.06	1.03	1.10	1.06
	Sweden	1.09	1.07	1.08	1.06	1.02	1.17	1.14	1.02	1.04
	Switzerland	1.00	1.03	1.05	1.02	1.03	1.02	1.02	1.04	1.01
	Turkey				1.01	1.01	1.01	1.03	1.02	1.00
	United Kingdom	1.02	1.05	1.07	1.08	1.04	1.04	1.03	1.03	1.07
	United States	1.01	1.01	1.01	1.10	1.07	1.07		1.01	1.00
Partners	Albania	1.01	1.08	1.15						
	Argentina	1.01	1.01	1.02				1.02	1.02	1.01
	Azerbaijan							1.06	1.02	1.02
	Brazil	1.03	1.07	1.22	1.05	1.02	1.11	1.05	1.02	1.05
	Bulgaria	1.01	1.00	1.06				1.01	1.01	1.01
	Chile	1.02	1.08	1.11				1.01	1.02	1.01
	Colombia							1.04	1.01	1.07
	Croatia							1.03	1.03	1.03
	Estonia							1.01	1.01	1.03
	Hong Kong-China	1.01	1.03	1.04	1.01	1.05	1.02	1.02	1.04	1.01
	Indonesia	1.02	1.02	1.03	1.05	1.02	1.03	1.00	1.02	1.00
	Israel	1.02	1.01	1.03				1.02	1.03	1.01
	Jordan							1.07	1.02	1.01
	Kyrgyzstan							1.03	1.02	1.00
	Latvia	1.02	1.05	1.01	1.03	1.02	1.02	1.02	1.01	1.01
	Liechtenstein	1.20	1.19	1.04	1.11	1.58	1.40	1.21	1.47	1.28
	Lithuania							1.03	1.06	1.01
	Macao-China				1.29	1.04	1.15	1.27	1.53	1.11
	Montenegro							1.12	1.28	1.15
	Peru	1.01	1.05	1.21						
	Qatar							1.48	1.62	1.25
	Romania							1.03	1.03	1.00
	Russian Federation	1.01	1.01	1.02	1.02	1.02	1.02	1.03	1.02	1.01
	Serbia				1.01	1.03	1.05	1.02	1.05	1.01
	Slovenia							1.24	1.34	1.10
	Chinese Taipei							1.04	1.01	1.01
	Thailand	1.01	1.04	1.02	1.12	1.04	1.06	1.03	1.05	1.02
	Tunisia				1.14	1.01	1.03	1.01	1.02	1.00
	Uruguay				1.08	1.02	1.01	1.04	1.06	1.03

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Table 11.13
Effective sample size 4 by country, by domain and cycle

