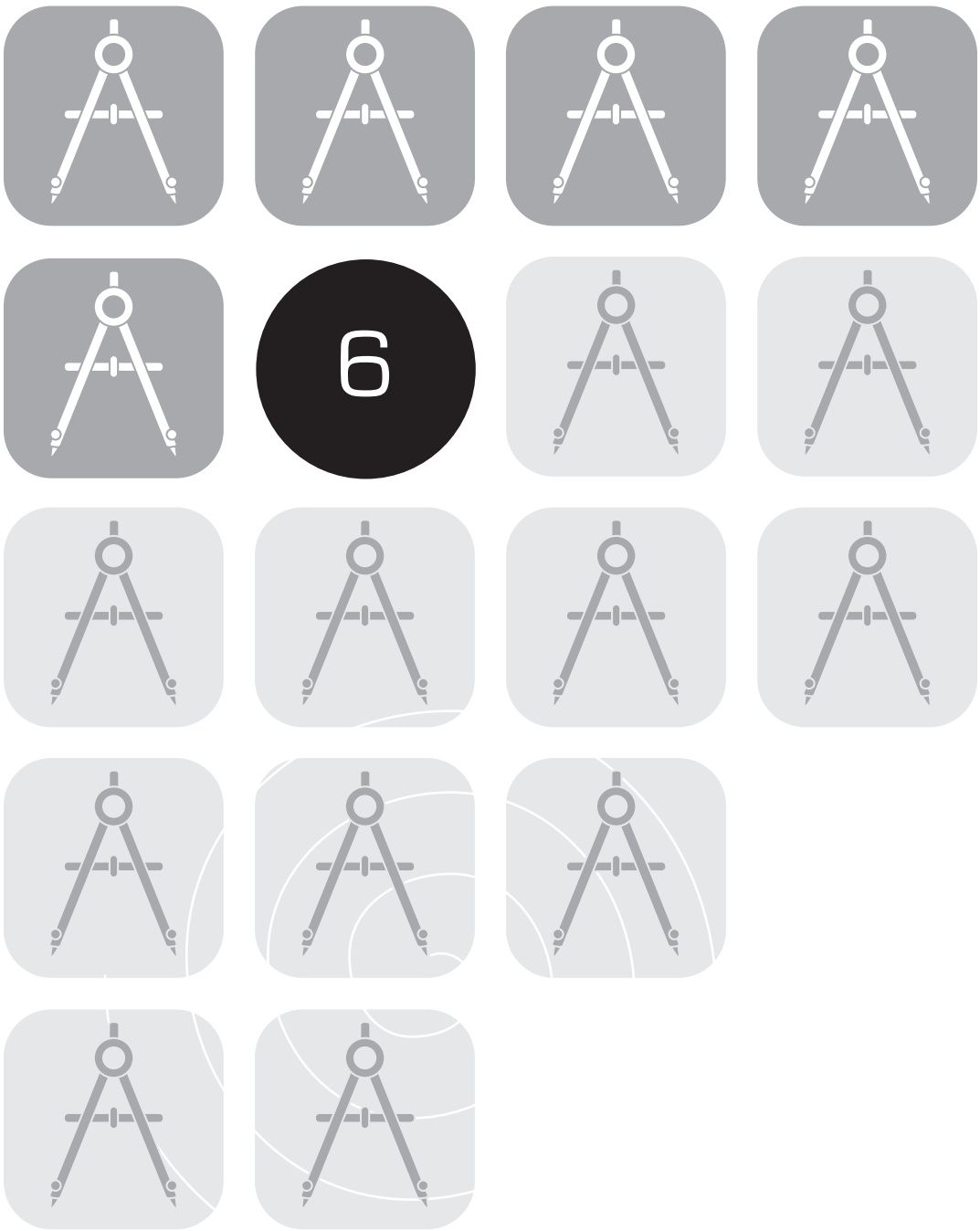

Sampling Design and Implementation for TIMSS 1999 Benchmarking

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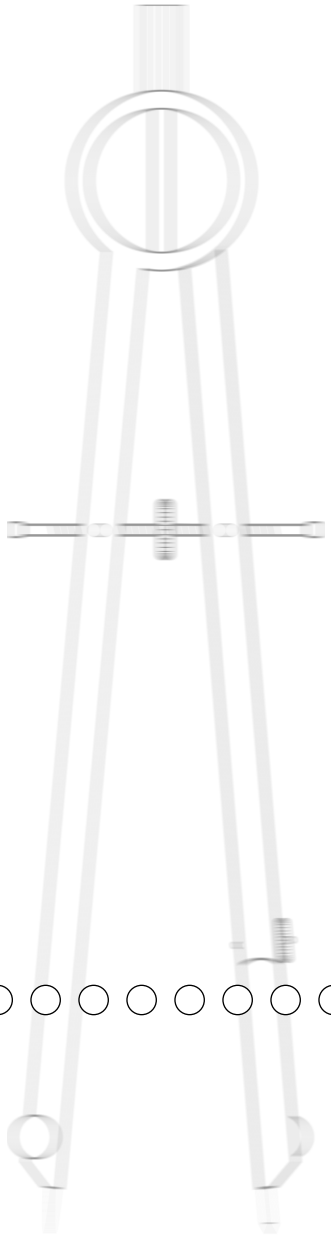

6 Sampling Design and Implementation for TIMSS 1999 Benchmarking

Jean Fowler
Lou Rizzo
Keith Rust

6.1 Overview

The previous chapter described the design and implementation of the TIMSS samples for the participating countries, including the United States. This chapter describes the sampling procedures for the 27 Benchmarking participants.

