

PIRLS Sampling Weights and Participation Rates

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9.1 Overview

Selecting valid and efficient samples is critical to the quality and success of an international comparative study, such as PIRLS. The accuracy of the survey results depends on the quality of the sampling information available when planning the sample, and on the care with which the sampling activities themselves are conducted. For PIRLS 2001, National Research Coordinators (NRCs) worked on all phases of sampling, in conjunction with staff from Statistics Canada. NRCs were trained in how to select the school and student samples, and in how to use the sampling software provided by the IEA Data Processing Center. This chapter summarizes major characteristics of the national samples, and describes the procedure for computing sampling weights and participation rates for each country. In consultation with the PIRLS 2001 sampling referee,¹ staff from Statistics Canada reviewed the national sampling plans, sampling data, sampling frames, and sample selection. The PIRLS International Study Center (ISC) at Boston College, jointly with Statistics Canada and the sampling referee, used this information to evaluate the quality of the samples. Summaries of the sample design for each country, including details of population coverage and exclusions, stratification variables, and participation rates, are provided in Appendix B.



1 Keith Rust, Westat.

9.2 Sampling implementation

9.2.1 PIRLS 2001 Target Population

In IEA studies, the target population for all countries is known as the *international desired population*. The international desired population for PIRLS 2001 was defined as:²

- All students enrolled in the upper of the two adjacent grades that contain the largest proportion of 9-year-olds at the time of testing.

Beyond the age criterion embedded in the above definition, the target grade should represent that point in the curriculum where students have essentially finished learning the basic reading skills, and will then focus more on “reading to learn” in the subsequent grades. Thus, the PIRLS 2001 target grade was expected to be the fourth grade in most countries (some countries, therefore, have students significantly older than nine years of age).³

Exhibit 9.1 summarizes the grades identified as the target grade in all participating countries. For most countries, the target grade did indeed turn out to be the fourth grade. Average student ages ranged from 9.7 (in Cyprus and Iceland) to 11.2 (in Morocco).

Exhibit 9.1: National Grade Definitions

Country	Country's Name for Grade Tested	Years of Formal Schooling	Mean Age of Students Tested
Argentina	4	4	10.2
Belize	Standard II	4	9.8
Bulgaria	4	4	10.9
Canada (O, Q) ¹	4	4	10.0
Colombia	4	4	10.5
Cyprus	4	4	9.7
Czech Republic	4	4	10.5
England	Year 5	5	10.2
France	Cours Moyen 1	4	10.1
Germany	4	4	10.5
Greece	4	4	9.9
Hong Kong, SAR	Primary 4	4	10.2
Hungary	4	4	10.7
Iceland	4	4	9.7
Iran, Islamic Rep. of	4	4	10.4
Israel	4	4	10.0
Italy	4	4	9.8
Kuwait	4	4	9.9
Latvia	4	4	11.0
Lithuania	4	4	10.9
Macedonia, Rep. of	4	4	10.7
Moldova	4	4	10.8
Morocco	4	4	11.2
Netherlands	6th group	4	10.3
New Zealand	Year 5 ²	4	10.1
Norway	4	4	10.0
Romania	4	4	11.1
Russian Federation	3 in stream I and 4 in stream II	3 or 4	10.3
Scotland	Primary 5	5	9.8
Singapore	Primary 4	4	10.1
Slovak Republic	4	4	10.3
Slovenia	3	3	9.8
Sweden	4	4	10.8
Turkey	4	4	10.2
United States	4	4	10.2

¹ Canada is represented by the provinces of Ontario and Quebec only

² The official nomenclature used in New Zealand since 1996 refers to students' years of schooling rather than a class/grade level. Year 5 students were at a class level equivalent to Grade 4.

² This is also the population definition used by TIMSS for primary-school students.

³ The target population for each participating country is described in Appendix B.

9.2.2 Population Coverage and Exclusions

Exhibit 9.2 summarizes population coverage and exclusions for the PIRLS 2001 target populations. National coverage of the

international desired target population was generally comprehensive. Only Canada and Lithuania chose a national desired population less than the international desired

Exhibit 9.2: Population Coverage and Exclusions

Country	International Desired Population		National Desired Population		
	Coverage	Notes on Coverage	School-Level Exclusions	Within-Sample Exclusions	Overall Exclusions
Argentina	100%		3.7%	0.4%	4.1%
Belize	100%		0.8%	0.0%	0.8%
Bulgaria	100%		2.7%	0.0%	2.7%
Canada (O, Q) ¹	60%	Provinces of Ontario and Quebec only	3.1%	2.2%	5.4%
Colombia	100%		3.2%	0.1%	3.3%
Cyprus	100%		0.0%	2.0%	2.0%
Czech Republic	100%		5.0%	0.0%	5.0%
England	100%		1.8%	3.9%	5.7%
France	100%		5.1%	0.3%	5.3%
Germany	100%		0.8%	1.0%	1.8%
Greece	100%		2.0%	5.3%	7.3%
Hong Kong, SAR	100%		2.8%	0.0%	2.8%
Hungary	100%		2.1%	0.0%	2.1%
Iceland	100%		1.8%	1.3%	3.1%
Iran, Islamic Rep. of	100%		0.5%	0.0%	0.5%
Israel	100%		16.5%	5.9%	22.4%
Italy	100%		0.0%	2.9%	2.9%
Kuwait	100%		0.0%	0.0%	0.0%
Latvia	100%		4.3%	0.3%	4.6%
Lithuania	90%	Lithuanian speaking students only	1.3%	2.5%	3.8%
Macedonia, Rep. of	100%		3.8%	0.4%	4.2%
Moldova	100%		0.5%	0.0%	0.5%
Morocco	100%		1.0%	0.0%	1.0%
Netherlands	100%		3.4%	0.3%	3.7%
New Zealand	100%		1.6%	1.7%	3.2%
Norway	100%		1.9%	0.8%	2.8%
Romania	100%		2.6%	1.9%	4.5%
Russian Federation	100%		2.8%	3.8%	6.6%
Scotland	100%		3.8%	0.8%	4.7%
Singapore	100%		1.3%	0.1%	1.4%
Slovak Republic	100%		1.4%	0.6%	2.0%
Slovenia	100%		0.0%	0.3%	0.3%
Sweden	100%		2.5%	2.5%	5.0%
Turkey	100%		3.9%	0.0%	3.9%
United States	100%		0.6%	4.7%	5.3%

¹ Canada is represented by the provinces of Ontario and Quebec only

population.⁴ Because coverage of the international desired population fell below 65 percent for Canada, the Canadian results have been labeled “Canada (O,Q)” in the international report. Coverage was more inclusive in Lithuania, but since it was less than 100 percent, the Lithuanian results were footnoted to reflect this.