		PISA 2000			PISA 2003			PISA 2006		
		Reading	Mathematics	Science	Reading	Mathematics	Science	Reading	Mathematics	Science
OECD	Australia	4 926	2 534	2 709	12 098	12 339	12 231	13 831	14 010	13 934
	Austria	4 657	2 630	2 582	4 525	4 485	4 524	4 862	4 796	4 852
	Belgium	6 617	3 692	3 702	8 579	8 655	7 911	8 762	8 821	8 762
	Canada	29 364	16 041	16 181	26 687	26 790	25 958	22 183	22 498	22 367
	Czech Republic	5 251	3 025	2 946	6 053	6 166	5 806	5 859	5 812	5 885
	Denmark	4 097	2 090	2 292	3 833	3 952	3 872	4 402	4 333	4 380
	Finland	4 697	2 352	2 414	5 412	5 287	5 177	4 540	3 964	4 301
	France	4 542	2 373	2 337	4 090	4 143	3 938	4 680	4 532	4 696
	Germany	4 800	2 738	2 466	4 612	4 648	4 546	4 845	4 799	4 833
	Greece	4 600	2 516	2 587	4 292	4 567	3 962	4 819	4 783	4 549
	Hungary	4 870	2 777	2 772	4 604	4 550	4 205	4 286	4 224	4 383
	Iceland	2 936	1 527	1 809	2 793	3 113	3 121	2 246	2 444	3 372
	Ireland	3 762	2 059	2 119	3 739	3 741	3 577	4 380	4 406	4 323
	Italy	4 822	2 464	2 712	10 650	10 887	11 397	21 390	21 264	21 547
	Japan	5 227	2 899	2 867	4 483	4 649	4 640	5 818	5 929	5 910
	Korea	4 875	2 656	2 561	5 270	5 264	5 354	4 923	5 116	5 047
	Luxembourg	2 893	1 713	1 691	2 301	3 804	2 730	3 291	3 542	3 999
	Mexico	4 489	2 460	2 439	29 508	29 656	26 950	30 236	29 401	30 322
	Netherlands	2 463	1 334	1 382	3 738	3 917	3 706	4 478	4 652	4 657
	New Zealand	3 617	1 908	1 980	4 330	4 120	4 200	4 613	4 542	4 756
	Norway	4 058	2 042	2 237	3 703	4 019	3 883	4 579	4 535	4 638
	Poland	3 575	1 947	1 888	4 194	4 220	4 334	5 452	5 199	5 419
	Portugal	4 495	2 497	2 536	4 542	4 597	4 508	4 897	4 809	4 911
	Slovak Republic				7 317	7 240	7 329	4 576	4 247	4 565
	Spain	6 050	3 403	3 420	9 673	10 301	10 228	19 085	17 896	18 461
	Sweden	4 059	2 295	2 265	4 362	4 541	3 966	3 906	4 355	4 287
	Switzerland	6 070	3 295	3 248	8 230	8 186	8 251	11 903	11 770	12 058
	Turkey				4 789	4 796	4 787	4 821	4 824	4 927
	United Kingdom	9 198	4 968	4 826	8 852	9 164	9 208	12 717	12 823	12 248
	United States	3 824	2 119	2 105	4 980	5 081	5 109		5 539	5 590
Partners	Albania	4 916	2 577	2 403						
	Argentina	3 961	2 201	2 160				4 251	4 252	4 307
	Azerbaijan							4 890	5 061	5 099
	Brazil	4 746	2 544	2 220	4 232	4 357	4 005	8 844	9 086	8 891
	Bulgaria	4 601	2 608	2 399				4 471	4 438	4 449
	Chile	4 815	2 536	2 451				5 162	5 131	5 198
	Colombia							4 318	4 421	4 189
	Croatia							5 038	5 065	5 069
	Estonia							4 802	4 806	4 705
	Hong Kong-China	4 365	2 358	2 343	4 439	4 275	4 387	4 548	4 485	4 597
	Indonesia	7 210	4 006	3 970	10 262	10 566	10 447	10 600	10 457	10 623
	Israel	4 420	2 454	2 450				4 499	4 446	4 544
	Jordan							6 088	6 382	6 436
	Kyrgyzstan							5 754	5 801	5 876
	Latvia	3 817	2 054	2 142	4 504	4 524	4 542	4 635	4 679	4 654
	Liechtenstein	261	147	169	300	210	238	281	231	266
	Lithuania							4 626	4 469	4 695
	Macao-China				969	1 203	1 089	3 741	3 104	4 276
	Montenegro							3 983	3 478	3 872
	Peru	4 381	2 406	2 088						
	Qatar							4 236	3 875	5 025
	Romania							4 966	4 962	5 093
	Russian Federation	6 622	3 664	3 656	5 849	5 839	5 885	5 604	5 675	5 749
	Serbia				4 349	4 259	4 205	4 701	4 575	4 760
	Slovenia							5 322	4 915	6 022
	Chinese Taipei							8 444	8 699	8 769
	Thailand	5 267	2 838	2 903	4 690	5 047	4 936	6 000	5 870	6 085
	Tunisia				4 154	4 669	4 602	4 582	4 536	4 620
	Uruguay				5 403	5 743	5 777	4 640	4 556	4 689