TIMSS 1999 Benchmarking study participants included thirteen states, eight public school districts, and six self-defined school consortia. Samples were selected according to a two-stage stratified systematic sample design. Schools were selected independently within the sampling strata, then classes were selected within schools. The student sample consisted of all eligible students within the selected classes.

6.2 School Sample

Sampling strata were defined by public/private status, where regular public, Bureau of Indian Affairs, Department of Defense, and state schools were "public"; Catholic, non-Catholic religious, and nonreligious private schools were "private". Strata were also defined to take into account selection of the TIMSS 1999 national sample primary sampling units (PSUs). A PSU is a consolidated metropolitan statistical area, a metropolitan statistical area, a county, or a group of contiguous counties. Benchmarking PSUs were grouped according to whether or not they had been selected for the TIMSS 1999 national sample, thus defining "overlap" and "nonoverlap" strata.

6.3 Target School Sample Size

The initial public school target sample size was 50 for states, 25 for districts and consortia. If schools from a participating Benchmarking jurisdiction were selected as part of the U.S. sample for the TIMSS 1999 international study (U.S. national sample), those schools were also included in the TIMSS 1999 Benchmarking study sample. Target stratum sample sizes were assigned so that the distribution of the Benchmarking study sample would be proportional to strata eighth grade enrollments. According to this scheme the sampling strata fell into three classes:

- Overlap strata where the TIMSS 1999 international sample met or exceeded the Benchmarking target stratum sample size. No additional schools were selected from these strata for the Benchmarking sample.
- Overlap strata where the TIMSS 1999 international sample was smaller than the Benchmarking target stratum sample size. A supplementary sample was drawn so that the final stratum sample size would meet the Benchmarking target.
- Nonoverlap strata. A sample was drawn, with target sample size equal to the Benchmarking target.

6.4 Selecting Schools

Within each stratum, the school frame was ordered according to eighth grade enrollment. Using a random start and an interval determined by total enrollment and desired sample size, schools were systematically selected. Thus a school's probability of selection was proportional to its share of the target population, that is, the eighth grade enrollment. All schools were selected with certainty in districts and consortia having 25 or fewer members. Final sample sizes ranged from 4 to 71 schools.

Since TIMSS 1999 national sample schools were not removed from the frame, the possibility existed in the overlap strata that some of these schools would be selected into the supplementary sample. Expected overlap was calculated for each sampling frame. For all jurisdictions but Miami Dade County this was less than two schools. Based on an expected overlap of about four schools, the Miami Dade County supplementary sample target size was set to 19. Four of the ten Miami Dade County TIMSS 1999 national sample schools were in fact selected, resulting in a final Benchmarking sample size equal to the target of 25 schools. Two TIMSS 1999 national sample schools were selected into the Massachusetts supplementary sample, reducing the final Benchmarking supplementary sample size from the target of 61 schools to 59. Otherwise, the TIMSS 1999 national and supplementary samples did not overlap.

States were offered the option of sampling private schools, with target sample sizes proportional to the private share of total eighth grade enrollment. Idaho, Indiana, Michigan, and Pennsylvania chose to sample private schools. Consortia might include private schools, but there was no provision to sample these schools independently. The exception to this scheme was the SW Pennsylvania Regional Math & Science Collaborative,

with a sample size of 50, split in proportion to enrollment and sampled independently: 44 public schools and 6 private. Private schools sampled in TIMSS 1999 Benchmarking were included in the final samples for these jurisdictions in the same manner as TIMSS 1999 public schools, described above.

6.5 Substitute Schools

When possible, two substitutes were identified for each Benchmarking sample school. The general rule was to assign as substitutes the two schools neighboring the sampled school on the frame, with the preceding school in the frame order as the first substitute, and the succeeding school as the second. The other conditions were that a TIMSS 1999 national sample school could not serve as a Benchmarking substitute, and that a substitute had to be in the same sampling stratum as the school to which it was assigned.

Exhibit 6.1 summarizes the Benchmarking school samples. Final sample sizes are shown for each jurisdiction, including the numbers of TIMSS 1999 original selections and substitutes. Counts are also broken down by sampling stratum, which are identified according to overlap status. This table reflects the sampling procedure described above by which states and the districts and consortia within them were sampled independently. Final state samples incorporated the district and consortium samples. The Illinois sample included Chicago Public Schools, First in the World Consortium, and Naperville Community Unit School District #203; the Maryland sample included Montgomery County Public Schools; the North Carolina sample included Guilford County Public Schools; the Pennsylvania sample included Southwest Pennsylvania Regional Math & Science Collaborative.

Exhibit 6.1 TIMSS 1999 Benchmarking School Sample Summary

State	Sample or Census	Jurisdiction	Number of Schools in TIMSS 1999 Benchmarking Sample	Stratum	N	Schools in National Sample		Type / Entity	Sampling Stratum
						Orig	Sub		
CO	Census	Academy	4		4			District	Rem[1]
CT	Sample		54	PU3	12	4	1	State	Ovp
				PU4	42			State	Rem
DE	Census	DE Sci Coal	25		25			Consortium	Ovp/Rem
FL	Sample	Dade Co	25		25	4	3	District	Ovp
ID	Sample		54	PR1	0			State	Ovp
				PR2	2			State	Rem
				PU3	2	2		State	Ovp
				PU4	50			State	Rem
IL	Sample		41	PU1	21	4	1	State	Ovp
				PU2	3			State	Ovp
				PU3	17			State	Rem
IL	Sample	Chicago PS	27		27	2	1	District	Ovp
IL	Census	1st in World	17		17		1	Consortium	Ovp
IL	Census	Naperville	5		5			District	Ovp
IN	Sample		61	PR1	2	1		State	Ovp
				PR2	5			State	Rem
				PU3	6			State	Ovp
				PU4	0			State	Ovp
				PU5	13	4	1	State	Ovp
				PU6	35			State	Rem
MD	Sample	Mont Co	25	PU3	25		1	District	Ovp
MD	Sample		54	PU4	17	1	1	State	Ovp
				PU5	30	3	2	State	Ovp
				PU6	7			State	Rem
MA	Sample		59	PU3	2			State	Rem
				PU4	35	2	1	State	Ovp
				PU5	8	3	1	State	Ovp
				PU6	5	4		State	Ovp
				PU7	9			State	Rem

1 "Ovp" means that some of the benchmark sample schools from this stratum were also in the national sample. "Rem" means that none of the benchmark sample schools from this stratum were part of the national sample..