For the most part, school-level exclusions consisted of schools for the disabled and very small schools; however, there were some exceptions that are documented in Appendix B. Within-school exclusions generally consisted of disabled students and students who could not be assessed in the language of the test. Only in Israel did the level of excluded students exceed 10 percent. Three other countries (England, Greece, and the Russian Federation) have an exclusion rate above 5 percent (but below 7%). This was reflected in footnotes in the international reports. A few countries had no within-school exclusions.

9.2.3 General Sample Design

The basic design of the sample used in PIRLS 2001 was a two-stage stratified cluster design.⁵ The first stage consisted of a sampling of schools, and the second stage of a sampling of intact classrooms from the target grade in the sampled schools.

The PIRLS 2001 design allowed countries to stratify the school sampling frame in order to improve the precision of survey results. Countries could use an explicit stratification procedure, by which schools were categorized according to some criterion (e.g., regions of the country), ensuring a predetermined number of schools would be selected from each stratum. Countries also could use an implicit stratification procedure, by which schools were sorted according to a set of stratification variables prior to sampling. This approach provided an efficient method of allocating the school sample in proportion to the size of the implicit stratum, when used in conjunction with a systematic PPS method. Stratification variables and procedures for each country are described in Appendix B.

Most countries sampled 150 schools and one intact classroom (with all of its students) from each school. Countries that selected larger school samples included large countries such as the United States and the Russian Federation, and countries such as Canada, Germany, and Hungary that required accurate survey estimates for regions or provinces. Schools were selected with probability proportional to size, and classrooms with equal probabilities. Upon recommendation from Statistics Canada, some countries chose to sample more than one classroom per selected school. Details of the sampling of schools and students for each country are provided in Appendix B.

4 The Lithuanian population was restricted to schools catering to Lithuanian-speaking students only, the Canadian population to schools from the provinces of Ontario and Quebec only.

5 The PIRLS sample design is described in Chapter 5.

9.2.4 Target Population Sizes

Exhibit 9.3 summarizes the number of schools and students in each country's target population, as well as the number of schools and students that participated in the study. Most of the target population sizes are derived from the sampling frames

from which the PIRLS samples were drawn. The school and student population sizes for the United States and the Russian Federation, however, were not computed from the sampling frame, but were instead provided by their respective NRC. Using the sampling weights computed for each

Exhibit 9.3: Population and Sample Sizes

Country	Population		Sample			Mean Age
	Schools	Students	Schools	Students	Estimated Population	
Argentina	14 055	709 772	138	3 300	709 193	10.2
Belize	237	9 261	120	2 909	7 408	9.8
Bulgaria	2 424	98 270	170	3 460	95 702	10.9
Canada (O, Q) ¹	5 357	241 805	372	8 253	222 012	10.0
Colombia	46 805	867 583	147	5 131	975 170	10.5
Cyprus	242	10 209	150	3 001	10 206	9.7
Czech Republic	3 830	121 330	141	3 022	123 831	10.5
England	15 191	629 524	131	3 156	592 787	10.2
France	31 056	748 424	145	3 538	717 378	10.1
Germany	19 207	941 200	211	7 726	899 014	10.5
Greece	4 999	102 927	145	2 494	97 288	9.9
Hong Kong, SAR	760	81 207	147	5 050	88 645	10.2
Hungary	2 700	113 594	216	4 666	117 238	10.7
Iceland	140	4 566	133	3 676	4 456	9.7
Iran, Islamic Rep. of	61 110	1 741 673	184	7 430	1 812 810	10.4
Israel	1 462	90 905	147	3 973	85 802	10.0
Italy	7 162	573 571	184	3 502	573 318	9.8
Kuwait	184	21 414	135	7 133	22 318	9.9
Latvia	940	34 216	141	3 019	34 213	11.0
Lithuania	1 146	44 188	146	2 567	43 094	10.9
Macedonia, Rep. of	351	27 726	146	3 711	27,365	10.7
Moldova	1 395	64 467	150	3 533	60 634	10.8
Morocco	14 828	529 105	117	3 153	554 573	11.2
Netherlands	7 185	183 599	134	4 112	181 387	10.3
New Zealand	1 984	59 705	156	2 488	58 122	10.1
Norway	2 468	60 503	136	3 459	58 174	10.0
Romania	10 582	306 891	144	3 625	283 340	11.1
Russian Federation	63 641	2 009 900	206	4 093	1 823 855	10.3
Scotland	2 045	62 783	118	2 717	64 375	9.8
Singapore	196	50 772	196	7 002	49 301	10.1
Slovak Republic	2 165	76 182	150	3 807	71 409	10.3
Slovenia	443	21 906	148	2 952	21 066	9.8
Sweden	3 727	117 767	146	6 044	118 134	10.8
Turkey	13 941	1 111 470	154	5 125	977 316	10.2
United States	71 498	3 871 487	174	3 763	3 802 557	10.2

¹ Canada is represented by the provinces of Ontario and Quebec only

country (see section 9.3), PIRLS derived an estimate of the student population size, which matched closely the student population size from the sampling frame.

