Sampling Design and Implementation for TIMSS 1999 Countries

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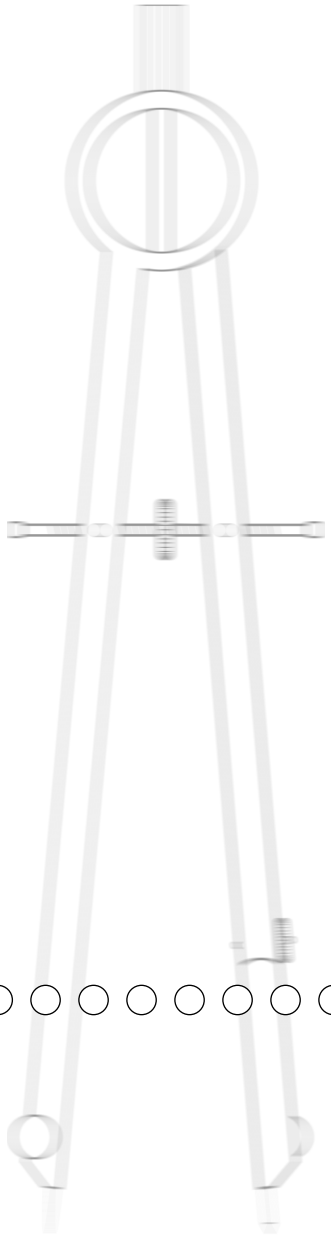

5 Sampling Design and Implementation for TIMSS 1999 Countries[1]

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5.1 Overview

This chapter describes the TIMSS 1999 sampling procedures as they were implemented in the TIMSS countries. The next chapter describes sampling activities in the Benchmarking jurisdictions. To be acceptable for TIMSS 1999, national sample designs had to result in probability samples that gave accurately weighted estimates of population parameters, and for which estimates of sampling variance could be computed. The TIMSS 1999 sample design was very similar to that of its predecessor, TIMSS 1995, with minor refinements made as a result of the 1995 sampling. The TIMSS design was chosen so as to balance analytical requirements and operational constraints, while keeping it simple enough for all participants to implement. Representative and efficient samples in all countries were crucial to the success of the project. The quality of the samples depends on the sampling information available at the design stage, and particularly on the sampling procedures.

The national research coordinators (NRCs) were aware that in a study as ambitious as TIMSS 1999, the sample design and sampling procedures would be complex, and that gathering the required information about the national education systems would place considerable demands on resources and expertise. At the same time, those directing and coordinating the project realized that the national centers had only limited numbers of qualified sampling personnel. Keeping the procedures as simple as possible, especially the sample selection within schools, was thus a major consideration.

The international project management provided manuals and expert national system and to guide them through the phases of sampling. The TIMSS 1999 *School Sampling Manual* (TIMSS, 1997) described how to implement the international sample

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1. This chapter describes the design and implementation of the TIMSS sampling plan for participating countries, and is based mainly on Foy & Joncas (2000a,2000b) and Foy (2000). The following chapter (Chapter 6) provides details of the sampling activities for the benchmarking jurisdictions.

design and offered advice on planning, working within constraints, establishing appropriate sample selection procedures, and fieldwork. The *Survey Operations Manual* (TIMSS, 1998a) and *School Coordinator Manual* (TIMSS, 1998b) discussed sample selection and execution within schools, the assignment of test booklets to selected students, and administration and monitoring procedures used to identify and track respondents and nonrespondents. NRCs also received software designed to automate the sometimes complex within-school sampling procedures.

In addition, NRCs had access to expert support. Statistics Canada, in consultation with the TIMSS 1999 sampling referee, Keith Rust, Westat, reviewed and approved the national sampling plans, sampling data, sampling frames, and sample selection. Statistics Canada also assisted nearly half of the TIMSS 1999 participants in drawing national school samples.

NRCs were allowed to adapt the basic TIMSS sample design to the needs of their education system by using more sampling information or more sophisticated designs and procedures. These adjustments, however, had to be approved by the International Study Center at Boston College and monitored by Statistics Canada.

The selection of valid and efficient samples is crucial to the quality and success of an international comparative study. 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 TIMSS 1999, NRCs provided documentation for all phases of sampling. This documentation was used by the International Study Center jointly with Statistics Canada, the sampling referee, and the Project Management Team (PMT) 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 C of the TIMSS 1999 Technical Report (Martin, Gregory, & Stemler, 2000).

5.2 Target Population

In IEA studies, the target population for all countries is known as the *international desired population*. The international desired population for TIMSS 1999 was as follows:

- All students enrolled in the upper of the two adjacent grades that contain the largest proportion of 13-year-olds at the time of testing.

The TIMSS 1999 target grade was the upper grade of the TIMSS 1995 Population 2 definition[2] and was expected to be the eighth grade in most countries. This would allow countries participating in both TIMSS 1995 and TIMSS 1999 to establish a trend line of comparable achievement data.

5.2.1 School and Within-School Exclusions

TIMSS 1999 expected all participating countries to define their *national desired population* to correspond as closely as possible to its definition of the international desired population. Sometimes, however, NRCs had to make changes. For example, some countries had to restrict geographical coverage by excluding remote regions; or to exclude a segment of their education system. The TIMSS 1999 International Reports (Martin et al., 2000; Mullis et al., 2000) document any deviations from the international definition of the TIMSS 1999 target population.

Using their national desired population as a basis, participating countries had to operationally define their population for sampling purposes. This definition, known in IEA terminology as the *national defined population*, was essentially the sampling frame from which the first stage of sampling takes place. The national defined population could be a subset of the national desired population. All schools and students from the former excluded from the latter are referred to as the *excluded population*.

TIMSS 1999 participants were expected to keep the excluded population to no more than 10% of the national desired population. Exclusions could occur at the school level, within schools, or both. Because the national desired population was restricted to schools that contained the target grade, schools not containing this grade were considered to be outside the scope of the sampling frame, and not part of the excluded population. Participants could exclude schools from the sampling frame for the following reasons:

- They were in geographically remote regions.
- They were of extremely small size.

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2. For the TIMSS 1995 Population definition, see Foy, Rust, & Schleicher (1996).

- They offered a curriculum, or school structure, that was different from the mainstream education system(s).
- They provided instruction only to students in the exclusion categories defined as "within-sample exclusions."