Exhibit 6.1 (continued) TIMSS 1999 Benchmarking School Sample Summary

State	Sample or Census	Jurisdiction	Number of schools from TIMSS 1999 National Sample	Stratum	N	Schools in National Sample		Type Entity	Type Sampling Stratum
						Orig	Sub		
MI	Census	Invit Group	21		21			Consortium	n/a
MI	Sample		66	PR1	6	3		State	Ovp
				PR2	3			State	Rem
				PU3	26	3		State	Ovp
				PU4	4	4		State	Ovp
				PU5	27			State	Rem
MO	Sample		57	PU1	3	3		State	Ovp
				PU2	18	4	2	State	Ovp
				PU3	36			State	Rem
NC	Census	Guilford Co	17	PU3	17			District	Rem
NC	Sample		54	PU4	4	4		State	Ovp
				PU5	50			State	Rem
NE	Census	Lincoln/ Fremont/ WestSide PS	12		12			Consortium	Rem
NJ	Census	Jrsy City PS	25		25	1		District	Ovp
NY	Census	Rochester PS	7		7			District	Rem
OH	Census	Prj SMART	24		24	1	1	Consortium	Ovp/Rem
OR	Sample		51	PU3	1	1		State	Ovp
				PU4	50			State	Rem
PA	Sample		66	PR2	6	2		State	Ovp
				PR3	7			State	Rem
				PU5	19	3	1	State	Ovp
				PU6	34			State	Rem
PA	Sample	SW PA Sci& Math Coll	50	PR1	6			Consortium	Rem
				PU4	44			Consortium	Rem
SC	Sample		53	PU3	3	3		State	Ovp
				PU4	50				Rem
TX	Sample		71	PU3	28	9	2	State	Ovp
				PU4	7	7		State	Ovp
				PU5	5	5		State	Ovp
				PU6	31			State	Rem

6.6 School Participation Rates

School participation rates are shown for all schools and by school type in Exhibits 6.2 and 6.3. Four states used replacement schools; this choice considerably improved school participation rates in two of them: Indiana and Missouri. Five jurisdictions sampled private schools, with unweighted participation rates ranging from 50 to 100 percent. Only in Indiana were public and private school participation rates about the same.

The three unweighted school participation rates were computed as in section 5.6.1. The weighted school participation rates shown in Exhibit 6.2 and 6.3 were calculated as follows:

$$R^{sc-s}_{wtd} = \frac{\sum_{i,j}^{s} BW^{i}_{sc} \cdot MOS_i}{\sum_{i,j}^{s+r1+r2} BW^{i}_{sc} \cdot MOS_i}$$

$$R^{sc-r1}_{wtd} = \frac{\sum_{i,j}^{s+r1} BW^{i}_{sc} \cdot MOS_i}{\sum_{i,j}^{s+r1+r2} BW^{i}_{sc} \cdot MOS_i}$$

$$R^{sc-r2}_{wtd} = \frac{\sum_{i,j}^{s+r1+r2} BW^{i}_{sc} \cdot MOS_i}{\sum_{i,j}^{s+r1+r2} BW^{i}_{sc} \cdot MOS_i}$$

where BW^{i}_{sc} is the basic school weight defined in Section 5.5.1 and represents the inverse of the first stage selection probability assigned to a sample school. MOS_i is the estimated eighth enrollment of the sampled school.

6.6.1 Alternate Method for Weighted School Participation Rates

Three weighted school-level participation rates were computed using the alternate method with similar results. This method is described in section 5.6.4 and is identical to the method used in the TIMSS 1999 International Reports. These rates are shown in Exhibits 6.4 and 6.5.