9.3 Calculating Sampling Weights

The PIRLS 2001 sampling design required schools to be sampled with a probability proportional to size (PPS), and for classrooms to be sampled with equal probabilities.⁶ PIRLS 2001 participants adapted the basic design to the requirements of their educational systems, with guidance from the PIRLS sampling consultants at Statistics Canada and the sampling referee. Very large countries could add an extra preliminary stage, where districts or regions were sampled first, and then schools within districts.⁷ Participants used stratification in order to improve the precision of their samples where appropriate. Individual country designs could be quite complex, as may be seen from the information in Appendix B – showing how the design was implemented in each country.

While the PIRLS 2001 multistage stratified cluster design provided very economical and effective data collection in a school environment, it resulted in differential probabilities of selection of the students. To adjust for these differential selection probabilities and ensure proper survey estimates,

PIRLS 2001 computed a sampling weight for each participating student. Because appropriate sampling weights were essential for the computation of accurate survey results, the ability to provide proper sampling weights was an essential requirement of an acceptable sample design. This section describes the procedures for calculating sampling weights for the PIRLS 2001 data.

Sampling weights were calculated according to a three-step procedure involving selection probabilities for schools, classrooms, and students. The first step consisted of calculating a school weight, which also incorporated weighting factors from any additional front-end sampling stages such as districts or regions. A school-level participation adjustment was then made to the school weight to compensate for any sampled schools that did not participate. This adjustment was calculated independently for each explicit stratum.

In the second step, a classroom weight reflecting the probability of the sampled classroom(s) being selected from among all the classrooms in the school at the target grade level was calculated. No classroom-level participation adjustment was necessary, since in most cases a single classroom was sampled in each school. If a school agreed to take part in the study, but the classroom refused to participate, adjustment for non-participation was made at the school level. If one of two selected class-

6 The PIRLS 2001 sampling design is presented in Chapter 5.

7 For example, the United States sampled school districts as primary sampling units and then schools within the school districts.

rooms in a school did not participate, then the classroom weight was calculated as though a single classroom had been selected in the first place. The classroom weight was calculated independently for each school.

Because intact classrooms were sampled in PIRLS, each student in the sampled classrooms was certain of selection, and so the student weight was 1.0. However, as a third and final step, a non-participation adjustment was made to compensate for students who did not take part in the testing. This was calculated independently for each sampled classroom. The basic sampling weight attached to each student record was the product of the three intermediate weights: the first stage (school) weight, the second stage (classroom) weight, and the third stage (student) weight. The overall student sampling weight was the product of the three weights including the non-participation adjustments.

9.3.1 The First Stage (School) Weight

Essentially, the first stage weight represented the inverse of the probability of a school being sampled on the first stage. The PIRLS 2001 sample design required that school selection probabilities be proportional to the school size, defined as enrollment in the target grade. The basic first stage weight for the i th sampled school was thus defined as:

$$BW_{sc}^i = \frac{M}{n \cdot m_i}$$

where n was the number of sampled schools, m_i was the measure of size for the i th school, and

$$M = \sum_{i=1}^N m_i$$

where N was the total number of schools in the explicit stratum containing the school.

For countries with a preliminary sampling stage (such as the United States and the Russian Federation), the basic first stage weight also incorporated the probability of selection in this preliminary stage. The first stage weight in such cases was simply the product of the “region” weight and the first stage weight, as described earlier.

In some countries, schools were selected with equal probabilities. This generally occurred when a large sampling ratio was used. In some countries also, explicit or implicit strata were defined to deal with very large schools or small schools. Equal probability sampling was necessary in these strata.

Under equal probability sampling, the basic first stage weight for the i th sampled school was defined as:

$$BW_{sc}^i = \frac{N}{n}$$

where n was the number of sampled schools and N was the total number of schools in the explicit stratum. The basic weight for all sampled schools in a stratum was identical in this context.

9.3.2 School Non-Participation Adjustment

First stage weights were calculated for all sampled and replacement schools that participated. A school-level participation adjustment was required to compensate for those schools that were sampled but did not participate, and hence were not replaced. Sampled schools that were found to be ineligible were removed from the calculation of this adjustment.⁸ The school-level participation adjustment was calculated separately for each explicit stratum.

The adjustment was calculated as follows:

$$A_{sc} = \frac{n_s + n_{r1} + n_{r2} + n_{nr}}{n_s + n_{r1} + n_{r2}}$$

where n_s was the number of originally sampled schools that participated, n_{r1} and n_{r2} the number of first and second replacement schools, respectively, that participated, and n_{nr} the number of schools that did not participate.

The final first stage weight for the i th School, corrected for non-participating schools, thus became:

$$FW_{sc}^i = A_{sc} \cdot BW_{sc}^i$$

9.3.3 The Second Stage (Classroom) Weight

The second stage weight represented the inverse of the second stage selection probability assigned to a sampled classroom. All classrooms were sampled with equal proba-

bility. For the i th school, let C^i be the total number of classrooms and c^i the number of sampled classrooms that participated in the study. Using equal probability sampling, the final second stage weight assigned to all sampled classrooms in the i th school was:

$$FW_{cl}^i = \frac{C^i}{c^i}$$

For most countries, c^i took the values 1 or 2, and remained fixed for all sampled schools. Some countries sampled all classrooms in a selected school.

9.3.4 The Third Stage (Student) Weight

The third stage weight represented the inverse of the third stage selection probability attached to a sampled student. Because intact classrooms were sampled, and all students in the classroom were expected to participate, the basic third stage weight for the j th classroom in the i th school was simply:

$$BW_{st}^{ij} = 1.0$$

9.3.5 Adjustment for Student Non-Participation

The student non-participation adjustment was calculated for each participating classroom as follows:

$$A_{st}^{ij} = \frac{s_{rs}^{ij} + s_{nr}^{ij}}{s_{rs}^{ij}}$$

8 A sampled school was ineligible if it was found to contain no eligible (i.e., fourth-grade) students. Such schools usually were in the sampling frame by mistake, or schools that had recently closed.

where $s_{rs}^{i,j}$ was the number of eligible students that participated in the j th classroom of the i th school and $s_{nr}^{i,j}$ was the number of eligible students that did not participate in the j th classroom of the i th school.