Table 11.14
Design effect 5 by country, by domain and cycle

		PISA 2000			PISA 2003			PISA 2006		
		Reading	Mathematics	Science	Reading	Mathematics	Science	Reading	Mathematics	Science
OECD	Australia	6.20	4.29	3.88	5.98	6.36	5.33	6.86	9.18	7.21
	Austria	3.16	1.94	2.08	6.11	5.66	5.78	7.00	7.15	7.93
	Belgium	7.37	5.10	5.56	4.85	3.81	4.67	6.77	6.87	5.50
	Canada	8.05	4.55	5.15	10.89	12.18	11.57	14.53	11.90	10.53
	Czech Republic	3.25	2.55	2.05	8.31	8.63	7.12	8.38	7.03	7.40
	Denmark	2.44	1.88	1.74	4.29	3.81	3.59	5.74	4.31	5.05
	Finland	4.04	1.93	2.23	2.38	2.88	2.60	3.29	3.80	2.62
	France	4.13	2.40	2.50	3.28	3.20	3.13	7.21	5.19	5.16
	Germany	2.49	1.71	1.63	4.49	4.87	4.96	7.59	7.45	7.05
	Greece	12.23	6.91	6.61	7.12	7.99	6.67	7.56	5.03	5.99
	Hungary	8.67	4.69	4.62	3.43	4.39	3.87	5.43	4.51	4.13
	Iceland	0.84	1.33	1.14	0.84	0.83	0.79	1.52	1.60	1.08
	Ireland	4.61	2.25	2.56	3.57	3.20	3.25	6.71	5.28	5.22
	Italy	5.06	2.91	2.68	10.63	12.02	9.80	10.83	12.36	9.72
	Japan	19.38	11.67	10.67	6.51	7.51	6.75	7.56	8.02	6.76
	Korea	6.02	2.97	3.07	7.63	6.69	6.75	9.65	8.54	7.19
	Luxembourg	0.89	0.90	1.13	0.87	0.44	0.83	0.75	0.59	0.54
	Mexico	6.85	4.23	4.34	55.44	54.48	48.54	31.66	36.46	35.04
	Netherlands	3.58	2.35	2.38	4.52	4.57	4.07	4.46	4.15	4.00
	New Zealand	2.43	2.07	1.15	2.49	2.38	2.31	3.90	3.16	3.04
	Norway	3.03	2.11	1.91	2.98	2.71	3.11	4.30	3.90	4.92
	Poland	7.28	5.64	5.72	3.94	3.37	3.43	4.31	4.42	3.77
	Portugal	9.91	5.07	5.14	7.46	6.95	6.32	6.63	5.85	5.95
	Slovak Republic				8.36	9.45	9.68	4.00	4.22	3.64
	Spain	6.35	4.07	3.31	8.01	8.00	7.34	12.39	13.51	15.74
	Sweden	2.52	1.71	1.77	2.97	3.37	3.01	5.44	3.20	2.82
	Switzerland	10.57	6.57	6.70	10.07	9.96	9.89	12.90	12.77	12.36
	Turkey				17.91	20.08	18.29	10.12	13.65	10.52
	United Kingdom	6.07	3.86	3.88	6.55	6.59	5.75	6.44	7.64	6.04
	United States	17.39	12.89	11.13	5.53	5.23	5.00		11.26	8.90
Partners	Albania	5.45	2.31	2.61						
	Argentina	32.83	13.49	13.53				14.46	16.53	15.65
	Azerbaijan							10.24	11.49	12.68
	Brazil	6.33	3.93	3.53	7.54	10.45	8.70	12.40	9.44	9.05
	Bulgaria	10.76	6.99	5.97				15.53	16.54	14.74
	Chile	7.78	4.23	3.64				12.24	14.37	11.61
	Colombia							9.95	8.27	7.09
	Croatia							5.20	4.20	4.24
	Estonia							5.77	5.67	4.43
	Hong Kong-China	5.35	2.95	3.05	8.46	9.18	9.18	4.07	3.80	3.38
	Indonesia	22.31	11.72	11.25	21.15	25.35	23.97	66.74	52.62	71.16
	Israel	27.07	12.59	13.15				6.75	7.51	5.07
	Jordan							7.86	10.14	6.49
	Kyrgyzstan							6.85	9.07	7.23
	Latvia	10.36	4.00	7.13	7.62	8.14	8.13	7.98	6.31	5.86
	Liechtenstein	0.57	0.93	0.99	0.53	0.57	0.58	0.57	0.70	0.61
	Lithuania							4.62	5.03	4.45
	Macao-China				1.30	1.37	1.48	0.98	1.14	0.87
	Montenegro							0.81	1.15	0.79
	Peru	9.34	4.11	5.12						
	Qatar							0.76	0.79	0.66
	Romania							13.36	12.86	13.71
	Russian Federation	13.69	10.24	8.48	10.63	12.37	10.29	12.48	10.82	9.71
	Serbia				8.41	8.66	7.87	6.83	7.02	6.10
	Slovenia							0.83	0.90	0.85
	Chinese Taipei							14.10	13.95	12.58
	Thailand	9.53	5.62	4.69	6.76	7.01	5.78	6.21	5.09	4.78
	Tunisia				4.06	4.52	4.06	7.92	8.60	5.98
	Uruguay				4.66	6.34	4.11	3.88	3.33	4.10

Table 11.15
Effective sample size 5 by country, by domain and cycle

		PISA 2000			PISA 2003			PISA 2006		
		Reading	Mathematics	Science	Reading	Mathematics	Science	Reading	Mathematics	Science
OECD	Australia	835	666	738	2 098	1 973	2 356	2 067	1 543	1 966
	Austria	1 502	1 360	1 284	752	813	795	704	689	622
	Belgium	905	742	670	1 815	2 311	1 883	1 308	1 290	1 610
	Canada	3 686	3 626	3 199	2 568	2 296	2 416	1 558	1 904	2 150
	Czech Republic	1 652	1 204	1 495	761	732	888	708	844	801
	Denmark	1 737	1 264	1 351	982	1 108	1 174	789	1 050	898
	Finland	1 203	1 402	1 214	2 437	2 011	2 226	1 431	1 242	1 801
	France	1 131	1 082	1 036	1 312	1 342	1 372	654	909	914
	Germany	2 036	1 656	1 757	1 039	957	939	644	656	694
	Greece	382	377	392	650	579	694	645	968	814
	Hungary	564	597	606	1 388	1 086	1 232	827	995	1 086
	Iceland	4 037	1 414	1 634	3 983	4 031	4 241	2 488	2 375	3 501
	Ireland	836	948	833	1 087	1 213	1 195	684	868	878
	Italy	985	950	1 033	1 095	969	1 188	2 010	1 762	2 239
	Japan	271	250	273	723	627	697	787	742	880
	Korea	828	934	899	713	814	807	536	606	719
	Luxembourg	3 970	2 170	1 727	4 509	8 942	4 706	6 113	7 681	8 432
	Mexico	671	606	587	541	550	618	978	850	884
	Netherlands	699	589	587	884	874	982	1 092	1 174	1 217
	New Zealand	1 510	988	1 762	1 811	1 897	1 950	1 237	1 524	1 587
	Norway	1 369	1 093	1 208	1 363	1 500	1 305	1 092	1 202	954
	Poland	502	350	357	1 114	1 299	1 279	1 286	1 255	1 472
	Portugal	462	502	496	618	663	729	770	873	858
	Slovak Republic				879	778	759	1 183	1 121	1 298
	Spain	979	841	1 046	1 346	1 349	1 469	1 582	1 451	1 246
	Sweden	1 749	1 441	1 379	1 559	1 371	1 535	817	1 387	1 574
	Switzerland	577	517	507	836	846	852	945	954	986
	Turkey				271	242	266	488	362	470
	United Kingdom	1 540	1 345	1 336	1 455	1 446	1 657	2 042	1 722	2 176
	United States	221	166	191	987	1 043	1 090		498	630
Partners	Albania	913	1 206	1 063						
	Argentina	121	165	163				300	262	277
	Azerbaijan							506	451	409
	Brazil	773	692	768	591	426	512	749	984	1 027
	Bulgaria	433	375	427				290	272	305
	Chile	628	647	748				428	364	451
	Colombia							450	542	632
	Croatia							1 002	1 242	1 230
	Estonia							844	858	1 099
	Hong Kong-China	823	827	799	529	488	488	1 140	1 224	1 374
	Indonesia	330	349	362	509	424	449	160	202	150
	Israel	166	197	191				679	611	905
	Jordan							829	642	1 003
	Kyrgyzstan							862	651	817
	Latvia	376	537	303	607	568	569	592	748	806
	Liechtenstein	547	189	178	632	579	573	591	486	557
	Lithuania							1 026	943	1 066
	Macao-China				962	910	845	4 853	4 186	5 469
	Montenegro							5 467	3 877	5 645
	Peru	474	615	495						
	Qatar							8 232	7 881	9 556
	Romania							383	398	373
	Russian Federation	490	363	438	562	483	580	465	536	597
	Serbia				524	509	559	703	683	786
	Slovenia							7 979	7 344	7 803
	Chinese Taipei							625	632	701
	Thailand	560	527	632	775	747	906	997	1 216	1 297
	Tunisia				1 163	1 045	1 163	586	539	776