Exhibit 6.2 TIMSS 1999 Benchmarking School Participation Rates

Jurisdiction	Number of Schools						Unweighted Participation Rate		Weighted Participation Rate	
	Selected	Ineligible	Refusing	Participating			Substitutes Not Included	Substitutes Included	Substitutes Not Included	Substitutes Included
				Originals	Substitutes	Total				
Connecticut	54	0	2	52	0	52	96.30	96.30	95.99	95.99
Idaho	54	0	7	47	0	47	87.04	87.04	87.16	87.16
Illinois	90	0	5	85	0	85	94.44	94.44	95.48	95.48
Indiana	61	0	22	39	13	52	63.93	85.25	62.42	83.01
Maryland	79	2	4	73	0	73	94.81	94.81	93.54	93.54
Massachusetts	59	1	1	57	0	57	98.28	98.28	98.22	98.22
Michigan	66	4	7	55	2	57	88.71	91.94	88.67	91.93
Missouri	57	2	12	43	8	51	78.18	92.73	78.73	93.39
North Carolina	71	3	1	67	0	67	98.53	98.53	98.01	98.01
Oregon	51	0	6	45	0	45	88.24	88.24	88.93	88.93
Pennsylvania	116	3	33	80	0	80	70.80	70.80	66.12	66.12
South Carolina	53	0	4	49	0	49	92.45	92.45	92.25	92.25
Texas	71	1	19	51	1	52	72.86	74.29	72.39	73.94
Academy #20, CO	4	0	0	4	0	4	100.00	100.00	100.00	100.00
Delaware Math & Sci., DE	25	0	0	25	0	25	100.00	100.00	100.00	100.00
Dade County, FL	25	0	0	25	0	25	100.00	100.00	100.00	100.00
Chicago Public Schools, IL	27	0	1	26	0	26	96.30	96.30	96.30	96.30
First in the World, IL	17	0	2	15	0	15	88.24	88.24	93.64	93.64
Naperville #203, IL	5	0	0	5	0	5	100.00	100.00	100.00	100.00
Montgomery County, MD	25	0	0	25	0	25	100.00	100.00	100.00	100.00
Invitational Group, MI	21	0	0	21	0	21	100.00	100.00	100.00	100.00
Fremont/Lincoln/ WestSide P.S., NE	12	0	0	12	0	12	100.00	100.00	100.00	100.00
Jersey City Public Schools, NJ	25	0	1	24	0	24	96.00	96.00	96.57	96.57
Rochester City Sch. Dist., NY	7	0	0	7	0	7	100.00	100.00	100.00	100.00
Guilford County, NC	17	0	0	17	0	17	100.00	100.00	100.00	100.00
Project SMART, OH	24	0	0	24	0	24	100.00	100.00	100.00	100.00
SW PA Math & Sci. Collaborative, PA	50	1	10	39	0	39	79.59	79.59	79.43	79.43
TOTAL SCHOOLS	1025	16	124	885	24	909				

Exhibit 6.3 TIMSS 1999 Benchmarking Participation Rates by School Type

Jurisdiction	School Type	Number of Schools						Unweighted Participation Rates		Weighted Participation Rates	
		Selected	Ineligible	Refusing	Participating			Substitutes Not Included	Substitutes Included	Substitutes Not Included	Substitutes Included
					Originals	Substitutes	Total				
Idaho	Private	2	0	1	1	0	1	50.00	50.00	50.00	50.00
	Public	52	0	6	46	0	46	88.46	88.46	88.46	88.46
Indiana	Private	7	0	1	6	0	6	85.71	85.71	74.72	74.72
	Public	54	0	21	33	13	46	61.11	85.19	60.94	84.01
Michigan	Private	9	1	0	8	0	8	100.00	100.00	100.00	100.00
	Public	57	3	7	47	2	49	87.04	90.74	87.13	90.83
Pennsylvania	Private	19	1	9	9	0	9	50.00	50.00	35.02	35.02
	Public	97	2	24	71	0	71	74.74	74.74	73.25	73.25
SW PA Math & Sci. Collaborative, PA	Private	6	0	0	6	0	6	100.00	100.00	100.00	100.00
	Public	44	1	10	33	0	33	76.74	76.74	76.74	76.74
TOTAL SCHOOLS	Private	56	3	20	33	0	33				
	Public	969	13	104	852	24	876				

Exhibit 6.4 TIMSS 1999 Benchmarking Weighted School Participation Rates: Alternate Method

Jurisdiction	Substitutes Not Included	Substitutes Included
Connecticut	96%	96%
Idaho	88%	88%
Illinois	95%	95%
Indiana	61%	83%
Maryland	94%	94%
Massachusetts	98%	98%
Michigan	89%	92%
Missouri	79%	94%
NC, combined	98%	98%
Oregon	89%	89%
PA, combined	66%	66%
South Carolina	92%	92%
Texas	73%	74%
Academy #20, CO	100%	100%
Delaware Math & Sci., DE	100%	100%
Dade County, FL	100%	100%
Chicago Public Schools, IL	95%	95%
First in the World, IL	93%	93%
Naperville #203, IL	100%	100%
Montgomery County, MD	100%	100%
Invitational Group, MI	100%	100%
Fremont/Lincoln/ WestSide P.S., NE	100%	100%
Jersey City Public Schools, NJ	97%	97%
Rochester City Sch. Dist., NY	100%	100%
Guilford County, NC	100%	100%
Project SMART, OH	100%	100%
SW PA Math & Sci. Collaborative, PA	78%	78%

Exhibit 6.5 TIMSS 1999 Benchmarking Weighted School Participation Rates by School Type: Alternate Method

Jurisdiction	School Type	Substitutes Not Included	Substitutes Included
Idaho	Private	50%	50%
	Public	89%	89%
Indiana	Private	75%	75%
	Public	59%	84%
Michigan	Private	100%	100%
	Public	87%	91%
PA, combined	Private	36%	36%
	Public	72%	72%
SW PA Math & Sci. Collaborative, PA	Private	100%	100%
	Public	76%	76%

6.7 Selecting Classes

Classes were randomly selected within schools. All eighth grade mathematics classes were listed in order of increasing difficulty, with a provision for grouping classes having nine or fewer students into "pseudo classes" of up to 20 students. Using a random start and an interval determined by the desired class sample size and the total number of classes on the list, classes were systematically selected for assessment. When the school sample size was 25 or greater, the number of classes sampled was two. For smaller school samples, the classroom sample was allocated among the schools in proportion to enrollment, so that the number of students assessed would be approximately 1000. In Academy School District 20, Colorado, with an estimated eighth grade enrollment of 1318, all classes were selected with certainty for assessment.

6.8 Student Sample

The student sample consisted of all eligible students within the selected classes. The exception to this plan was Montgomery County, Maryland, where students were sampled, not classes. Using a random start, 60 students were systematically selected in each school from a list of eighth grade math students. The selected students were randomly assigned to two groups, which were treated as classes for weighting.