Within-sample exclusions were limited to students who, because of some disability, were unable to take the TIMSS 1999 tests. NRCs were asked to define anticipated within-sample exclusions. Because these definitions can vary internationally, NRC's were also asked to follow certain rules adapted to their jurisdictions. In addition, they were to estimate the size of such exclusions so that compliance with the 10% rule could be gauged in advance.

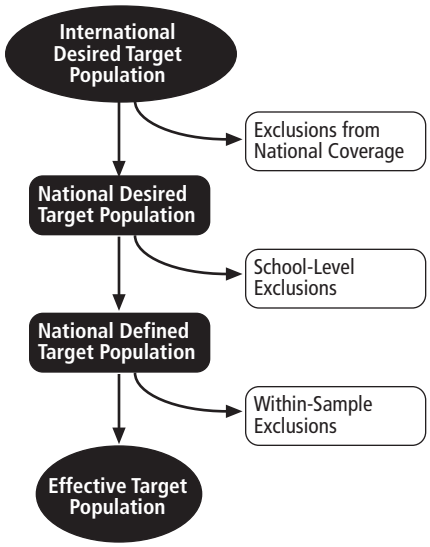
The general TIMSS 1999 rules for defining within-school exclusions included:

- **Educable mentally disabled students**. These are students who were considered, in the professional opinion of the school principal or other qualified staff members, to be educable mentally disabled, or students who had been so diagnosed by psychological tests. This included students who were emotionally or mentally unable to follow even the general instructions of the TIMSS 1999 test. It did not include students who merely exhibited poor academic performance or discipline problems.
- **Functionally disabled students**. These are students who were permanently physically disabled in such a way that they could not perform the tasks required for the TIMSS 1999 tests. Functionally disabled students who could perform were included in the testing.
- **Non-native-language speakers**. These are students who could not read or speak the language of the test and so could not overcome the language barrier of testing. Typically, a student who had received less than one year of instruction in the language of the test was excluded, but this definition was adapted in different countries.

The stated objective in TIMSS 1999 was that the effective target population, the population actually sampled by TIMSS 1999, be as close as possible to the international desired population. Exhibit 5.1 illustrates the relationship between the desired populations and the excluded populations. Any exclusion of eligible students from the international desired population had to be accounted for, both at the school level and within samples.

The size of the excluded population was documented and served as an index of the coverage and representativeness of the selected samples.

Exhibit 5.1 Relationship Between the Desired Populations and Exclusions



5.3 Sample Design

The basic sample design for TIMSS 1999 is generally referred to as a two-stage stratified cluster sample design. The first stage consisted of a sample of schools[3], which may be stratified; the second stage consisted of a single mathematics classroom selected at random from the target grade in sampled schools. It was also permissible to add a third stage, in which students could be sampled within classrooms. This design lent itself to the many analytical requirements of TIMSS 1999.

5.3.1 Units of Analysis and Sampling Units

The TIMSS 1999 analytical focus was both on the cumulative learning of students and on the instructional characteristics affecting learning. The sample design, therefore, had to address the measurement both of characteristics thought to influence cumulative learning and of specific characteristics of instruction.

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3. In some very large countries, it was necessary to include an extra preliminary stage in which school districts were sampled first, and then schools.

Because schools, classrooms, and students were all considered potential units of analysis, they had to be considered as sampling units. This was necessary in order to meet specific requirements for data quality and sampling precision at all levels.

Although in the second sampling stage the sampling units were intact mathematics classrooms, the ultimate sampling elements were students. Consequently, it was important that each student from the target grade be a member of one and only one of the mathematics classes in a school from which the sampled classes were to be selected. In most education systems, the mathematics class coincided with a student homeroom or science class. In some systems, however, mathematics and science classes did not coincide. In any case, participating countries were asked to define the classrooms on the basis of mathematics instruction. If not all students in the national desired population belonged to a mathematics class, then an alternative definition of the classroom was required for ensuring that the non-mathematics students had an opportunity to be selected.

5.3.2 Sampling Precision and Sample Size

Sample sizes for TIMSS 1999 had to be specified so as to meet the analytic requirements of the study. Since students were the principal units of analysis, the ability to produce reliable estimates of student characteristics was important. The TIMSS 1999 standard for sampling precision required that all population samples have an effective sample size of at least 400 students for mathematics and science achievement. In other words, the samples should have sampling errors no greater than those that would be obtained from a simple random sample of 400 students.

An effective sample size of 400 students results in the following 95% confidence limits for sample estimates of population means, percentages, and correlation coefficients.

- Means: $m \pm 0.1s$ (where m is the mean estimate and s is the estimated standard deviation for students)
- Percentages: $p \pm 5.0\%$ (where p is a percentage estimate)
- Correlations: $r \pm 0.1$ (where r is a correlation estimate)

Furthermore, since TIMSS 1999 was designed to allow for analyses at the school and classroom levels, at least 150 schools were to be selected from the target population. A sample of 150 schools results in 95% confidence limits for school-level and classroom-

level mean estimates that are precise to within ± 16% of their standard deviations. To ensure sufficient sample precision for these units of analysis, some participants had to sample more schools than they would have selected otherwise.

The precision of multistage cluster sample designs are generally affected by the so-called clustering effect. A classroom as a sampling unit constitutes a cluster of students who tend to be more like each other than like other members of the population. The *intraclass correlation* is a measure of this similarity. Sampling 30 students from a single classroom, when the intraclass correlation is positive, will yield less information than a random sample of 30 students spread across all classrooms in a school. Such sample designs are less efficient, in terms of information per sampled student, than a simple random sample of the same size. This clustering effect had to be considered in determining the overall sample size for TIMSS 1999.

The magnitude of the clustering effect is determined by the size of the cluster (classroom) and the size of the intraclass correlation. For planning the sample size, therefore, each country had to choose a value for the intraclass correlation, and a value for the expected cluster size (this was known as the minimum cluster size). The intraclass correlation for each country was estimated from past studies, such as TIMSS 1995, or from national assessments. In the absence of such sources, an intraclass correlation of 0.3 was assumed. Since all participants chose to test intact classrooms, the minimum cluster size was in fact the average classroom size. The specification of the minimum cluster size affected not only the number of schools sampled, but also the way in which small schools and small classrooms were treated.