The third, and final, stage weight for students in the j th classroom in the i th school thus became:

$$FW_{st}^{i,j} = A_{st}^{i,j} \cdot BW_{st}^{i,j}$$

9.3.6 Overall Sampling Weight

The overall sampling weight was simply the product of the final first stage weight, the final second stage weight, and the final third stage weight and is given by:

$$W^{i,j} = FW_{sc}^i \cdot FW_{cl}^{i,j} \cdot FW_{st}^{i,j}$$

or

$$W^{i,j} = A_{sc} \cdot BW_{sc}^i \cdot FW_{cl}^{i,j} \cdot A_{st}^{i,j} \cdot BW_{st}^{i,j}$$

It is important to note that sampling weights vary by school and classroom, but that students within the same classroom have the same sampling weights. It is also important to note that sampling weights were calculated separately by explicit strata.

9.4 Calculating School and Student Participation Rates

Since non-participation by sampled schools or students can lead to bias in the study results, a variety of participation rates were computed to reveal the level of success each country achieved in securing participation from their sampled schools and students. To monitor school participation, three school participation rates were computed: one using originally sampled schools only; one using sampled and first replacement schools; and one using sampled and both first and second replacement schools. Student participation rates were also computed, as were overall participation rates.

9.4.1 Unweighted School Participation Rates

The three unweighted school participation rates that were computed were the following:

R_{unw}^{sc-s} = unweighted school participation rate for originally sampled schools only,

R_{unw}^{sc-r1} = unweighted school participation rate, including sampled and first replacement schools,

R_{unw}^{sc-r2} = unweighted school participation rate, including sampled, first, and second replacement schools.

Each unweighted school participation rate was defined as the ratio of the number of participating schools to the number of originally sampled schools, excluding any ineligible schools. The rates were calculated as follows:

$$R_{unw}^{sc-s} = \frac{n_s}{n_s + n_{r1} + n_{r2} + n_{nr}}$$

$$R_{unw}^{sc-r1} = \frac{n_s + n_{r1}}{n_s + n_{r1} + n_{r2} + n_{nr}}$$

$$R_{unw}^{sc-r2} = \frac{n_s + n_{r1} + n_{r2}}{n_s + n_{r1} + n_{r2} + n_{nr}}$$

9.4.2 Unweighted Student Participation Rates

The unweighted student participation rate was computed as follows:

$$R_{unw}^{st} = \frac{\sum_{ij} s_{rs}^{ij}}{\sum_{ij} s_{rs}^{ij} + \sum_{ij} s_{nr}^{ij}}$$

9.4.3 Unweighted Overall Participation Rates

Three unweighted overall participation rates were computed for each country. They were as follows:

R_{unw}^{ov-s} = unweighted overall participation rate for originally sampled schools only,

R_{unw}^{ov-r1} = unweighted overall participation rate, including sampled and first replacement schools,

R_{unw}^{ov-r2} = unweighted overall participation rate, including sampled, first, and second replacement schools.

For each country, the overall participation rate was defined as the product of the unweighted school participation rate and the unweighted student participation rate. They were calculated as follows:

$$R_{unw}^{ov-s} = R_{unw}^{sc-s} \cdot R_{unw}^{st}$$

$$R_{unw}^{ov-r1} = R_{unw}^{sc-r1} \cdot R_{unw}^{st}$$

$$R_{unw}^{ov-r2} = R_{unw}^{sc-r2} \cdot R_{unw}^{st}$$

9.4.4 Weighted School Participation Rates

Three weighted school-level participation rates were computed for each country. They were as follows:

R_{wtd}^{sc-s} = weighted school participation rate for originally sampled schools only,

R_{wtd}^{sc-r1} = weighted school participation rate, including sampled and first replacement schools,

R_{wtd}^{sc-r2} = weighted school participation rate, including sampled, first, and second replacement schools.

The weighted school participation rates were calculated as follows:

$$R_{wtd}^{sc-s} = \frac{\sum_{i,j}^{s+r1+r2} BW_{sc}^i \cdot FW_{cl}^{i,j} \cdot FW_{st}^{i,j}}{\sum_{i,j}^{s+r1+r2} FW_{sc}^i \cdot FW_{cl}^{i,j} \cdot FW_{st}^{i,j}}$$

$$R_{wtd}^{sc-r1} = \frac{\sum_{i,j}^{s+r1} BW_{sc}^i \cdot FW_{cl}^{i,j} \cdot FW_{st}^{i,j}}{\sum_{i,j}^{s+r1+r2} FW_{sc}^i \cdot FW_{cl}^{i,j} \cdot FW_{st}^{i,j}}$$

$$R_{wtd}^{sc-r2} = \frac{\sum_{i,j}^{s+r1+r2} BW_{sc}^i \cdot FW_{cl}^{i,j} \cdot FW_{st}^{i,j}}{\sum_{i,j}^{s+r1+r2} FW_{sc}^i \cdot FW_{cl}^{i,j} \cdot FW_{st}^{i,j}}$$

where both the numerator and denominator were summations over all responding students and the appropriate classroom-level and student-level sampling weights were used. Note that the basic school-level weight appears in the numerator, whereas the final school-level weight appears in the denominator.

The denominator remains unchanged in all three equations and is the weighted estimate of the total enrollment in the target population. The numerator, however, changes from one equation to the next. Only students from originally-sampled schools were included in the first equation. Students from first replacement schools were added in the second equation, and students from first and second replacement schools were added in the third equation.