SUMMARY ANALYSES OF THE DESIGN EFFECT

To better understand the evolution of the design effect for a particular country across the three PISA cycles, some information related to the design effects and their respective effective sample sizes, are presented in appendix 3. In particular, as the design effect and the effective sample size depends on:

- ***The sample size***, the number of participating schools, the number of participating students and the average school sample size, which are provided in Table A3.2;
- ***The school variance***, school variance estimates and the intraclass correlation, which are provided respectively in Table A3.3 and Table A3.4;
- ***The stratification variables***, the intraclass correlation coefficient within explicit strata (provided in Table A3.5), and the percentage of school variance explained by explicit stratification variables (provided in Table A3.6).

Finally, the standard errors on the mean performance estimates are provided in Table A3.1.

Table 11.16 to Table 11.21 present the median of the indices presented in Table 11.6 and in Table A3.1 to Table A3.6 by cycle and per domain.

Table 11.16
Median of the design effect 3 per cycle and per domain across the 35 countries that participated in every cycle

	Reading	Mathematics	Science
PISA 2000	5.90	3.68	2.93
PISA 2003	6.02	6.25	5.45
PISA 2006	6.69	6.26	5.63

In PISA 2000, student performance estimates for a particular domain were only provided for students who responded to testing material from that domain, while in 2003 and 2006, student proficiency estimates were provided for all domains. For PISA 2000 about five-ninths of the students were assessed in the minor domains (Adams & Wu, 2002). This difference explains why the design effects in mathematics and science for 2000 are so low in comparison with all other design effects.

The design effect associated with scientific literacy is always the smallest for any data collection. As shown by Table 11.16, this outcome seems to result from the smaller school variance estimates in scientific literacy in comparison with reading literacy and mathematical literacy. Indeed, for the three cycles, the school variance in science literacy is always the smallest. However, as will be explained below, the school variance estimates in PISA 2000 and PISA 2003 are suspected to be biased downwards.

Table 11.17 presents summary information about the standard errors of national mean achievement across PISA cycles.

Table 11.17
Median of the standard errors of the student performance mean estimate for each domain and PISA cycle for the 35 countries that participated in every cycle

	Reading	Mathematics	Science
PISA 2000	3.10	3.26	3.18
PISA 2003	2.88	3.00	3.08
PISA 2006	3.18	2.89	2.79

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With the exception of reading literacy in 2006, the standard errors, on average, have decreased between the 2000 data collection and the 2006 data collection. This decrease is associated with the continuously increasing school sample size. Note that, generally speaking, the sample size increase in a given country, in 2006 compared with earlier cycles, was intended to provide adequate data for regional or other subgroup estimates. Consequently the reduction in standard error for the national mean achievement is often not particularly great for countries with a noticeable increase in sample size. In other words, the sample size increased, but so did the design effects for country mean achievement estimates.

This reduction of the standard errors might also be explained by a better efficiency of the explicit stratification variables. Indeed, the median percentage of school variance explained by explicit stratification variables have slightly increased, mainly between 2003 and 2006 data collection, as shown by Table 11.18.

Table 11.18 shows that school sample sizes have generally been increasing across PISA cycles.

Table 11.18
Median of the number of participating schools for each domain and PISA cycle for the 35 countries that participated in every cycle

	Number of schools
PISA 2000	176
PISA 2003	193
PISA 2006	199

Table 11.19 shows information about the size of the between-school variance across PISA cycles.