Sample-design tables were produced and included in the *TIMSS 1999 School Sampling Manual* (see Exhibit 5.2 for an example). These tables illustrated the number of schools that had to be sampled to meet the TIMSS sampling precision requirements for a range of values of intraclass correlation and minimum cluster sizes. TIMSS 1999 participants could use these tables to determine how many schools they should sample. For example, an examination of Exhibit 5.2 shows that a participant whose intraclass correlation was expected to be 0.6 and whose average classroom size was 30 needed to sample a minimum of 248 schools. Whenever the estimated number of schools to sample fell below 150, participants were asked to sample at least 150 schools.

The sample-design tables could be used also to determine sample sizes for more complex designs. For example, a number of strata could be constructed for which different minimum cluster sizes could be specified, thereby refining the national sample design in a way that might avoid special treatment of small schools (See the following section on Small Schools).

Exhibit 5.2: Sample-Design Table* (95%Confidence Limits For Means ±0.1s / Percentages ±5.0)

MCS**		Intraclass Correlation								
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
5	a	150	157	189	221	253	285	317	349	381
	n	750	785	945	1 105	1 265	1 425	1 585	1 745	1 905
10	a	150	150	155	191	227	263	299	335	371
	n	1 500	1 500	1 550	1 910	2 270	2 630	2 990	3 350	3 710
15	a	150	150	150	180	218	255	292	330	367
	n	2 250	2 250	2 250	2 700	3 270	3 825	4 380	4 950	5 505
20	a	150	150	150	175	213	251	289	327	365
	n	3 000	3 000	3 000	3 500	4 260	5 020	5 780	6 540	7 300
25	a	150	150	150	172	211	249	287	326	364
	n	3 750	3 750	3 750	4 300	5 275	6 225	7 175	8 150	9 100
30	a	150	150	150	170	209	248	286	325	364
	n	4 500	4 500	4 500	5 100	6 270	7 440	8 580	9 750	10 920
35	a	150	150	150	169	208	246	285	324	363
	n	5 250	5 250	5 250	5 915	7 280	8 610	9 975	11 340	12 705
40	a	150	150	150	168	207	246	285	324	363
	n	6 000	6 000	6 000	6 720	8 280	9 840	11 400	12 960	14 520
45	a	150	150	150	167	206	245	284	323	362
	n	6 750	6 750	6 750	7 515	9 270	11 025	12 780	14 535	16 290
50	a	150	150	150	166	205	245	284	323	362
	n	7 500	7 500	7 500	8 300	10 250	12 250	14 200	16 150	18 100

a = number of sampled schools
n = number of sampled students in target grade
*Minimum school sample required = 150
**MCS is the number of students selected in each sampled school (generally the average classroom size).

5.3.3 Stratification

Stratification is the grouping of sampling units (e.g., schools) in the sampling frame according to some attribute or variable prior to drawing the sample. It is generally used for the following reasons:

- To improve the efficiency of the sample design, thereby making survey estimates more reliable
- To apply different sample designs, or disproportionate sample-size allocations, to specific groups of schools (such as those within certain states or provinces)
- To ensure adequate representation in the sample of specific groups from the target population.

Examples of stratification variables for school samples are geography (such as states or provinces), school type (such as public and private schools), and level of urbanization (such as rural and urban). Stratification variables in the TIMSS 1999 sample design could be used explicitly, implicitly, or both.

Explicit stratification consists of building separate school lists, or sampling frames, according to the stratification variables under consideration. Where, for example, geographic regions were an explicit stratification variable, separate school sampling frames were constructed for each region. Different sample designs, or different sampling fractions, could then be applied to each school-sampling frame to select the sample of schools. In practice, the main reason for considering explicit stratification in TIMSS 1999 was disproportionate allocation of the school sample across strata. For example, a country might require an equal number of schools from each stratum, regardless of the relative size of each stratum.

Implicit stratification makes use of a single school sampling frame, but sorts the schools in this frame by a set of stratification variables. This is a simple way of ensuring proportional sample allocation without the complexity of explicit stratification. Implicit stratification can also improve the reliability of survey estimates, provided the variables are related to school mean student achievement in mathematics and science.

5.3.4 Replacement Schools

Although TIMSS participants placed great emphasis on securing school participation, it was anticipated that a 100% participation rate would not be possible in all countries. To avoid losses in sample size, a mechanism was instituted to identify, *a priori*, two replacement schools for each sampled school. The use of implicit stratification variables and the subsequent ordering of the school sampling frame by size ensured that any sampled school's replacement would have similar characteristics. Although this approach was not guaranteed to avoid response bias, it would tend to minimize the potential for bias. Furthermore, it was deemed more acceptable than over-sampling to accommodate a low response rate.

5.3.5 First Sampling Stage

The sample-selection method used for the first-stage of sampling in TIMSS 1999 made use of a systematic probability-proportional-to-size (PPS) technique. Use of this method required some measure of size (MOS) of the sampling units. Ideally this was the number of sampling elements within the unit (e.g., number of students in the target grade in the school). If this information was unavailable, some other highly correlated measure, such as total school enrollment, was used.

The schools in each explicit stratum were listed in order of the implicit stratification variables, together with the MOS for each school. They were further sorted by MOS within each variable. The measures of size were accumulated from school to school, and the running total (the cumulative MOS) was listed next to each school (see Exhibit 5.3). The cumulative MOS was a measure of the size of the population of sampling elements; dividing it by the number of schools sampled gives the *sampling interval*.

The first school was sampled by choosing a random number in the range between one and the sampling interval. The school whose cumulative MOS contained the random number was the sampled school. By adding the sampling interval to that first random number, a second school was identified. This process of consistently adding the sampling interval to the previous selection number resulted in a PPS sample of the required size.

As each school was selected, the next school in the sampling frame was designated as a replacement school for use should the sampled school not participate in the study, and the next after that as a second replacement, for use should neither the sampled school nor its replacement participate.

Two of the many benefits of the PPS sample selection method are that it is easy to implement, and that it is easy to verify that it was implemented properly. The latter was critical since one of TIMSS 1999's major objectives was to be able to verify that a sound sampling methodology had been used.

Exhibit 5.3 illustrates the PPS systematic sampling method applied to a fictitious sampling frame. The first three sampled schools are shown, as well as their corresponding first and second replacements (R1 and R2).