Exhibit 6.6 shows the number of students sampled by jurisdiction and school type.

Exhibit 6.6 TIMSS 1999 Benchmarking Student Sample Size by Jurisdiction and School Type

Jurisdiction	School Type	Student Population	Estimated Student Population	Number of Sampled Schools	Number of Sampled Students
Connecticut	Public	36775	38742	54	2190
Idaho	Private	747	729	2	26
	Public	19430	18185	52	1942
	All	20177	18914	54	1968
Illinois	Public	144323	147621	90	5144
Indiana	Private	8684	10934	7	135
	Public	76504	66650	54	2040
	All	85188	77584	61	2175
Maryland	Public	60756	59789	79	3877
Massachusetts	Public	65981	67531	59	2538
Michigan	Private	16375	15974	9	238
	Public	121972	124773	57	2573
	All	138347	140747	66	2811
Missouri	Public	67278	65074	57	2147
North Carolina	Public	92684	84685	71	3502
Oregon	Public	41762	40847	51	2044
Pennsylvania	Private	31014	23915	19	282
	Public	132795	130658	97	3181
	All	163809	154573	116	3463
South Carolina	Public	51632	50165	53	2177
Texas	Public	284146	283538	71	2189
Academy #20, CO	Public	1588	1318	4	1329
Delaware Math & Sci., DE	Public	6753	7861	25	1389
Dade County, FL	Public	24485	22040	25	1356
Chicago Public Schools, IL	Public	33355	26118	27	1227
First in the World, IL	Public	2533	2611	17	782
Naperville #203, IL	Public	1430	1472	5	1343
Montgomery County, MD	Public	8787	9432	25	1481
Invitational Group, MI	Public	3156	3039	21	994
Fremont/Lincoln/ West Side P.S., NE	Public	3105	3044	12	1178
Jersey City Public Schools, NJ	Public	2365	1749	25	1116
Rochester City Sch. Dist., NY	Public	2669	2001	7	1165

Exhibit 6.6 (continued) TIMSS 1999 Benchmarking Student Sample Size by Jurisdiction and School Type

Jurisdiction	School Type	Student Population	Estimated Student Population	Number of Sampled Schools	Number of Sampled Students
Guilford County, NC	Public	4396	5155	17	1215
Project SMART, OH	Public	5940	5956	24	1188
SW PA Math & Sci Collaborative, PA	Private	3661	3181	6	166
	Public	28648	26895	44	1472
	All	32309	30076	50	1638
TOTAL	All	1764489	1723486	1025	45940

6.9 Student Participation Rates

Student participation rates were calculated as shown in sections 5.6. Exhibits 6.7 and 6.8 show the weighted and unweighted student participation rates overall and by school type.

Exhibit 6.7 TIMSS 1999 Benchmarking Student Participation Rates

Jurisdiction	Number of Students						Participation Rates	
	Population	Est. Population	Sampled	Excluded	Absent	Participating	Unweighted	Weighted
Connecticut	36775	38742	2190	43	124	2023	94%	94%
Idaho	20177	18914	1968	27	94	1847	95%	95%
Illinois	144323	147621	5144	136	227	4781	95%	96%
Indiana	85188	77584	2175	27	102	2046	95%	95%
Maryland	60756	59789	3877	339	221	3317	94%	94%
Massachusetts	65981	67531	2538	54	131	2353	95%	95%
Michigan	138347	140747	2811	45	143	2623	95%	96%
Missouri	67278	65074	2147	40	128	1979	94%	94%
North Carolina	92684	84685	3502	191	214	3097	94%	94%
Oregon	41762	40847	2044	29	126	1889	94%	93%
Pennsylvania	163809	154573	3463	60	167	3236	95%	95%
South Carolina	51632	50165	2177	36	130	2011	94%	94%
Texas	284146	283538	2189	44	149	1996	93%	93%
Academy #20, CO	1588	1318	1329	15	81	1233	94%	94%
Delaware Math & Sci., DE	6753	7861	1389	18	103	1268	92%	92%
Dade County, FL	24485	22040	1356	10	117	1229	91%	91%
Chicago Public Schools, IL	33355	26118	1227	21	74	1132	94%	94%
First in the World, IL	2533	2611	782	2	30	750	96%	96%
Naperville #203, IL	1430	1472	1343	84	47	1212	96%	96%
Montgomery County, MD	8785	9432	1481	254	72	1155	94%	94%
Invitational Group, MI	3156	3039	994	11	80	903	92%	91%
Fremont/Lincoln/ WestSide P.S., NE	3105	3044	1178	25	60	1093	95%	95%
Jersey City Public Schools, NJ	2365	1749	1116	47	65	1004	94%	94%
Rochester City Sch. Dist., NY	2669	2001	1165	9	190	966	84%	84%
Guilford County, NC	4396	5155	1215	121	76	1018	93%	92%
Project SMART, OH	5940	5956	1188	18	74	1096	94%	94%
SW PA Math & Sci. Collaborative, PA	32309	30076	1638	21	79	1538	95%	95%
TOTAL STUDENTS	1764489	1723486	45940	1224	2726	41990		