Table 11.19
Median of the school variance estimate for each domain and PISA cycle for the 35 countries that participated in every cycle

	Reading	Mathematics	Science
PISA 2000	3305	3127	2574
PISA 2003	2481	2620	2270
PISA 2006	2982	2744	2520

To understand the pattern of school variance estimates, it is important to recall how the school membership was implemented in the conditioning model. In PISA 2000 and PISA 2003, the conditioning variable consists of the school average of student performance weighted maximum likelihood estimates in the major domain. In 2006, the conditioning variables consist of *n*-1 dummy variables, with *n* being the number of participating schools (see Chapter 9). The method used in the first two PISA studies seems to generate an underestimation of the school variance estimates in the minor domains. This bias might therefore explain why the largest school variance estimate in 2000 and in 2003 was associated with the major domain, respectively reading literacy and mathematic literacy.

Table 11.20
Median of the intraclass correlation for each domain and PISA cycle for the 35 countries that participated in every cycle

	Reading	Mathematics	Science
PISA 2000	0.37	0.36	0.33
PISA 2003	0.30	0.34	0.28
PISA 2006	0.38	0.36	0.35

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Table 11.21
Median of the within explicit strata intraclass correlation for each domain and PISA cycle for the 35 countries that participated in every cycle

	Reading	Mathematics	Science
PISA 2000	0.21	0.19	0.18
PISA 2003	0.18	0.20	0.14
PISA 2006	0.27	0.22	0.20

Table 11.22
Median of the percentages of school variances explained by explicit stratification variables, for each domain and PISA cycle for the 35 countries that participated in every cycle

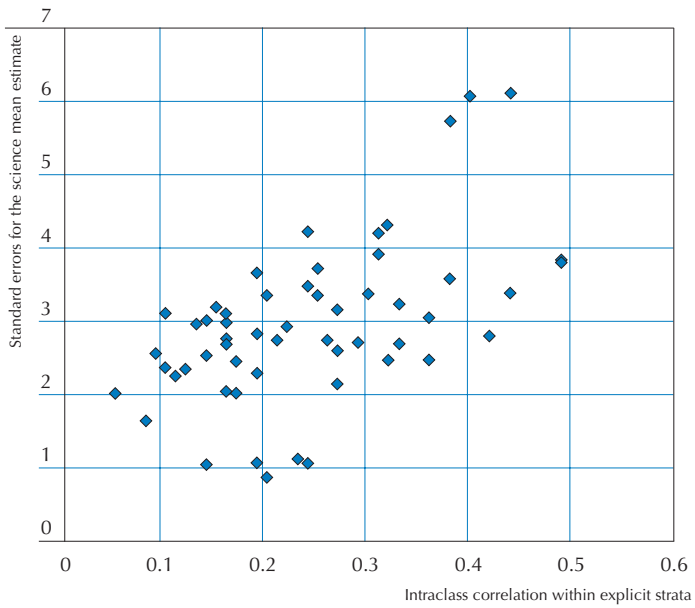
	Reading	Mathematics	Science
PISA 2000	23	22	24
PISA 2003	23	22	21
PISA 2006	34	28	34

Countries with outlying standard errors

Figure 11.2 presents the relationship between the intraclass correlation within explicit strata and the standard errors for the science performance mean estimates. The correlation between these 2 variables is equal to 0.54.

The three outlying dots in the scatter plot represent Indonesia, Argentina and Bulgaria. The large standard error for Indonesia is due to an error in the school frame for the measure of size of a single school. Removing that school from the PISA database reduces the standard errors from 5.73 to 3.33. In Bulgaria and in Argentina, the school variance within explicit stratification variable is quite large (the intraclass correlation is above 0.40) and the percentage of school variance explained by explicit stratification variable is quite low (about 0.30). This suggests that, in future cycles, efforts might be needed to improve the effectiveness of the explicit stratification in these two countries.

Figure 11.2
Relationship between the standard error for the science performance mean and the intraclass correlation within explicit strata (PISA 2006)



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Five countries have an intraclass correlation within explicit strata higher than, or equal to, 0.30 but present a percentage of school variance explained by explicit stratification variables above 0.50 – Austria, Belgium, Chile, Hungary and Romania.

Greece has an intraclass correlation within explicit strata equal to 0.33 and a percentage of explained school variance equal to 0.43. This suggests that stratification variables used are quite efficient for explaining the school variance but can still be improved.

The following countries have an intraclass correlation within explicit strata above or equal to 0.30 and a percentage of explained variance close or below 0.30: Columbia, Hong Kong-China, Serbia, Chinese Taipei, Indonesia, Argentina, Azerbaijan, Brazil, Japan, Bulgaria, Germany and Turkey. In these countries, the sampling design should be revised and more efficient stratification variables should be identified.