Exhibit 5.3: Application of the PPS Systematic Sampling Method

Total MOS:	392154	Sampling Interval:	2614
School Sample:	150	Random Start:	1135

School Identification Number	Measure of Size (MOS)	Cumulative MOS	Sampled and Replacement Schools
172989	532	532	
976181	517	1049	
564880	487	1536	S
387970	461	1997	R1
483231	459	2456	R2
550766	437	2893	
228699	406	3299	
60318	385	3684	
201035	350	4034	S
107346	341	4375	R1
294968	328	4703	R2
677048	311	5014	
967590	299	5313	
644562	275	5588	
32562	266	5854	
194290	247	6101	
129135	215	6316	
1633	195	6511	S
256393	174	6685	R1
754196	152	6837	R2
750793	133	6970	
757843	121	7091	
743500	107	7198	
84930	103	7301	
410355	97	7398	

S = Sampled School
R1, R2 = Replacement Schools

5.3.6 Small Schools

Small schools tend to be problematic in PPS samples because students sampled from these schools get disproportionately large sampling weights, and when the school size falls below the minimum cluster size, it reduces the overall student sample size. A school was deemed small in TIMSS 1999 if it was smaller than the minimum cluster size. Thus, if the minimum cluster size for a country was set at 20, then a school with fewer than 20 students in the target grade was considered a small school. Extremely small schools were defined as schools with fewer students than half the minimum cluster size. For example, if the minimum cluster size was set at 20, then schools with fewer than 10 students in the target grade were considered extremely small schools.

In TIMSS 1999, small schools were handled differently than in TIMSS 1995. In TIMSS 1999, two options were available for dealing with small schools:

- **Exclusion**. If student enrollment in these schools was less than 2% of the eligible population, they were excluded, provided the overall exclusion rate did not exceed the 10% criterion.
- **Explicit stratum of small schools**. If fewer than 10% of eligible students were enrolled in small schools, then no additional action was required. If, however, more than 10% of eligible students were enrolled in small schools, then an explicit stratum of small schools was required. The number of schools to sample from this stratum remained proportional to the stratum size, but all schools had an equal probability of selection. This action ensured greater stability in the resulting sampling weights.

5.3.7 Optional Preliminary Sampling Stage

Some very large countries chose to introduce a preliminary sampling stage before sampling schools. This consisted of a PPS sample of geographic regions. A sample of schools was then selected from each sampled region. This design was used mostly as a cost-reduction measure where the construction of a comprehensive list of schools would have been either impossible or prohibitively expensive. Also, this additional sampling stage reduced the dispersion of the school sample, thereby potentially reducing travel costs. Sampling guidelines were put

in place to ensure that an adequate number of units were sampled from this preliminary stage. The sampling frame had to consist of at least 80 primary sampling units, of which at least 40 had to be sampled at this stage.

5.3.8 Second Sampling Stage

The second sampling stage consisted of selecting classrooms within sampled schools. As a rule, one classroom per school was sampled, although some participants opted to sample two classrooms. Classrooms were selected either with equal probabilities or with probabilities proportional to their size. Participants who opted to test all students in selected classrooms sampled classrooms with equal probabilities. This was the method of choice for most participants. A procedure was also available whereby NRCs could choose to sub-sample students within randomly selected classrooms using PPS.

5.3.9 Small Classrooms

Generally, classes in an education system tend to be of roughly equal size. Occasionally, however, small classes are devoted to special activities, such as remedial or accelerated programs. These can become problematic, since they can lead to a shortfall in sample size and thus introduce some instability in the resulting sampling weights when classrooms are selected with PPS.

In order to avoid these problems, the classroom sampling procedure specified that any classroom smaller than half the minimum cluster size be combined with another classroom from the same grade and school. For example, if the minimum cluster size was set at 30, then any classroom with fewer than 15 students was combined with another. The resulting pseudo-classroom then constituted a sampling unit.

5.3.10 Required Participation Rates

School-Level Participation Rates

The minimum acceptable school-level participation rate, before the use of replacement schools, was set at 85%. This criterion was applied to the unweighted school response rate. School response rates were computed and reported both weighted and unweighted, with and without replacement schools as described in section 5.6.

Student-Level Participation Rates

Like the school-level participation rate, the minimum acceptable student-within-school participation rate was set at 85%. This criterion was applied to the unweighted student-level participation rate. Both weighted and unweighted student participation rates were computed and reported.

Overall Participation Rates

The minimum acceptable overall participation rate was set at 75%. This rate was calculated as the product of the weighted school-level participation rate without replacement schools and the weighted student-level participation rate. Weighted overall participation rates were computed and reported both with and without replacement schools.

5.4 Implementation of the Sample Design

5.4.1 Target Population Grades

Exhibit 5.4 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 eighth grade.[4] Only in Finland, Morocco, and some states in the Russian Federation was the seventh grade the target grade. In parts of Australia and New Zealand, the target grade was the ninth grade. Average student ages ranged from 13.8 in Cyprus and Finland to 15.5 in South Africa.

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4. In TIMSS in 1995, Romania and Slovenia selected the eighth grade as the upper of their target grades. Subsequently, analysis of the age distributions in those countries showed that their students were older, on average, than students in most other countries. Both countries chose to test the same grade again in 1999 in order to have comparable trend data.

Exhibit 5.4 National Grade Definitions

Country	Country's Name for Grade Tested	Years of Formal Schooling	Mean Age of Students Tested
Australia	8 or 9	8 or 9	14.3
Belgium (Flemish)	2A & 2P	8	14.1
Bulgaria	8	8	14.8
Canada	8	8	14.0
Chile	8	8	14.4
Chinese Taipei	2nd Grade Junior High School	8	14.2
Cyprus	8	8	13.8
Czech Republic	8	9	14.4
England	Year 9	9	14.2
Finland	7	7	13.8
Hong Kong, SAR	Secondary 2	8	14.2
Hungary	8	8	14.4
Indonesia	2nd Grade Junior High School	8	14.6
Iran, Islamic Rep.	9	8	14.6
Israel	9	8	14.1
Italy	3rd Grade Middle School	8	14.0
Japan	2nd Grade Lower Secondary	8	14.4
Jordan	8	8	14.0
Korea, Rep. of	2nd Grade Middle School	8	14.4
Latvia (LSS)	8	8	14.5
Lithuania	9	8.5	15.2
Macedonia, Rep. of	8	8	14.6
Malaysia	Form 2	8	14.4
Moldova	8	9	14.4
Morocco	7	7	14.2
Netherlands	Secondary 2	8	14.2
New Zealand	Year 9	8.5 to 9.5	14.0
Philippines	1st Year High School	7	14.1
Romania	8	8	14.8
Russian Federation	8	7 or 8	14.1
Singapore	Secondary 2	8	14.4
Slovak Republic	8	8	14.3
Slovenia	8	8	14.8
South Africa	8	8	15.5
Thailand	Secondary 2	8	14.5
Tunisia	8	8	14.8
Turkey	8	8	14.2
United States	8	8	14.2