Exhibit 6.8 TIMSS 1999 Benchmarking Student Participation Rates by School Type

Jurisdiction	School Type	Number of Students						Participation Rates	
		Population	Est. Population	Sampled	Excluded	Absent	Participating	Unweighted	Weighted
Idaho	Private	747	729	26	0	1	25	96%	96%
	Public	19430	18185	1942	27	93	1822	95%	95%
Indiana	Private	8684	10934	135	0	9	126	93%	95%
	Public	76504	66650	2040	27	93	1920	95%	95%
Michigan	Private	16375	15974	238	0	9	229	96%	97%
	Public	121972	124773	2573	45	134	2394	95%	95%
Pennsylvania	Private	31014	23915	282	1	10	271	96%	96%
	Public	132795	130658	3181	59	157	2965	95%	95%
SW PA Math & Sci. Collaborative, PA	Private	3661	3181	166	1	3	162	98%	98%
	Public	28648	26895	1472	20	76	1376	95%	95%
TOTAL STUDENTS	Private	87834	75466	681	1	29	651		
	Public	1676655	1648020	45259	1223	2697	41339		

6.10 Combined Participation Rates

The combined school and student Benchmarking participation rates are shown in Exhibits 6.9 through 6.11. The combined rates are the product of the school and student participation rates.

Exhibit 6.9 TIMSS 1999 Benchmarking Combined Participation Rates

Jurisdiction	Unweighted Rate		Weighted Rate	
	Including Substitutes	Not Including Substitutes	Including Substitutes	Not Including Substitutes
Connecticut	91%	91%	90%	90%
Idaho	83%	83%	83%	83%
Illinois	90%	90%	91%	91%
Indiana	61%	81%	59%	79%
Maryland	89%	89%	88%	88%
Massachusetts	93%	93%	93%	93%
Michigan	84%	87%	85%	88%
Missouri	74%	87%	74%	88%
North Carolina	92%	92%	92%	92%
Oregon	83%	83%	83%	83%
Pennsylvania	67%	67%	63%	63%
South Carolina	87%	87%	87%	87%
Texas	68%	69%	67%	69%
Academy #20, CO	94%	94%	94%	94%
Delaware Math & Sci., DE	92%	92%	92%	92%
Dade County, FL	91%	91%	91%	91%
Chicago Public Schools, IL	90%	90%	91%	91%
First in the World, IL	85%	85%	90%	90%
Naperville #203, IL	96%	96%	96%	96%
Montgomery County, MD	94%	94%	94%	94%
Invitational Group, MI	92%	92%	91%	91%
Fremont/Lincoln/ WestSide P.S., NE	95%	95%	95%	95%
Jersey City Public Schools, NJ	90%	90%	91%	91%
Rochester City Sch. Dist., NY	84%	84%	84%	84%
Guilford County, NC	93%	93%	92%	92%
Project SMART, OH	94%	94%	94%	94%
SW PA Math & Sci. Collaborative, PA	76%	76%	76%	76%

Exhibit 6.10 TIMSS 1999 Benchmarking Combined Participation Rates by School Type

Jurisdiction	School Type	Unweighted Rate		Weighted Rate	
		Not Including Substitutes	Including Substitutes	Not Including Substitutes	Including Substitutes
Idaho	Private	48%	48%	48%	48%
	Public	84%	84%	84%	84%
Indiana	Private	80%	80%	71%	71%
	Public	58%	81%	58%	80%
Michigan	Private	96%	96%	97%	97%
	Public	82%	86%	83%	87%
Pennsylvania	Private	48%	48%	34%	34%
	Public	71%	71%	70%	70%
SW PA Math & Sci. Collaborative, PA	Private	98%	98%	98%	98%
	Public	73%	73%	73%	73%

Exhibit 6.11 TIMSS 1999 Benchmarking Weighted Combined Participation Rates Alternate Method

Jurisdiction	Substitutes Not Included	Substitutes Included
Connecticut	90%	90%
Idaho	83%	83%
Il, combined	91%	91%
Indiana	58%	79%
MD, combined	88%	88%
Massachusetts	93%	93%
Michigan	85%	88%
Missouri	75%	88%
NC, combined	92%	92%
Oregon	83%	83%
PA, combined	63%	63%
South Carolina	86%	86%
Texas	67%	67%
Academy #20, CO	94%	94%
Delaware Math & Sci., DE	92%	92%
Dade County, FL	91%	91%
Chicago Public Schools, IL	90%	90%

Exhibit 6.11 (continued) TIMSS 1999 Benchmarking Weighted Combined Participation Rates Alternate Method

Jurisdiction	Substitutes Not Included	Substitutes Included
First in the World, IL	90%	90%
Naperville #203, IL	96%	96%
Montgomery County, MD	94%	94%
Invitational Group, MI	91%	91%
Fremont/Lincoln/ WestSide P.S., NE	95%	95%
Jersey City Public Schools, NJ	91%	91%
Rochester City Sch. Dist., NY	84%	84%
Guilford County, NC	92%	92%
Project SMART, OH	94%	94%
SW PA Math & Sci. Collaborative, PA	75%	75%

Exhibit 6.12 TIMSS 1999 Benchmarking Weighted Combined Participation Rates: Alternate Method

Jurisdiction	School Type	Substitutes Not Included	Substitutes Included
Idaho	Private	48%	48%
	Public	85%	85%
Indiana	Private	71%	71%
	Public	56%	80%
Michigan	Private	97%	97%
	Public	83%	87%
PA, combined	Private	34%	34%
	Public	69%	69%
SW PA Math & Sci. Collaborative, PA	Private	98%	98%
	Public	72%	72%

6.11 TIMSS 1999 Benchmarking Sample Weights

Benchmarking sample weights have four components:

1. **The school base weight** is the reciprocal of the school's selection probability;
2. **A school nonresponse adjustment** is an adjustment to the school base weight for schools that did not participate;
3. **The student base weight** is the product of the adjusted school weight and the reciprocal of the student's selection probability;
4. **A student nonresponse adjustment** is an adjustment to the student base weight for eligible students that did not participate.

