Chapter 9

TIMSS 2003 Sampling Weights and Participation Rates

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9.1 Overview

As described in Chapter 5, TIMSS uses rigorous sampling of schools and students to provide valid and efficient estimates of mathematics and science achievement in the fourth- and eighth- grade student populations of participating countries. The accuracy of these estimates depends to a great extent on the quality of the sampling in each country, which in turn is determined by the quality of the sampling information available ! g .g g fng ihe

9.2 Sampling implementation

9.2.1 TIMSS 2003 Target Populations

In IEA studies, the target population for all countries is known as the international desired population. The *international desired populations* for TIMSS 2003 were defined as:

Population 1: 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. This grade level was intended to represent four years of schooling, counting from the first year of primary or elementary schooling, and was the fourth grade in most countries.

Population 2: 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. This grade level was intended to represent eight years of schooling, counting from the first year of primary or elementary schooling, and was the eighth grade in most countries.

To measure trends in student achievement, the TIMSS 2003 eighth- and fourth-grade target populations were intended to correspond to the upper grades of the TIMSS 1995 population definitions, and the TIMSS 2003 eighth-grade target population to the eighth-grade population in TIMSS 1999.

Exhibits 9.1 and 9.2 summarize the grades identified as the target grades for sampling in all participating countries and Benchmarking entities for the eighth and fourth grades, respectively. For most countries, the target grades did indeed turn out to be the grades with eight and four years of schooling. A number of countries decided to target the eighth or fourth grades even though their students were somewhat older as a result. These included Botswana, Estonia, Ghana, Latvia, Morocco, Romania, and South Africa at the eighth grade and Latvia, Moldova, Morocco, and Yemen at the fourth grade.

Exhibit 9.1 **National Grade Definitions – Eighth Grade** *(...Continued)*

Country	Country's Name for Grade Tested	Years of Formal Schooling	Mean Age of Students Tested
P`lɑi^ka	Pb`lka^ov / %P/&	6	.0÷4
Pbo f^	5qe do^ab lc Mofj^ov P`elli	5	.1÷6
Pfkd^mlob			

sions generally consisted of disabled students and students who could not be assessed in t2set ʒ et t2set 2 s

Within the national desired population, it was possible to exclude certain school types, such as very small or very remote schools, and certain types of students, such as those with a disability that prevented them from participating in the assessment. For 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 exclu-

	nternational overage	Desirei otes on	Ropulation Coverage	ational chool- xclusions	Desirei ithin- ample xclusions	Ropulation veral xclusions
o j bkf^						
rpqo^if^						
^eo^fk	-- "			+- "	+- "	+- "
bidfr j %Cib j fpe&	-- "			+ "	+ "	+/ "
lqp t ^k^						
rid^of^	-- "			+ "	+- "	+ "
efib	-- "			+3 "	+4 "	+/ "
efkbpb Q^fmbf	-- "			+/ "	+3 "	+5 "
vmorp	-- "			+. "	+ "	+ "
dvmq	-- "			+ "	+- "	+ "
kdi^ka	-- "			+. "	+- "	+. "
pqlkf^	-- "			+3 "	+5 "	+ "
e^k^	-- "			+6 "	+- "	+6 "
lkd HIkd) P>O	-- "			+ "	+. "	+ "
rkd^ov	-- "			+ "	+/	+ "
kalkbq						

above, some countries where large classrooms are the norm sampled students within classrooms was a means of reducing the data collection effort. In these cases, classrooms were sampled with PPS, and then a fixed number of students (with equal probabilities) were sampled from within the sampled

Exhibit 9. 5 **Population and Sample Sizes – Eighth Grade**

Country	Population		Sample			Mean Age of Students Tested
	Schools	Students	Schools	Students	Est. Pop.	
>0 i bkf^	.)106	23)51.	.16	2)4/3	21)2-/	.1+6
>rDQ0^if^	/)/64	/20)2//	/-4	1)46.	/24)1-4	.0+6
?^e0^fk	34	.-)25.	34	1).66	.-)210	