9.4.5 Weighted Student Participation Rates

The weighted student participation rate was computed as follows:

$$R_{wtd}^{st} = \frac{\sum_{i,j}^{s+r1+r2} BW_{sc}^i \cdot FW_{cl}^{i,j} \cdot BW_{st}^{i,j}}{\sum_{i,j}^{s+r1+r2} BW_{sc}^i \cdot FW_{cl}^{i,j} \cdot FW_{st}^{i,j}}$$

where both the numerator and denominator were summations over all responding students, and the appropriate classroom-level and student-level sampling weights were used. Note that the basic student-level weight appears in the numerator, whereas the final student-level weight appears in the denominator. Furthermore, the denominator in this formula was the same quantity that appears in the numerator of the weighted school-level participation rate for all participating schools, sampled and replacement.

9.4.6 Weighted Overall Participation Rates

Three weighted overall participation rates were computed. They were as follows:

R_{wtd}^{ov-s} = weighted overall participation rate for originally sampled schools only,

R_{wtd}^{ov-r1} = weighted overall participation rate, including sampled and first replacement schools,

R_{wtd}^{ov-r2} = weighted overall participation rate, including sampled, first, and second replacement schools.

Each weighted overall participation rate was defined as the product of the appropriate weighted school participation rate and the weighted student participation rate. They were computed as follows:

$$R_{wtd}^{ov-s} = R_{wtd}^{sc-s} \cdot R_{wtd}^{st}$$

$$R_{wtd}^{ov-r1} = R_{wtd}^{sc-r1} \cdot R_{wtd}^{st}$$

$$R_{wtd}^{ov-r2} = R_{wtd}^{sc-r2} \cdot R_{wtd}^{st}$$

Weighted school, student, and overall participation rates were computed for each participating country using these procedures. Countries understood that the goal for sampling participation was 100 percent for all sampled schools and students. Guidelines for reporting achievement data for countries securing less than full participation were modeled after IEA's TIMSS study. Countries were assigned to one of three categories on the basis of their sampling participation (Exhibit 9.4). Countries in Category 1 were considered to have met the PIRLS sampling requirements, and to have an acceptable participation rate. Countries in Category 2 met the sampling requirements only after including replacement schools. Countries that failed to meet the participation requirements even with the use of replacement schools were assigned to Category 3. One of the main goals for quality data in PIRLS 2001 was to have as many countries as possible achieve Category 1 status, and to have no countries in Category 3.

Exhibits 9.5 through 9.8 present the school, student, and overall participation rates and achieved sample sizes for each participating country. As can be seen from these exhibits, almost all countries met the PIRLS sampling requirements, and belong in Category 1. Because they met the sampling requirements only after including replacement schools – England, The Netherlands, and the United States belong in Category 2, and their results were annotated with an obelisk in the achievement exhibits in the international report. Although Morocco and Scotland had overall weighted participation rates of 69 and 74 percent, respectively (even after including replacement schools), it was decided during the sampling adjudication that these rates did not warrant the placement of the countries in Category 3. Instead, results for Morocco and Scotland were annotated with a double-obelisk indicating that they nearly satisfied the guidelines for sample participation rates after including replacement schools.

Exhibit 9.4: Categories of Sampling Participation

Category 1	<p>Acceptable sampling participation rate without the use of replacement school. In order to be placed in this category, a country had to have:</p> <ul style="list-style-type: none"> • An unweighted school response rate without replacement of at least 85% (after rounding to the nearest whole percent) AND an unweighted student response rate (after rounding) of at least 85%. <p>OR</p> <ul style="list-style-type: none"> • A weighted school response rate without replacement of at least 85% (after rounding to the nearest whole percent) AND a weighted student response rate (after rounding) of at least 85%. <p>OR</p> <ul style="list-style-type: none"> • The product of the (unrounded) weighted school response rate without replacement and the (unrounded) weighted student response rate of at least 75% (after rounding to the nearest whole percent). <p>Countries in this category appeared in the tables and figures in international reports without annotation ordered by achievement as appropriate.</p>
Category 2	<p>Acceptable sampling participation rate only when replacement schools were included. A country was placed in category 2 if:</p> <ul style="list-style-type: none"> • It failed to meet the requirements for Category 1 but had either an unweighted or weighted school response rate without replacement of at least 50% (after rounding to the nearest percent). <p>AND HAD EITHER</p> <ul style="list-style-type: none"> • An unweighted school response rate with replacement of at least 85% (after rounding to the nearest whole percent) AND an unweighted student response rate (after rounding) of at least 85%. <p>OR</p> <ul style="list-style-type: none"> • A weighted school response rate with replacement of at least 85% (after rounding to nearest whole percent) AND a weighted student response rate (after rounding) of at least 85%. <p>OR</p> <ul style="list-style-type: none"> • The product of the (unrounded) weighted school response rate with replacement and the (unrounded) weighted student response rate of at least 75% (after rounding to the nearest whole percent). <p>Countries in this category were annotated in the tables and figures in international reports and ordered by achievement as appropriate.</p>
Category 3	<p>Unacceptable sampling response rate even when replacement schools are included. Countries that could provide documentation to show that they complied with PIRLS sampling procedures and requirements but did not meet the requirements for Category 1 or Category 2 were placed in Category 3.</p> <p>Countries in this category would appear in a separate section of the achievement tables, below the other countries, in international reports. These countries were presented in alphabetical order.</p>