Sample weights were computed by the same general methodology for all Benchmarking jurisdictions. The following sections discuss: computation of school base weights for the Benchmarking samples, school-level non-response adjustment, non-response adjustment at the student level, computation of final student weights, and the creation of variance estimation strata and replicates for jackknife variance estimators.

6.11.1 School Base Weights

The school base weight is the inverse of the sampled school's probability of selection into the TIMSS 1999 Benchmarking sample. (see Section 5.5.1):

$$BW_{sc}^{i} = \frac{M}{n \bullet m_i} = (p_i^{(B)})^{-1} .$$

TIMSS 1999 overlap strata where no supplementary Benchmarking sample was selected.

The only sample schools in these strata were TIMSS 1999 national sample schools. The probability of selection into the Benchmarking sample was the conditional probability of selection into the TIMSS 1999 national sample, given that the PSU had been selected:

$$p_i^{(B)} = p_i^{(N)}$$

TIMSS 1999 overlap strata where a supplementary Benchmarking sample was selected

Any school in these strata had a chance of selection into both samples: the TIMSS 1999 national sample $(p_i^{(N)})$ and the Benchmarking supplementary sample $(p_i^{(S)})$. Since the final Benchmarking sample was composed of schools in either sample, the probability of selection for these schools was:

$p_i^{(B)} = p_i^{(N)} + p_i^{(S)} - p_i^{(N)} p_i^{(S)}$.

Nonoverlap strata

These strata were composed of PSUs that had not been selected for the TIMSS 1999 national sample. Thus the final sample was composed entirely of schools selected into the Benchmarking sample with probability $p_i^{(B)}$.

Each participating substitute school was assigned the weight w_i of the sample school it replaced.

Adjustment for school nonresponse

The school base weights were adjusted for nonresponse by a factor equal to the reciprocal of the weighted school response rates:

$$SCNRA_a = \frac{\sum_{sampled\ schools} w_i \cdot G_i}{\sum_{i participating\ schools} w_i \cdot G_i}$$

where w_i is the school base weight defined in Section 6.11.1, G_i is the estimated eighth grade enrollment, and a is the school nonresponse cell. Sampled schools included eligible participating and refusing originally selected schools; participating schools included originally selected schools and substitutes. Nonresponse cells were defined within private and public sampling strata by zip code.

6.11.2 Student Base Weights

Within each sampled school, eighth grade math classes were selected with equal probability and all students in the selected classes were sampled. The calculation of the student base weights is shown in section 5.5.4.

Student Nonresponse Adjustments

Student nonresponse cells were defined by classes within schools. This is described in section 5.5.5.

Final Student Weights

The final weight assigned to each student is the nonresponse-adjusted student weight shown in section 5.6.5. Exhibit 6.12 shows the distribution of the final student sampling weights for each Benchmarking jurisdiction.

Exhibit 6.12 Distribution of TIMSS 1999 Benchmarking Final Student Weights

Jurisdiction	Minimum	25th percentile	Median	75th percentile	Maximum
Connecticut	4.7803	15.3726	17.8114	20.3611	39.1346
Idaho	6.5487	7.3725	8.5156	10.7137	30.5891
Chicago Public Schools, IL	3.2342	17.3196	22.1894	27.5666	42.6459
First in the World, IL	1.0000	2.9268	3.3951	3.7372	6.6755
Naperville #203, IL	1.0000	1.0256	1.1818	1.2273	1.3016
Illinois	1.0000	1.3016	18.2931	56.3814	154.3068
Indiana	15.9424	30.3584	33.2721	38.8407	261.3641
Montgomery County, MD	2.5783	5.4959	6.7896	7.6230	11.4781
Maryland	2.5783	7.4833	19.3411	22.6094	37.7517
Massachusetts	10.7310	21.3892	26.4631	32.2549	57.6235
Michigan	12.9524	43.7418	49.8401	57.5453	302.1111
Missouri	13.7907	26.3760	29.4220	34.8685	94.7381
North Carolina	6.0000	33.3203	37.1670	44.3448	87.3830
Guilford County, NC	2.6744	3.4690	4.4103	5.3191	10.0000
NC, combined	2.6744	5.3191	33.3745	41.1138	87.3830
Oregon	13.5971	15.1030	18.1235	23.3453	68.5553
Pennsylvania	8.2000	48.4389	59.4357	82.3808	298.4658
SW PA Math & Sci Collaborative, PA	8.9883	14.2627	18.5946	25.7996	36.2519
PA, combined	8.2000	16.4507	32.6016	66.0394	298.4658
South Carolina	4.0663	20.2412	24.2094	28.0881	58.3424
Texas	27.5546	112.7242	133.6627	171.0004	386.1602
Academy #20, CO	1.0000	1.0333	1.0435	1.0833	1.2667
Delaware Math & Sci, DE	2.6563	4.5776	6.0000	7.5122	9.7347
Dade County, FL	7.5118	13.4984	17.5315	20.9744	30.4205
Invitational Group, MI	1.0000	2.2623	3.0000	3.4167	6.7273
Lincoln/Fremont/West Side P.S., NE	1.0000	1.0455	1.0952	4.2857	10.0000
Jersey City Public Schools, NJ	1.0357	1.1081	1.6216	2.1053	2.6500
Rochester City Sch. Dist., NY	1.5039	1.8107	1.9402	2.2279	3.2464
Project SMART, OH	1.5882	4.2927	5.6667	6.3750	8.8000

6.12 Defining Variance Estimation Strata and Creating Replicates

The sampling variability of statistics based on TIMSS 1999 Benchmarking data was estimated by the jackknife repeated replication method, as described by Gonzalez & Foy in chapter 11 of this volume. This method requires repeatedly dividing the full sample into subsamples, or replicates, and calculating the statistic of interest for each replicate. The jackknife variance estimator is then:

$$v(p) = \sum_{k=1}^{K} (p_k - p)^2,$$

where

p = the full-sample statistic of interest

p_k = the statistic of interest for the k^{th} replicate

K = the number of replicates

Replicates are created by randomly deleting first-stage sampling units from the full sample, which for the TIMSS 1999 Benchmarking samples were schools, classes (or pseudo classes), or sets of students.