Exhibit 9. 5 **Population and Sample Sizes – Eighth Grade** *(...Continued)*

Country	Population		Sample			Mean Age of Students Tested
	Schools	Students	Schools	Students	Est. Pop.	
Orppf^k Cbabo^qflk	25)262	/)-5.)6.6	/.1	1)334	.)6/0).40	.1+/
P^raf >o^ f^	3)//1	022)343	.22	1)/62	0/3)421	.1+.
P`lqi^ka	1/2	30)462	./5	0)2.3	25)5/1	.0+4
Pbo f^	.).--	6/)/3.	.16	1)/63	54)00-	.1+6
Pfkd^mlob	.31	20).--	.31	3)-.5	20)/6/	.1+0
Pils^h Obmr_if`	.)313	52)132	.46	1)/.2	42)4.5	.1+0

9.3 Calculating Sampling Weights

While the TIMSS 2003 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. Individual country designs could be quite complex, as may be seen from Appendix B showing how the design was implemented in each country. To adjust for these differential selection probabilities and ensure accurate survey estimates, TIMSS 2003 computed a sampling weight for each participant student. Because appropriate sampling weights were essential for the computation of accurate survey results, the capacity 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 TIMSS 2003 data.

Sampling weights were calculated according to a three-step procedure involving selection probabilities for schools, classrooms, and students. The first

The basic sampling weight attached to each student record was the product of the three weights described above: 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 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 at the first stage. The TIMSS 2003 sample design required that school selection probabilities be proportional to the school size, generally defined as enrolment in the target grade. The basic first stage weight for the i^{th} sampled school was thus μ O

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 applied 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 for all participants except England at the eighth grade.[7]

The adjustment was calculated as follows:

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

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:

$$i \\ s$$

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

$$BW_{cl2}^{i,j} \quad \frac{K^{i}}{c^{i} \quad k^{i,j}}$$

where c^{i}EW

9.3.5 The Third Stage (Student) Weight

The third stage weight represented the inverse of the probability of a student in a sampled class being selected. Where intact classrooms that included all students were sampled, as was the case in most participating countries, this probability was unity. However, the probability of selection varied when students were sampled within classrooms. Procedures for calculating weights are presented below for both sampling approaches. The third stage weight is calculated independently for each sampled classroom.

Sampling Intact Classrooms: The basic third stage weight for the j^{th} classroom in the i^{th} school was simply:

$$BW_{st1}^{i,j} \quad 1.0$$

Subsampling Students: The basic third stage weight for the j^{th} classroom in the i^{th} school was :

9.3.7 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. For example, when no subsampling of classrooms was involved, this product is given by

$$w_{ij} = w_{i}^{sc} \; w_{i}^{cl} \; w_{ij}^{st}$$

$R_{unw}^{ov\ s}$ 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

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

where both the numerator and denominator were summations over all responding students and the appropriate classroom-level and student-level sampling weights were

9.4.7 Weighted Student Participation Rates

9.5 Meeting TIMSS' Standards for Sampling Participation

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 modelled after IEA's TIMSS previous studies. As summarized in Exhibit 9.7, countries were assigned to one of three categories on the basis of their sampling participation. Countries in Category 1 were considered to have met the TIMSS sampling requirement, 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 TIMSS 2003 was to have as many countries as possible achieve Category 1 status.

Exhibit 9. 7 **Categories of Sampling Participation**

Category 1	>``bmq^_ib p^ j mifkd m^oqf`fm^qf l k o^qb **without** qeb rpb l c obmi^``b j bkq p`e l l ip+
	fk l oabo q l _b mi^``ba fk qefp `^qbd l ov) ^ `l rkqov e^a q l e^sb7
	± >k

Ol j ^kf^	66+0 "	66+0 "	.2-	.16	.15	.15
Orppf^k Cbab0^qflk	66+0 "	66+0 "	/ .3	/ .3	/ .1	/ .1
P^raf >0^_f^	62+. "					

Exhibit 9. 10 **Student Participation Rates & Sample Sizes - Eighth** *(...Continued)*

Country	Within School Student Participation (Weighted Percentage)	Number of Sampled Students in Participating Schools	Number of Students Withdrawn from Class/ School	[illegible] of [illegible]