Exhibit 9.5: School Participation Rates and Sample Sizes

Country	School Participation Before Replacement (Weighted Percentage)	School Participation After Replacement (Weighted Percentage)	Number of Schools in Original Sample	Number of Eligible Schools in Original Sample	Number of Schools in Original Sample That Participated	Number of Replacement Schools That Participated	Total Number of Schools That Participated
Argentina	89%	92%	150	150	133	5	138
Belize	80%	80%	150	150	119	1	120
Bulgaria	97%	97%	177	176	170	0	170
Canada (O, Q) ¹	90%	97%	387	387	359	13	372
Colombia	80%	98%	150	150	119	28	147
Cyprus	98%	100%	150	150	148	2	150
Czech Republic	90%	95%	150	148	135	6	141
England	57%	87%	150	150	88	43	131
France	93%	97%	150	150	140	5	145
Germany	98%	98%	216	215	209	2	211
Greece	78%	85%	170	170	133	12	145
Hong Kong, SAR	73%	98%	150	150	115	32	147
Hungary	98%	98%	220	220	216	0	216
Iceland	95%	95%	140	140	133	0	133
Iran, Islamic Rep. of	97%	100%	184	184	180	4	184
Israel	96%	98%	150	150	144	3	147
Italy	90%	100%	184	184	164	20	184
Kuwait	87%	89%	150	150	133	2	135
Latvia	89%	96%	148	147	133	8	141
Lithuania	56%	97%	150	150	84	62	146
Macedonia, Rep. of	97%	97%	150	150	145	1	146
Moldova	84%	100%	150	150	133	17	150
Morocco	74%	74%	158	158	117	0	117
Netherlands	53%	89%	150	150	80	54	134
New Zealand	94%	100%	156	156	144	12	156
Norway	82%	89%	162	160	119	17	136
Romania	96%	96%	150	150	144	0	144
Russian Federation	100%	100%	206	206	205	1	206
Scotland	76%	79%	150	150	113	5	118
Singapore	100%	100%	196	196	196	0	196
Slovak Republic	88%	100%	150	150	130	20	150
Slovenia	98%	99%	150	150	147	1	148
Sweden	97%	99%	150	149	142	4	146
Turkey	100%	100%	154	154	154	0	154
United States	61%	86%	200	200	125	49	174

¹ Canada is represented by the provinces of Ontario and Quebec only

Exhibit 9.6: Student Participation Rates and Sample Sizes

Country	Within School Student Participation (Weighted Percentage)	Number of Sampled Students in Participating Schools	Number of Students Withdrawn from Class/School	Number of Students Excluded	Number of Students Eligible	Number of Students Absent	Number of Students Assessed
Argentina	91%	3 769	132	13	3 624	324	3 300
Belize	94%	3 137	32	0	3 105	196	2 909
Bulgaria	97%	3 633	53	0	3 580	120	3 460
Canada (O, Q) ¹	94%	9 151	99	228	8 824	571	8 253
Colombia	96%	5 582	225	5	5 352	221	5 131
Cyprus	97%	3 149	2	63	3 084	83	3 001
Czech Republic	94%	3 220	10	0	3 210	188	3 022
England	94%	3 528	46	122	3 360	204	3 156
France	97%	3 673	20	11	3 642	104	3 538
Germany	88%	8 997	27	58	8 912	1186	7 726
Greece	97%	2 718	0	151	2 567	73	2 494
Hong Kong, SAR	99%	5 192	69	0	5 123	73	5 050
Hungary	97%	4 819	14	0	4 805	139	4 666
Iceland	87%	4 320	29	58	4 233	557	3 676
Iran, Islamic Rep. of	98%	7 703	104	0	7 599	169	7 430
Israel	96%	4 400	33	214	4 153	180	3 973
Italy	98%	3 703	15	103	3 585	83	3 502
Kuwait	91%	7 874	0	0	7 874	741	7 133
Latvia	93%	3 266	8	11	3 247	228	3 019
Lithuania	85%	3 114	7	72	3 035	468	2 567
Macedonia, Rep. of	97%	3 904	42	14	3 848	137	3 711
Moldova	96%	3 679	9	0	3 670	137	3 533
Morocco	93%	3 452	35	0	3 417	264	3 153
Netherlands	98%	4 256	11	14	4 231	119	4 112
New Zealand	96%	2 720	68	53	2 599	111	2 488
Norway	92%	3 784	25	26	3 733	274	3 459
Romania	97%	3 744	23	2	3 719	94	3 625
Russian Federation	97%	4 281	24	42	4 215	122	4 093
Scotland	95%	2 912	20	26	2 866	149	2 717
Singapore	98%	7 162	46	4	7 112	110	7 002
Slovak Republic	96%	4 034	33	18	3 983	176	3 807
Slovenia	95%	3 112	10	8	3 094	142	2 952
Sweden	93%	6 678	38	145	6 495	451	6 044
Turkey	97%	5 390	123	0	5 267	142	5 125
United States	96%	4 091	55	121	3 915	152	3 763

¹ Canada is represented by the provinces of Ontario and Quebec only

Exhibit 9.7: School and Student Participation Rates

Country	School Participation Before Replacement	School Participation After Replacement	Student Participation	Overall Participation Before Replacement	Overall Participation After Replacement
Argentina	89%	92%	91%	81%	84%
Belize	79%	80%	94%	74%	75%
Bulgaria	97%	97%	97%	93%	93%
Canada (O, Q) ¹	93%	96%	94%	87%	90%
Colombia	79%	98%	96%	76%	94%
Cyprus	99%	100%	97%	96%	97%
Czech Republic	91%	95%	94%	86%	90%
England	59%	87%	94%	55%	82%
France	93%	97%	97%	91%	94%
Germany	97%	98%	87%	84%	85%
Greece	78%	85%	97%	76%	83%
Hong Kong, SAR	77%	98%	99%	76%	97%
Hungary	98%	98%	97%	95%	95%
Iceland	95%	95%	87%	82%	82%
Iran, Islamic Rep. of	98%	100%	98%	96%	98%
Israel	96%	98%	96%	92%	94%
Italy	89%	100%	98%	87%	98%
Kuwait	89%	90%	91%	80%	82%
Latvia	90%	96%	93%	84%	89%
Lithuania	56%	97%	85%	47%	82%
Macedonia, Rep. of	97%	97%	96%	93%	94%
Moldova	89%	100%	96%	85%	96%
Morocco	74%	74%	92%	68%	68%
Netherlands	53%	89%	97%	52%	87%
New Zealand	92%	100%	96%	88%	96%
Norway	74%	85%	93%	69%	79%
Romania	96%	96%	97%	94%	94%
Russian Federation	100%	100%	97%	97%	97%
Scotland	75%	79%	95%	71%	75%
Singapore	100%	100%	98%	98%	98%
Slovak Republic	87%	100%	96%	83%	96%
Slovenia	98%	99%	95%	94%	94%
Sweden	95%	98%	93%	89%	91%
Turkey	100%	100%	97%	97%	97%
United States	63%	87%	96%	60%	84%