Coverage And Exclusions

Exhibit 5.5 summarizes national coverage and exclusions in the TIMSS 1999 target populations. National coverage of the international desired target population was generally comprehensive. Only Latvia and Lithuania chose a national desired population less than the international desired population.[5] Because coverage of the international desired population fell below 65% for Latvia, the Latvian results have been labelled "Latvia (LSS)," for Latvian-speaking schools. Coverage was more inclusive in Lithuania, but since it was less than 100%, the Lithuanian results were footnoted to reflect this situation. The Lithuanian results were also footnoted to indicate that although Lithuania tested the same cohort of students as other countries, it did so later in 1999, at the beginning of the next school year.

School-level exclusions generally consisted of schools for the disabled and very small schools; however, there were some national deviations that are documented in Appendix C of the TIMSS 1999 Technical Report (Martin, Gregory, & Stemler, 2000). Within-school exclusions generally consisted of disabled students and students that could not be assessed in the language of the test. Only in Israel did the level of excluded students exceed the TIMSS maximum of 10%, and this was reflected in a footnote in the TIMSS 1999 International Reports (Martin et al., 2000; Mullis et al., 2000). A few countries had no within-school exclusions.

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5. The Latvian population was restricted to schools catering to Latvian-speaking students only, and the Lithuanian population to schools catering to Lithuanian-speaking students only.

Exhibit 5.5 National Coverage and Overall Exclusion Rates

	International Desired Population		National Desired Population		Overall
	Coverage	Notes on Coverage	School-Level Exclusions	Within-Sample Exclusions	Overall Exclusions
Australia	100%		1%	1%	2%
Belgium (Flemish)	100%		1%	0%	1%
Bulgaria	100%		5%	0%	5%
Canada	100%		4%	2%	6%
Chile	100%		3%	0%	3%
Chinese Taipei	100%		1%	1%	2%
Cyprus	100%		0%	1%	1%
Czech Republic	100%		5%	0%	5%
England	100%		2%	3%	5%
Finland	100%		3%	0%	4%
Hong Kong, SAR	100%		1%	0%	1%
Hungary	100%		4%	0%	4%
Indonesia	100%		0%	0%	0%
Iran, Islamic Rep.	100%		4%	0%	4%
Israel	100%		8%	8%	16%
Italy	100%		4%	2%	7%
Japan	100%		1%	0%	1%
Jordan	100%		2%	1%	3%
Korea, Rep. of	100%		2%	2%	4%
Latvia	61%	Latvian-speaking students only	4%	0%	4%
Lithuania	87%	Lithuanian-speaking students only	5%	0%	5%
Macedonia, Rep. of	100%		1%	0%	1%
Malaysia	100%		5%	0%	5%
Moldova	100%		2%	0%	2%
Morocco	100%		1%	0%	1%
Netherlands	100%		1%	0%	1%
New Zealand	100%		2%	1%	2%
Philippines	100%		3%	0%	3%
Romania	100%		4%	0%	4%
Russian Federation	100%		1%	1%	2%
Singapore	100%		0%	0%	0%
Slovak Republic	100%		7%	0%	7%
Slovenia	100%		3%	0%	3%
South Africa	100%		2%	0%	2%
Thailand	100%		3%	0%	3%
Tunisia	100%		0%	0%	0%
Turkey	100%		2%	0%	2%
United States	100%		0%	4%	4%

5.4.2 Sampling of Schools and Students

Target Population Sizes

Exhibit 5.6 summarizes the number of schools and students in each country's target population, as well as the sample sizes of schools and students that participated in the study. Most of the target population sizes are derived from the sampling frames from which the TIMSS samples were drawn. The school and student population sizes for Turkey, however, were estimated from

the number of students in the primary sampling units (provinces) that Turkey sampled. In addition, the school and student population sizes for the United States and the Russian Federation were not computed from the sampling frame, but were provided by their respective NRC. Using the sampling weights computed for each country (see section 5.5), TIMSS derived an estimate of the student population size, which matched closely the student population size from the sampling frame (see Exhibit 5.6).

Exhibit 5.6 Population and Sample Sizes

Country	Population		Sample		
	Schools	Students	Schools	Students	Est. Pop.
Australia	2072	255648	170	4032	260130
Belgium (Flemish)	697	67765	135	5259	65539
Bulgaria	2160	85066	163	3272	88389
Canada	5925	395960	385	8770	371061
Chile	4044	238894	185	5907	208910
Chinese Taipei	758	342753	150	5772	310428
Cyprus	61	9862	61	3116	9785
Czech Republic	1606	124583	142	3453	119462
England	3784	566590	128	2960	552231
Finland	649	64386	159	2920	59665
Hong Kong SAR	408	79397	137	5179	79097
Hungary	2693	114156	147	3183	111298
Indonesia	18565	2167498	150	5848	1956221
Iran Islamic Rep.	24560	1576860	170	5301	1655741
Israel	834	95031	139	4195	81486
Italy	5488	582110	180	3328	548711
Japan	10102	1449671	140	4745	1411038
Jordan	1276	100176	147	5052	89171
Korea Rep. of	2504	635080	150	6114	609483
Latvia	586	19663	145	2873	18122
Lithuania	954	41824	150	2361	40452
Macedonia Rep. of	355	30387	149	4023	30280
Malaysia	1642	378762	150	5577	397762
Moldova	1216	64241	150	3711	59956
Morocco	1094	330186	173	5402	347675
Netherlands	730	175513	126	2962	198144
New Zealand	379	51716	152	3613	51553
Philippines	5001	1233150	150	6601	1078093
Romania	6691	258833	147	3425	259621
Russian Federation	58595	2100000	189	4332	2057412
Singapore	145	41700	145	4966	41346
Slovak Republic	1392	76790	145	3497	72521
Slovenia	434	24645	149	3109	23514
South Africa	7234	968857	194	8146	844705
Thailand	7839	790788	150	5732	727087
Tunisia	533	140580	149	5051	139639
Turkey	6531	636242	204	7841	618058
United States	41499	3464627	221	9072	3336295

5.5 Sampling Weights

The multi-stage nature of the TIMSS sampling design meant that students were sampled with varying probabilities. Consequently, one student in the assessment does not necessarily represent the same proportion of students in the population as another, as would be the case with a simple random sampling approach. To account for differential probabilities of selection due to the design and to ensure proper survey estimates, TIMSS computed a sampling weight for each participating student. The procedures for calculating sampling weights are described fully in Foy (2000).