Reader's Guide

Country codes – the following country codes are used in this report:

OECD countries

AUS	Australia
AUT	Austria
BEL	Belgium
BEF	Belgium (French Community)
BEN	Belgium (Flemish Community)
CAN	Canada
CAE	Canada (English Community)
CAF	Canada (French Community)
CZE	Czech Republic
DNK	Denmark
FIN	Finland
FRA	France
DEU	Germany
GRC	Greece
HUN	Hungary
ISL	Iceland
IRL	Ireland
ITA	Italy
JPN	Japan
KOR	Korea
LUX	Luxembourg
LXF	Luxembourg (French Community)
LXG	Luxembourg (German Community)
MEX	Mexico
NLD	Netherlands
NZL	New Zealand
NOR	Norway
POL	Poland
PRT	Portugal
SVK	Slovak Republic
ESP	Spain
ESB	Spain (Basque Community)
ESC	Spain (Catalonian Community)
ESS	Spain (Castillian Community)
SWE	Sweden
CHE	Switzerland
CHF	Switzerland (French Community)
CHG	Switzerland (German Community)
CHI	Switzerland (Italian Community)
TUR	Turkey
GBR	United Kingdom
IRL	Ireland
SCO	Scotland
USA	United States

Partner countries and economies

ARG	Argentina
AZE	Azerbaijan
BGR	Bulgaria
BRA	Brazil
CHL	Chile
COL	Colombia
EST	Estonia
HKG	Hong Kong-China
HRV	Croatia
IDN	Indonesia
JOR	Jordan
KGZ	Kyrgyztan
LIE	Liechtenstein
LTU	Lithuania
LVA	Latvia
LVL	Latvia (Latvian Community)
LVR	Latvia (Russian Community)
MAC	Macao-China
MNE	Montenegro
QAT	Qatar
ROU	Romania
RUS	Russian Federation
SRB	Serbia
SVN	Slovenia
TAP	Chinese Taipei
THA	Thailand
TUN	Tunisia
URY	Uruguay

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References

Adams, R.J., Wilson, M. & **Wang, W.C.** (1997), The multidimensional random coefficients multinomial logit model. *Applied Psychological Measurement,* No. 21, pp. 1-23.

Adams, R.J., Wilson, M. R. & **Wu, M.L.** (1997), Multilevel item response models: An approach to errors in variables regression, *Journal of Educational and Behavioural Statistics,* No. 22 (1), pp. 46-75.

Adams, R.J. & **Wu, M.L.** (2002), *PISA 2000 Technical Report,* OECD, Paris.

Bollen, K.A. & **Long, S.J.** (1993) (eds.), *Testing Structural Equation Models*, Newbury Park: London.

Beaton, A.E. (1987), Implementing the new design: The NAEP 1983-84 technical report (Rep. No. 15-TR-20), Princeton, NJ: Educational Testing Service.

Buchmann, C. (2000), Family structure, parental perceptions and child labor in Kenya: What factors determine who is enrolled in school? *Soc. Forces,* No. 78, pp. 1349-79.

Buchmann, C. (2002), Measuring Family Background in International Studies of Education: Conceptual Issues and Methodological Challenges, in Porter, A.C. and Gamoran, A. (eds.). *Methodological Advances in Cross-National Surveys of Educational Achievement* (pp. 150-97), Washington, DC: National Academy Press.

Creemers, B.P.M. (1994), *The Effective Classroom*, London: Cassell.

Cochran, W.G. (1977), *Sampling techniques,* third edition, New York, NY: John Wiley and Sons.

Ganzeboom, H.B.G., de Graaf, P.M. & **Treiman, D.J.** (1992), A standard international socio-economic index of occupational status, *Social Science Research*, No. 21, pp. 1-56.

Ganzeboom H.B. & **Treiman, D.J.** (1996), Internationally comparable measures of occupational status for the 1988 international standard classification of occupations, *Social Science Research*, No. 25, pp. 201-239.

Grisay, A. (2003), Translation procedures in OECD/PISA 2000 international assessment, *Language Testing,* No. 20 (2), pp. 225-240.

Hambleton, R.K., Swaminathan, H. & **Rogers, H.J.** (1991), *Fundamentals of item response theory*, Newbury Park, London, New Delhi: SAGE Publications.

Hambleton, R.K., Merenda, P.F. & **Spielberger, C.D.** (2005), *Adapting Educational and Psychological Tests for Cross-Cultural Assessment,* IEA Lawrence Erlbaum Associates, Publishers, Mahwah, New Jersey.

Harkness, J.A., Van de Vijver, F.J.R. & **Mohler, P.Ph** (2003), *Cross-Cultural Survey Methods,* Wiley-Interscience, John Wiley & Sons, Inc., Hoboken, New Jersey.

Harvey-Beavis, A. (2002), Student and School Questionnaire Development, in R.J. Adams and M.L. Wu (eds.), *PISA 2000 Technical Report,* (pp. 33-38), OECD, Paris.

International Labour Organisation (ILO) (1990), *International Standard Classification of Occupations: ISCO-88.* Geneva: International Labour Office.

Jöreskog, K.G. & **Sörbom, Dag** (1993), *LISREL 8 User's Reference Guide*, Chicago: SSI.

Judkins, D.R. (1990), Fay's Method of Variance Estimation, *Journal of Official Statistics*, No. 6 (3), pp. 223-239.

Kaplan, D. (2000), *Structural equation modeling: Foundation and extensions,* Thousand Oaks: SAGE Publications.

Keyfitz, N. (1951), Sampling with probabilities proportionate to science: Adjustment for changes in probabilities, *Journal of the American Statistical Association,* No. 46, American Statistical Association, Alexandria, pp. 105-109.