¹ Canada is represented by the provinces of Ontario and Quebec only

Exhibit 9.8: School and Students Participation Rates (Weighted)

Country	School Participation Before Replacement	School Participation After Replacement	Student Participation	Overall Participation Before Replacement	Overall Participation After Replacement
Argentina	89%	92%	91%	81%	84%
Belize	80%	80%	94%	75%	75%
Bulgaria	97%	97%	97%	93%	93%
Canada (O, Q) ¹	90%	97%	94%	85%	
Colombia	80%	98%	96%	76%	94%
Cyprus	98%	100%	97%	95%	97%
Czech Republic	90%	95%	94%	85%	90%
England	57%	87%	94%	54%	82%
France	93%	97%	97%	90%	94%
Germany	98%	98%	88%	86%	86%
Greece	78%	85%	97%	76%	82%
Hong Kong, SAR	73%	98%	99%	72%	97%
Hungary	98%	98%	97%	95%	95%
Iceland	95%	95%	87%	82%	82%
Iran, Islamic Rep. of	97%	100%	98%	95%	98%
Israel	96%	98%	96%	92%	94%
Italy	90%	100%	98%	88%	98%
Kuwait	87%	89%	91%	80%	81%
Latvia	89%	96%	93%	83%	89%
Lithuania	56%	97%	85%	47%	83%
Macedonia, Rep. of	97%	97%	97%	94%	94%
Moldova	84%	100%	96%	81%	96%
Morocco	74%	74%	93%	69%	69%
Netherlands	53%	89%	98%	52%	87%
New Zealand	94%	100%	96%	90%	96%
Norway	82%	89%	92%	76%	82%
Romania	96%	96%	97%	93%	93%
Russian Federation	100%	100%	97%	97%	97%
Scotland	76%	79%	95%	72%	74%
Singapore	100%	100%	98%	98%	98%
Slovak Republic	88%	100%	96%	84%	96%
Slovenia	98%	99%	95%	94%	94%
Sweden	97%	99%	93%	90%	92%
Turkey	100%	100%	97%	97%	97%
United States	61%	86%	96%	59%	83%

¹ Canada is represented by the provinces of Ontario and Quebec only

9.5 Trends in IEA's Reading Literacy Study

9.5.1 Overview

Because the data collection for PIRLS 2001 was scheduled 10 years after IEA's 1991 Reading Literacy Study, PIRLS 2001 provided an option for countries that participated in the earlier study to measure trends in their children's reading literacy since 1991 by readministering the 1991 Reading Literacy Test at the same time as the PIRLS assessment.

9.5.2 Target Population

The target population in 1991 was the grade with the greatest number of nine-year-olds at the time of testing, and, to maintain comparability, the same population was targeted by the Trends in IEA's Reading Literacy Study data collection in 2001. However, the PIRLS 2001 target population differs somewhat from the 1991 population in that PIRLS targeted the upper of the *two* grades with most nine-year-olds, and so the target

grade in each country was not always the same for the two studies. These definitions yield the same target grade in Greece, Iceland, Italy, New Zealand, Slovenia, and the United States – but different ones in Hungary, Singapore, and Sweden. Average student ages ranged from 9.1 in Singapore to 10.2 in the United States. All definitions and quality criteria regarding the national desired and defined target populations (described in Chapter 5 and section 9.2), applied also to the Trends in IEA's Reading Literacy Study. Exhibit 9.9 provides the country's name for the grade tested, the corresponding number of years of formal schooling, and the average age of the students tested in each of the nine participating countries.

9.5.3 Population Coverage and Exclusions

Exhibit 9.10 summarizes population coverage and exclusions for the Trends in IEA's Reading Literacy Study target populations. The national desired target population corresponded to 100 percent of the international desired target population in each country. The percentage of students excluded from testing because of disabilities was below the maximum permitted (10%) in all countries, and below 5 percent in all countries except Greece.

9.5.4 General Sampling Design

The basic idea behind the sampling approach for the Trends in IEA's Reading Literacy Study is rather simple: to select every second school sampled for PIRLS. From each of these selected schools, an additional classroom was sampled for the Trends in IEA's Reading Literacy Study. When there weren't enough classrooms in the sampled schools, PIRLS 2001 replace-

Exhibit 9.9: Countries Participating in the Trends in IEA's Reading Literacy Study

Country	Country's Name for Grade Tested	Years of Formal Schooling	Mean Age of Students Tested
Greece	4	4	9.9
Hungary	3	3	9.7
Iceland	4	4	9.8
Italy	4	4	9.9
New Zealand	Year 5 ¹	4	10.0
Singapore	Primary 3	3	9.1
Slovenia	3	3	9.8
Sweden	3	3	9.8
United States	4	4	10.2

¹ The official nomenclature used in New Zealand since 1996 refers to students' years of schooling rather than a class/grade level. Year 5 students were at a class level equivalent to Grade 4.

Exhibit 9.10: Population Coverage and Exclusions – Trends in IEA’s Reading Literacy Study

Country	International Desired Population Coverage	National Desired Population		
		School-Level Exclusions	Within-Sample Exclusions	Overall Exclusions
Greece	100%	2.0%	4.0%	6.0%
Hungary	100%	1.8%	0.0%	1.8%
Iceland	100%	1.8%	2.0%	3.8%
Italy	100%	0.0%	3.4%	3.4%
New Zealand ¹	100%	1.6%	1.3%	2.9%
Singapore	100%	1.3%	0.0%	1.3%
Slovenia	100%	0.0%	0.9%	0.9%
Sweden	100%	2.5%	2.2%	4.7%
United States	100%	0.6%	3.9%	4.5%

¹ The Maori school stratum was not part of the study.

ment schools were used. When available, PIRLS 2001 replacement schools also became Trends in IEA’s Reading Literacy Study replacement schools.