5.5.1 The First Stage (School) Weight

The first stage weight represented the inverse of the first stage selection probability assigned to a sampled school. The TIMSS 1999 sample design required that school selection probabilities be proportional to the school size (PPS). The basic first stage weight for the i^{th} sampled school was thus defined as

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

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.

5.5.2 School Non-Participation Adjustment

First stage weights were calculated for all sampled schools and replacement schools that participated. A school-level participation adjustment was required to compensate for schools that were sampled but did not participate and were not replaced. Sampled schools that were found to be ineligible[6] were removed from the calculation of this adjustment. The school-level participation adjustment was calculated separately for each explicit stratum.

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

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 nonparticipating schools, thus became:

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

5.5.3 The Second Stage (Classroom) Weight

The second stage weight represented the inverse of the second stage selection probability assigned to a sampled classroom. Although almost all TIMSS 1999 participants sampled intact classrooms using equal probability sampling, it also was permissible to subsample students within classes using PPS techniques. Procedures for calculating sampling weights are presented below for both approaches.

Equal Probability Weighting: For the ith school, let C^i be the total number of classrooms and c^i the number of sampled classrooms. Using equal probability sampling, the final second stage weight assigned to all sampled classrooms in the ith school was

$$FW_{cl1}^{i} = \frac{C^i}{c^i}$$

As a rule, c^i took the values 1 or 2 and remained fixed for all sampled schools. In those cases where c^i took the value 2 and only one of the sampled classrooms participated, the second stage weight was adjusted by multiplying it by 2.

Probability Proportional to Size Weighting: For the i^{th} school, let $k^{i,j}$ be the size of the j^{th} classroom. Using PPS sampling, the final second stage weight assigned to the j^{th} sampled classroom in the i^{th} school was

$$FW_{cl2}^{i,j} = \frac{K^i}{c^i \cdot k^{i,j}}$$

where c^i was the number of sampled classrooms in the i^{th} school, as defined earlier, and

$$K^i = \sum_{j=1}^{c^i} k^{i,j}$$

Again, usually c^i took the values one or two and remained fixed for all sampled schools. In those cases where c^i took the value 2 and only one of the sampled classrooms participated, the second stage weight was adjusted by multiplying it by two.

5.5.4 The Third Stage (Student) Weight

The third stage weight represented the inverse of the third stage selection probability attached to a sampled student.

Sampling Intact Classrooms: If intact classrooms were sampled, then the basic third stage weight for the j^{th} classroom in the i^{th} school was simply

$$BW_{st1}^{i,j} = 1.0$$

Although in the standard TIMSS data collection each student was assigned one of eight achievement test booklets[7], countries were permitted to add a further national booklet as required. Where a country chose to add a national booklet, the basic third stage weight was adjusted to reflect the change in the fraction of students responding to each booklet. The basic third stage weight thus became

$$BW_{st1}^{i,j} = \frac{k_{TIMSS\ 1999}^{i,j} + k_{natl}^{i,j}}{k_{TIMSS\ 1999}^{i,j}}$$

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7. See chapter 2 for a description of the TIMSS test design.

where

$k^{i,j}_{TIMSS\ 1999}$ = number of students assigned a TIMSS 1999 booklet in the j^{th} classroom of the i^{th} school,

$k^{i,j}_{natl}$ = number of students assigned a national booklet in the j^{th} classroom of the i^{th} school, and

$$k^{i,j}_{TIMSS\ 1999} + k^{i,j}_{natl} + k^{i,j}_{ex} = k^{i,j}$$

where $k^{i,j}_{ex}$ was the number of excluded students[8] that were not assigned any booklet. Note that this number could be zero if there were no excluded students in the classroom.

5.5.5 Adjustment for Student Non-Participation

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

$$A^{i,j}_{st} = \frac{s^{i,j}_{rs} + s^{i,j}_{nr}}{s^{i,j}_{rs}}$$

This adjustment is the inverse of the unweighted student participation rate, R_{st}, computed for the corresponding classroom:

$$A^{i,j}_{st} = \frac{1}{R^{i,j}_{st}}$$

The third and final stage weight for the j^{th} classroom in the i^{th} school thus became

$$FW^{i,j}_{st1} = A^{i,j}_{st} \cdot BW^{i,j}_{st1}$$

when intact classrooms were sampled.

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8. Criteria for excluding students from the data collection are presented in chapter 2.

5.5.6 Overall Sampling Weights

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. When intact classrooms were tested the overall sampling weight was

$$W^{i,j} = A^{i,j}_{sc} \cdot BW^{i}_{sc} \cdot FW^{i,j}_{cl1} \cdot A^{i,j}_{st} \cdot BW^{i,j}_{st1}$$

or

$$W^{i,j} = FW^{i}_{sc} \cdot FW^{i,j}_{cl1} \cdot FW^{i,j}_{st1}$$

When students were subsampled within classrooms, the overall sampling weight was

$$W^{i,j} = A^{i,j}_{sc} \cdot BW^{i}_{sc} \cdot FW^{i,j}_{cl2} \cdot A^{i,j}_{st} \cdot BW^{i,j}_{st2}$$

or

$$W^{i,j} = FW^{i}_{sc} \cdot FW^{i,j}_{cl2} \cdot FW^{i,j}_{st2}$$

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.

5.6 Calculating Participation Rates

Since lack of participation by sampled schools or students can lead to bias in the results, a variety of participation rates were computed to reveal how successful countries had been in securing participation from their sampled schools. To monitor school participation, three school participation rates were computed: (1) using originally sampled schools only; (2) using sampled and first replacement schools; and (3) using sampled and both first and second replacement schools. Student participation rates were also computed, as were overall participation rates.