Kish, L. (1992), Weighting for Unequal, *Pi. Journal of Official Statistics*, No. 8 (2), pp. 183-200.

LISREL (1993), K.G. Jöreskog & D. Sörbom, [computer software], Lincolnwood, IL: Scientific Software International, Inc.

Lohr, S.L. (1999), *Sampling: Design and Analysis*, Duxberry: Pacific Grove.

Macaskill, G., Adams, R.J. & **Wu, M.L.** (1998), Scaling methodology and procedures for the mathematics and science literacy, advanced mathematics and physics scale, in M. Martin and D.L. Kelly, Editors, *Third International Mathematics and Science Study, technical report Volume 3: Implementation and analysis*, Boston College, Chestnut Hill, MA.

Masters, G.N. & **Wright, B.D.** (1997), The Partial Credit Model, in W.J. van der Linden, & R.K. Hambleton (eds.), *Handbook of Modern Item Response Theory* (pp. 101-122), New York/Berlin/Heidelberg: Springer.

Mislevy, R.J. (1991), Randomization-based inference about latent variables from complex samples, *Psychometrika,* No. 56, pp. 177-196.

Mislevy, R.J., Beaton, A., Kaplan, B.A. & **Sheehan, K.** (1992), Estimating population characteristics from sparse matrix samples of item responses, *Journal of Educational Measurement,* No. 29 (2), pp. 133-161.

Mislevy, R.J. & **Sheehan, K.M.** (1987), Marginal estimation procedures, in Beaton, A.E., Editor, 1987. *The NAEP 1983-84 technical report,* National Assessment of Educational Progress, Educational Testing Service, Princeton, pp. 293-360.

Mislevy, R.J. & **Sheehan, K.M.** (1989), Information matrices in latent-variable models, *Journal of Educational Statistics,* No. 14, pp. 335-350.

Mislevy, R.J. & **Sheehan, K.M.** (1989), The role of collateral information about examinees in item parameter estimation, *Psychometrika,* No. 54, pp. 661-679.

Monseur, C. & **Berezner, A.** (2007), The Computation of Equating Errors in International Surveys in Education, *Journal of Applied Measurement,* No. 8 (3), 2007, pp. 323-335.

Monseur, C. (2005), An exploratory alternative approach for student non response weight adjustment, *Studies in Educational Evaluation,* No. 31 (2-3), pp. 129-144.

Muthen, B. & **L. Muthen** (1998), [computer software], *Mplus* Los Angeles, CA: Muthen & Muthen.

Muthen, B., du Toit, S.H.C. & **Spisic, D.** (1997), *Robust inference using weighted least squares and quadratic estimating equations in latent variable modeling with categorical and continuous outcomes,* unpublished manuscript.

OECD (1999), *Classifying Educational Programmes. Manual for ISCED-97 Implementation in OECD Countries,* OECD, Paris.

OECD (2003), *Literacy Skills for the World of Tomorrow: Further results from PISA 2000,* OECD, Paris.

OECD (2004), *Learning for Tomorrow's World – First Results from PISA 2003,* OECD, Paris.

OECD (2005), *Technical Report for the OECD Programme for International Student Assessment 2003,* OECD, Paris.

OECD (2006), *Assessing Scientific, Reading and Mathematical Literacy: A framework for PISA 2006,* OECD, Paris.

OECD (2007), *PISA 2006: Science Competencies for Tomorrow's World,* OECD, Paris.

PISA Consortium (2006), *PISA 2006 Main Study Data Management Manual, https://mypisa.acer.edu.au/images/mypisadoc/opmanual/pisa2006_data_management_manual.pdf*

Rasch, G. (1960), Probabilistic models for some intelligence and attainment tests, Copenhagen: Nielsen & Lydiche.

Routitski A. & **Berezner, A.** (2006), Issues influencing the validity of cross-national comparisons of student performance. Data Entry Quality and Parameter Estimation. Paper presented at the Annual Meeting of the American Educational Research Association (AERA) in San Francisco, 7-11 April, *https://mypisa.acer.edu.au/images/mypisadoc/aera06routitsky_berezner.pdf*

Rust, K. (1985), Variance Estimation for Complex Estimators in Sample Surveys, *Journal of Official Statistics,* No. 1, pp. 381-397.

Rust, K.F. & **Rao, J.N.K.** (1996), Variance Estimation for Complex Surveys Using Replication Techniques, *Survey Methods in Medical Research,* No. 5, pp. 283-310.

Shao, J. (1996), Resampling Methods in Sample Surveys (with Discussion), *Statistics,* No. 27, pp. 203-254.

Särndal, C.-E., Swensson, B. & **Wretman, J.** (1992), *Model Assisted Survey Sampling,* New York: Springer-Verlag.

SAS® CALIS (1992), W. Hartmann [computer software], Cary, NC: SAS Institute Inc.

Scheerens, J. (1990), School effectiveness and the development of process indicators of school functioning, *School effectiveness and school improvement,* No. 1, pp. 61-80.

Scheerens, J. & **Bosker, R.J.** (1997), *The Foundations of School Effectiveness,* Oxford: Pergamon.

Schulz, W. (2002), Constructing and Validating the Questionnaire composites, in R.J. Adams and M.L. Wu (eds.), *PISA 2000 Technical Report,* OECD, Paris.