This approach was used for all countries, except in Hungary, where all sampled schools did both studies, and in Sweden, where no overlap of school samples was allowed. Summaries of the sample design for each country, including details of population coverage and exclusions, stratification variables, and participation rates, are provided in Appendix B.

9.5.5 Target Population Sizes

Exhibit 9.11 summarizes the number of schools and students in each country’s target population, as well as the number of schools and students that participated in the Trends in IEA’s Reading Literacy Study. Using the sampling weights computed for each country (see section 9.3), the Trends in IEA’s Reading Literacy Study derived an estimate of the student population size, which matched closely the student population size from the sampling frame (see Exhibit 9.11).

Exhibit 9.11: Population and Sample Sizes – Trends in IEA’s Reading Literacy Study

Country	Population		Sample			Mean Age
	Schools	Students	Schools	Students	Estimated Student Population	
Greece	4 999	102 927	68	1 109	92 290	9.9
Hungary	2 700	113 594	216	4 707	116 164	9.7
Iceland	140	4 566	65	1 797	4 478	9.8
Italy	7 162	573 571	92	1 590	520 379	9.9
New Zealand ¹	1 925	59 097	73	1 188	58 236	10.0
Singapore	196	50 586	98	3 601	48 566	9.1
Slovenia	443	21 906	75	1 502	22 093	9.8
Sweden	4 040	124 986	148	5 361	114 977	9.8
United States	71 498	3 871 487	85	1 826	3 856 987	10.2

¹ The Maori school stratum was not part of the study.

9.5.6 Sampling Weights and School and Student Participation Rates

Since the sample designs used for PIRLS 2001 and in the Trends in IEA's Reading Literacy studies are similar, the calculation of sampling weights was done in exactly the same way as described in section 9.3.

Participation rates for the Trends in IEA's Reading Literacy Study also were computed in the same way as for PIRLS. Exhibits 9.12 through 9.15 present the school, student, and overall participation rates, and the achieved sample sizes for each participating country. As can be seen from these exhibits, seven of the nine countries met the requirements described in Exhibit 9.4, and belong in Category 1. Because they met the sampling requirements only after including

replacement schools, Greece and the United States belong in Category 2. Accordingly, the results for these countries were annotated with an obelisk in the achievement exhibits in the international report. No country was assigned to Category 3.

Exhibit 9.12: School Participation Rates and Sample Sizes – Trends in IEA's Reading Literacy Study

Country	School Participation Before Replacement (Weighted Percentage)	School Participation After Replacement (Weighted Percentage)	Number of Schools in Original Sample	Number of Eligible Schools in Original Sample	Number of Schools in Original Sample That Participated	Total Number of Schools That Participated
Greece	73%	79%	85	85	63	68
Hungary	98%	98%	220	220	216	216
Iceland	93%	93%	70	70	65	65
Italy	89%	100%	92	92	81	92
New Zealand	90%	98%	75	75	67	73
Singapore	100%	100%	98	98	98	98
Slovenia	100%	100%	75	75	75	75
Sweden	96%	100%	150	150	142	148
United States	58%	85%	100	100	54	85

Exhibit 9.13: Student Participation Rates and Sample Sizes – Trends in IEA’s Reading Literacy Study

Country	Within School Student Participation (Weighted Percentage)	Number of Sampled Students in Participating Schools	Number of Students Withdrawn from Class/School	Number of Students Excluded	Number of Students Eligible	Number of Students Absent	Number of Students Assessed
Greece	97%	1 195	0	47	1 148	39	1 109
Hungary	97%	4 859	20	0	4 839	132	4 707
Iceland	86%	2 137	14	44	2 079	282	1 797
Italy	97%	1 697	6	56	1 635	45	1 590
New Zealand ¹	95%	1 308	43	19	1 246	58	1 188
Singapore	98%	3 729	46	0	3 683	82	3 601
Slovenia	95%	1 577	0	2	1 575	73	1 502
Sweden	96%	5 706	33	118	5 555	194	5 361
United States	95%	1 980	20	40	1 920	94	1 826

¹ The Maori school stratum was not part of the study.

Exhibit 9.14: School and Student Participation Rates (Weighted) – Trends in IEA’s Reading Literacy Study

Country	School Participation Before Replacement	School Participation After Replacement	Student Participation	Overall Participation Before Replacement	Overall Participation After Replacement
Greece	73%	79%	97%	70%	77%
hungary	98%	98%	97%	96%	96%
Iceland	93%	93%	87%	80%	80%
Italy	89%	100%	97%	86%	97%
New Zealand ¹	90%	98%	95%	85%	93%
Singapore	100%	100%	98%	98%	98%
Slovenia	100%	100%	95%	95%	95%
Sweden	96%	100%	97%	93%	97%
United States	58%	85%	95%	55%	81%

¹ The Maori school stratum was not part of the study.

Exhibit 9.15: School and Student Participation Rates (Unweighted) – Trends in IEA’s Reading Literacy Study

Country	School Participation Before Replacement	School Participation After Replacement	Student Participation	Overall Participation Before Replacement	Overall Participation After Replacement
Greece	74%	80%	97%	72%	77%
Hungary	98%	98%	97%	96%	96%
Iceland	93%	93%	86%	80%	80%
Italy	88%	100%	97%	86%	97%
New Zealand ¹	89%	97%	95%	85%	93%
Singapore	100%	100%	98%	98%	98%
Slovenia	100%	100%	95%	95%	95%
Sweden	95%	99%	97%	91%	95%
United States	54%	85%	95%	51%	81%

¹ The Maori school stratum was not part of the study.