5.6.1 Unweighted School Participation Rates

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

R^{sc-s}_{unw} = 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:

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

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

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

5.6.2 Unweighted Student Participation Rate

The unweighted student participation rate was computed as follows:

$$R_{unw}^{st} = \frac{\sum_{i,j} s_{rs}^{i,j}}{\sum_{i,j} s_{rs}^{i,j} + \sum_{i,j} s_{nr}^{i,j}}$$

5.6.3 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, and 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:

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

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

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

5.6.4 Weighted School Participation Rates

In TIMSS 1995, the weighted school-level participation rates were computed using school sampling frame information. TIMSS 1999 used student-level information instead. The alternate method has two advantages:

- Weighted school participation rates can be easily replicated by all data users since all the required data are available from the international database
- These rates more accurately reflect the current size of the target population since they rely on up to date within-school sampling information.

The TIMSS 1995 method relied on school data as reported on the sampling frame, which often were not up to date with regard to current school enrollment. Conceptually, however, both methods are equivalent when assuming an up to date sampling frame, and should yield comparable results in practice.

Three weighted school-level participation rates were computed using the alternate method. They were as follows:

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

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

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

The weighted school participation rates were calculated as follows:

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

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

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

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.

5.6.5 Weighted Student Participation Rates

The weighted student response rate was computed as follows:

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

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 weight appears in the numerator, whereas the final student 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.

5.6.6 Weighted Overall Participation Rates

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

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

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

R^{ov-r2}_{wtd} = 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:

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

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

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

5.7 Final Participation Rates

Countries understood that the goal for sampling participation was 100% for all sampled schools and students, and that the guidelines established by TIMSS in 1995 for reporting achievement data for countries securing less than full participation also would be applied in 1999.

According to TIMSS, countries would be assigned to one of three categories on the basis of their sampling participation (Exhibit 5.7). Countries in category 1 were considered to have met the TIMSS sampling requirements and to have an acceptable partici-

pation 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 TIMSS 1999 was to have as many countries as possible achieve category 1 status, and to have no countries in category 3.

Exhibit 5.7 Categories of Sampling Participation

Category 1	Acceptable sampling participation rate **without** the use of replacement schools. In order to be placed in this category, a country had to have: • An **unweighted** school response rate **without** replacement of at least 85% (after rounding to nearest whole percent) AND an **unweighted** student response rate (after rounding) of at least 85% OR • A **weighted** school response rate **without** replacement of at least 85% (after rounding to nearest whole percent) AND a **weighted** student response rate (after rounding) of at least 85% OR • 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). Countries in this category appeared in the tables and figures in international reports without annotation ordered by achievement as appropriate.
Category 2	Acceptable sampling participation rate **only after replacement schools were included**. A country was placed in category 2 if: • 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) AND HAD EITHER • An **unweighted** school response rate **with** replacement of at least 85% (after rounding to nearest whole percent) AND an **unweighted** student response rate (after rounding) of at least 85% OR • 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% OR • 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). Countries in this category were annotated in the tables and figures in international reports and ordered by achievement as appropriate.
Category 3	Unacceptable sampling response rate even when replacement schools are included. Countries that could provide documentation to show that they complied with TIMSS sampling procedures and requirements but did not meet the requirements for category 1 or category 2 were placed in category 3. 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.

Exhibits 5.8 through 5.11 present the school, student, and overall participation rates and achieved sample sizes for each participating country. As can be seen from these exhibits, all TIMSS 1999 countries except England met the requirements for category 1. England had an unweighted school participation rate before

including replacement schools of 51%. With replacement this increased to 85%, which meant that England belonged in category 2. Accordingly the results for England were annotated in the achievement exhibits in the TIMSS 1999 International Reports. In TIMSS 1999, no country was assigned to category 3.

Exhibit 5.8 School Participation Rates & 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
Australia	83%	93%	184	182	152	18	170
Belgium (Flemish)	72%	89%	150	150	106	29	135
Bulgaria	97%	97%	172	169	163	0	163
Canada	92%	95%	410	398	376	9	385
Chile	98%	100%	186	185	181	4	185
Chinese Taipei	100%	100%	150	150	150	0	150
Cyprus	100%	100%	61	61	61	0	61
Czech Republic	94%	100%	150	142	136	6	142
England	49%	85%	150	150	76	52	128
Finland	97%	100%	160	160	155	4	159
Hong Kong, SAR	75%	76%	180	180	135	2	137
Hungary	98%	98%	150	150	147	0	147
Indonesia	84%	100%	150	150	132	18	150
Iran, Islamic Rep.	96%	100%	170	170	164	6	170
Israel	98%	100%	150	139	137	2	139
Italy	94%	100%	180	180	170	10	180
Japan	93%	93%	150	150	140	0	140
Jordan	99%	100%	150	147	146	1	147
Korea, Rep. of	100%	100%	150	150	150	0	150
Latvia	96%	98%	150	148	143	2	145
Lithuania	100%	100%	150	150	150	0	150
Macedonia, Rep. of	99%	99%	150	150	149	0	149
Malaysia	99%	100%	150	150	148	2	150
Moldova	96%	100%	150	150	145	5	150
Morocco	99%	99%	174	174	172	1	173
Netherlands	62%	85%	150	148	86	40	126
New Zealand	93%	97%	156	156	145	7	152
Philippines	98%	100%	150	150	148	2	150
Romania	98%	98%	150	150	147	0	147
Russian Federation	98%	100%	190	190	186	3	189
Singapore	100%	100%	145	145	145	0	145
Slovak Republic	95%	96%	150	150	143	2	145
Slovenia	98%	99%	150	150	147	2	149
South Africa	85%	91%	225	219	183	11	194
Thailand	93%	100%	150	150	143	7	150
Tunisia	84%	100%	150	149	126	23	149
Turkey	99%	100%	204	204	202	2	204
United States	83%	90%	250	246	202	19	221