Schulz, W. (2004), Mapping Student Scores to Item Responses, in W. Schulz and H. Sibberns (eds.), *IEA Civic Education Study, Technical Report* (pp. 127-132), Amsterdam: IEA.

Schulz, W. (2006a), *Testing Parameter Invariance for Questionnaire Indices using Confirmatory Factor Analysis and Item Response Theory,* Paper presented at the Annual Meetings of the American Educational Research Association (AERA) in San Francisco, 7-11 April.

Schulz, W. (2006b), *Measuring the socio-economic background of students and its effect on achievement in PISA 2000 and PISA 2003,* Paper presented at the Annual Meetings of the American Educational Research Association (AERA) in San Francisco, 7-11 April.

Thorndike, R.L. (1973), *Reading comprehension in fifteen countries,* New York, Wiley: and Stockholm: Almqvist & Wiksell.

Travers, K.J. & **Westbury, I.** (1989), *The IEA Study of Mathematics I: Analysis of Mathematics Curricula,* Oxford: Pergamon Press.

Travers, K.J., Garden R.A. & **Rosier, M.** (1989), Introduction to the Study, in Robitaille, D. A. and Garden, R. A. (eds), *The IEA Study of Mathematics II: Contexts and Outcomes of School Mathematics Curricula,* Oxford: Pergamon Press.

Verhelst, N. (2002), Coder and Marker Reliabilaity Studies, in R.J. Adams & M.L. Wu (eds.), *PISA 2000 Technical Report*. OECD, Paris.

Walberg, H.J. (1984), Improving the productivity of American schools, *Educational Leadership,* No. 41, pp. 19-27.

Walberg, H. (1986), Synthesis of research on teaching, in M. Wittrock (ed.), *Handbook of research on teaching* (pp. 214-229), New York: Macmillan.

Walker, M. (2006), *The choice of Likert or dichotomous items to measure attitudes across culturally distinct countries in international comparative educational research*. Paper presented at the Annual Meetings of the American Educational Research Association (AERA) in San Francisco, 7-11 April.

Walker, M. (2007), Ameliorating Culturally-Based Extreme Response Tendencies To Attitude items, *Journal of Applied Measurement,* No. 8, pp. 267-278.

Warm, T.A. (1989), Weighted Likelihood Estimation of Ability in Item Response Theory, *Psychometrika*, No. 54 (3), pp. 427-450.

Westat (2007), *WesVar® 5.1* Computer software and manual, Rockville, MD: Author (also see *http://www.westat.com/wesvar/*).

Wilson, M. (1994), Comparing Attitude Across Different Cultures: Two Quantitative Approaches to Construct Validity, in M. Wilson (ed.), *Objective measurement II: Theory into practice* (pp. 271-292), Norwood, NJ: Ablex.

Wolter, K.M. (2007), *Introduction to Variance Estimation*. Second edition, Springer: New York.

Wu, M.L., Adams, R.J. & **Wilson, M.R.** (1997), *ConQuest®: Multi-Aspect Test Software* [computer program manual], Camberwell, Vic.: Australian Council for Educational Research.

List of abbreviations – the following abbreviations are used in this report:

ACER	Australian Council for Educational Research
AGFI	Adjusted Goodness-of-Fit Index
BRR	Balanced Repeated Replication
CBAS	Computer Based Assessment of Science
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CITO	National Institute for Educational Measurement, The Netherlands
CIVED	Civic Education Study
DIF	Differential Item Functioning
ENR	Enrolment of 15-year-olds
ESCS	PISA Index of Economic, Social and Cultural Status
ETS	Educational Testing Service
IAEP	International Assessment of Educational Progress
I	Sampling Interval
ICR	Inter-Country Coder Reliability Study
ICT	Information Communication Technology
IEA	International Association for the Evaluation of Educational Achievement
INES	OECD Indicators of Education Systems
IRT	Item Response Theory
ISCED	International Standard Classification of Education
ISCO	International Standard Classification of Occupations
ISEI	International Socio-Economic Index
MENR	Enrolment for moderately small school
MOS	Measure of size
NCQM	National Centre Quality Monitor
NDP	National Desired Population
NEP	National Enrolled Population
NFI	Normed Fit Index
NIER	National Institute for Educational Research, Japan
NNFI	Non-Normed Fit Index
NPM	National Project Manager
OECD	Organisation for Economic Cooperation and Development
PISA	Programme for International Student Assessment
PPS	Probability Proportional to Size
PGB	PISA Governing Board
PQM	PISA Quality Monitor
PSU	Primary Sampling Units
QAS	Questionnaire Adaptations Spreadsheet
RMSEA	Root Mean Square Error of Approximation
RN	Random Number
SC	School Co-ordinator
SE	Standard Error
SD	Standard Deviation
SEM	Structural Equation Modelling
SMEG	Subject Matter Expert Group
SPT	Study Programme Table
TA	Test Administrator
TAG	Technical Advisory Group
TCS	Target Cluster Size
TIMSS	Third International Mathematics and Science Study
TIMSS-R	Third International Mathematics and Science Study – Repeat
VENR	Enrolment for very small schools
WLE	Weighted Likelihood Estimates

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