Exhibit 5.9 Student Participation Rates & 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
Australia	90%	4600	96	53	4451	419	4032
Belgium (Flemish)	97%	5387	12	0	5375	116	5259
Bulgaria	96%	3461	63	0	3398	126	3272
Canada	96%	9490	84	245	9161	391	8770
Chile	96%	6283	119	18	6146	239	5907
Chinese Taipei	99%	5889	30	42	5817	45	5772
Cyprus	97%	3296	38	32	3226	110	3116
Czech Republic	96%	3640	24	0	3616	163	3453
England	90%	3400	27	115	3258	298	2960
Finland	96%	3060	17	13	3030	110	2920
Hong Kong SAR	98%	5310	18	1	5291	112	5179
Hungary	95%	3350	0	0	3350	167	3183
Indonesia	97%	6162	106	1	6055	207	5848
Iran Islamic Rep.	98%	5497	104	0	5393	92	5301
Israel	94%	4670	29	187	4454	259	4195
Italy	97%	3531	23	86	3422	94	3328
Japan	95%	4996	15	12	4969	224	4745
Jordan	99%	5300	130	42	5128	76	5052
Korea Rep. of	100%	6285	29	128	6128	14	6114
Latvia	93%	3128	16	4	3108	235	2873
Lithuania	89%	2668	0	0	2668	307	2361
Macedonia Rep. of	98%	4096	0	0	4096	73	4023
Malaysia	99%	5713	98	0	5615	38	5577
Moldova	98%	3824	23	0	3801	90	3711
Morocco	92%	5841	42	0	5799	397	5402
Netherlands	95%	3099	12	0	3087	125	2962
New Zealand	94%	3966	96	22	3848	235	3613
Philippines	92%	7591	461	0	7130	529	6601
Romania	98%	3514	36	0	3478	53	3425
Russian Federation	97%	4557	48	34	4475	143	4332
Singapore	98%	5100	37	0	5063	97	4966
Slovak Republic	98%	3695	149	0	3546	49	3497
Slovenia	95%	3287	0	4	3283	174	3109
South Africa	93%	9071	256	0	8815	669	8146
Thailand	99%	5831	59	0	5772	40	5732
Tunisia	98%	5189	45	0	5144	93	5051
Turkey	99%	7972	49	0	7923	82	7841
United States	94%	9981	115	142	9724	652	9072

Exhibit 5.10 Unweighted Participation Rates

Country	School Participation Before Replacement	School Participation After Replacement	Student Participation	Overall Participation Before Replacement	Overall Participation After Replacement
Australia	84%	93%	91%	76%	85%
Belgium (Flemish)	71%	90%	98%	69%	88%
Bulgaria	96%	96%	96%	93%	93%
Canada	94%	97%	96%	90%	93%
Chile	98%	100%	96%	94%	96%
Chinese Taipei	100%	100%	99%	99%	99%
Cyprus	100%	100%	97%	97%	97%
Czech Republic	96%	100%	95%	91%	95%
England	51%	85%	91%	46%	78%
Finland	97%	99%	96%	93%	96%
Hong Kong, SAR	75%	76%	98%	73%	75%
Hungary	98%	98%	95%	93%	93%
Indonesia	88%	100%	97%	85%	97%
Iran, Islamic Rep.	96%	100%	98%	95%	98%
Israel	99%	100%	94%	93%	94%
Italy	94%	100%	97%	92%	97%
Japan	93%	93%	95%	89%	89%
Jordan	99%	100%	99%	98%	99%
Korea, Rep. of	100%	100%	100%	100%	100%
Latvia	97%	98%	92%	89%	91%
Lithuania	100%	100%	88%	88%	88%
Macedonia, Rep. of	99%	99%	98%	98%	98%
Malaysia	99%	100%	99%	98%	99%
Moldova	97%	100%	98%	94%	98%
Morocco	99%	99%	93%	92%	93%
Netherlands	58%	85%	96%	56%	82%
New Zealand	93%	97%	94%	87%	91%
Philippines	99%	100%	93%	91%	93%
Romania	98%	98%	98%	97%	97%
Russian Federation	98%	99%	97%	95%	96%
Singapore	100%	100%	98%	98%	98%
Slovak Republic	95%	97%	99%	94%	95%
Slovenia	98%	99%	95%	93%	94%
South Africa	84%	89%	92%	77%	82%
Thailand	95%	100%	99%	95%	99%
Tunisia	85%	100%	98%	83%	98%
Turkey	99%	100%	99%	98%	99%
United States	82%	90%	93%	77%	84%

Exhibit 5.11 Weighted Participation Rates

Country	School Participation Before Replacement	School Participation After Replacement	Student Participation	Overall Participation Before Replacement	Overall Participation After Replacement
Australia	83%	93%	90%	75%	84%
Belgium (Flemish)	72%	89%	97%	70%	87%
Bulgaria	97%	97%	96%	93%	93%
Canada	92%	95%	96%	88%	92%
Chile	98%	100%	96%	94%	96%
Chinese Taipei	100%	100%	99%	99%	99%
Cyprus	100%	100%	97%	97%	97%
Czech Republic	94%	100%	96%	90%	96%
England	49%	85%	90%	45%	77%
Finland	97%	100%	96%	93%	96%
Hong Kong, SAR	75%	76%	98%	74%	75%
Hungary	98%	98%	95%	93%	93%
Indonesia	84%	100%	97%	81%	97%
Iran, Islamic Rep.	96%	100%	98%	95%	98%
Israel	98%	100%	94%	93%	94%
Italy	94%	100%	97%	91%	97%
Japan	93%	93%	95%	89%	89%
Jordan	99%	100%	99%	98%	99%
Korea, Rep. of	100%	100%	100%	100%	100%
Latvia	96%	98%	93%	89%	91%
Lithuania	100%	100%	89%	89%	89%
Macedonia, Rep. of	99%	99%	98%	98%	98%
Malaysia	99%	100%	99%	98%	99%
Moldova	96%	100%	98%	94%	98%
Morocco	99%	99%	92%	91%	92%
Netherlands	62%	85%	95%	59%	81%
New Zealand	93%	97%	94%	87%	91%
Philippines	98%	100%	92%	91%	92%
Romania	98%	98%	98%	97%	97%
Russian Federation	98%	100%	97%	95%	97%
Singapore	100%	100%	98%	98%	98%
Slovak Republic	95%	96%	98%	93%	94%
Slovenia	98%	99%	95%	93%	94%
South Africa	85%	91%	93%	79%	84%
Thailand	93%	100%	99%	93%	99%
Tunisia	84%	100%	98%	82%	98%
Turkey	99%	100%	99%	98%	99%
United States	83%	90%	94%	78%	85%

5.8 Summary

Population coverage and sampling participation rates were good for all countries that participated in TIMSS 1999. Unlike the situation in 1995 when a number of countries had difficulty securing acceptable participation rates or complying fully with sampling guidelines, all countries met the standards for compliance in 1999 and had acceptable participation rates (although one country had to rely on replacement schools). Full details of the outcome of the TIMSS sampling in each country is presented in Appendix C of the TIMSS 1999 Technical Report (Martin, Gregory, & Stemler, 2000).

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