Replicates for the TIMSS 1999 Benchmarking samples corresponded to variance strata that in most cases were defined by pairs (or triples) of schools or classes. Within these variance strata the variance unit was a school or a class, respectively. In some cases, variance strata were defined by single classes. This occurred when a school had been selected with certainty and all classes within that school were selected for assessment. In such cases students were systematically assigned to two groups within each class, and variance strata were defined by these "half-class" pairs; the variance unit was a half-class. Variance strata were assigned within sampling strata after sorting each sample in selection order. They were numbered sequentially within each sample across the sampling strata. The Benchmarking samples were classified into three groups for replication. Exhibit 6.13 shows this classification and identifies the variance strata and variance units for each sample.

6.12.1 Group A: districts and consortia having fewer than 25 schools

All schools were selected with certainty in these small self-defined jurisdictions. Variance strata were defined by half-class pairs when classes had been selected with certainty, or by class pairs (or triples) otherwise. Variance units were half-classes for certainty selections and classes for noncertainties.

Pseudo classes that had been created for sampling were defined as classes, and each sample was sorted by certainty status, school ID, (pseudo) class ID, and student ID. Variance strata and variance units were then assigned in order at the appropriate level. Five of these jurisdictions had at least one school where some classes were selected with certainty; all students were selected with certainty in Academy School District # 20, Colorado (see Exhibit 6.13).

6.12.2 Group B: districts and consortia having at least 25 schools

Three of the jurisdictions in this group were public school districts: Miami Dade County, FL; Chicago, IL; and Montgomery County, MD. The fourth was a consortium of public and private schools: Southwest Pennsylvania Regional Mathematics and Science Collaborative. The Miami Dade County, Chicago, and Southwest Pennsylvania samples were composite samples, that is, they were composed of schools that had been selected for the TIMSS 1999 national assessment, in addition to those selected for their respective Benchmarking assessments. There were no explicit sampling strata in Miami Dade County, Chicago, or Montgomery County. Southwest Pennsylvania, however, had public and private, overlap and nonoverlap sampling strata. "Overlap" refers to PSUs within a Benchmarking jurisdiction that were also TIMSS 1999 national PSUs. TIMSS 1999 national sample schools in Pennsylvania were assigned to appropriate Southwest Pennsylvania Benchmarking sampling strata for the purpose of defining variance strata.

Eight schools were selected with certainty in Montgomery County; these schools defined variance strata. Since students, not classes, had been sampled in Montgomery County schools, the sampled students within each school were systematically assigned to two groups, treated as classes. These classes defined variance units in the Montgomery County certainty schools. In all four of these samples, school pairs were variance strata and schools were variance units for noncertainty selections.

Each sample was sorted within sampling strata by certainty status, enrollment, and class ID. Variance strata and variance units were then assigned in order at the appropriate level; they are shown in Exhibit 6.13.

6.12.3 Group C: States

All TIMSS 1999 Benchmarking state samples were composite samples consisting of schools that had been selected for the TIMSS 1999 national assessment, in addition to those selected for the state Benchmarking assessments. Idaho, Indiana, Michigan, and Pennsylvania sampled both private and public schools; all others sampled only public schools. Thus, there were private and public, overlap and nonoverlap state Benchmarking sampling strata. Overlap sampling strata were defined by TIMSS 1999 national PSUs.

Five schools were selected with certainty in Idaho, two in North Carolina; these schools defined variance strata, and classes within them were variance units. All other state Benchmarking sample schools were noncertainty selections. Variance strata were defined in these samples by school pairs (or triples); the schools were variance units. Each sample was sorted within sampling strata by certainty status, enrollment, and class ID. Variance strata and variance units were then assigned in order at the appropriate level.

School districts and consortia undertook independent Benchmarking assessments in four states: Illinois, Maryland, North Carolina, and Pennsylvania. The records for these district and consortium samples (Groups A and B) were appended to the appropriate state samples (Group C), and their variance strata were renumbered. These renumbered variance strata are shown in Exhibit 6.13.

Exhibit 6.13 TIMSS 1999 Benchmarking Variance Strata

Group	IDCNTRY	Entity	Variance Stratum		Variance Unit
A	10801	Academy CO	1-49	Class (certainty)	Half-class
A	11001	DE Sci Coal	1-25	Class pair	Class
A	11701	Naperville IL	1-21 22-34	Class (certainty) Class pair	Half-class Class
A	11702	1st in World IL	1 2-15	Class (certainty) Class pair	Half-class Class
A	12601	MI Invitational Group	1-7 8-24	Class (certainty) Class pair	Half-class Class
A	13101	Lincoln/Fremont/ West Side PS NE	1-33 34-43	Class (certainty) Class pair	Half-class Class
A	13401	Jersey City PS NJ	1-22 23-35	Class (certainty) Class pair	Half-class Class
A	13601	Rochester PS NY	1-24	Class pair	Class
A	13701	Guilford Co NC	1-21	Class pair	Class
A	13901	Project SMART OH	1-24	Class pair	Class
B	11201	Dade Co FL	1-12	School pair	School
B	11703	Chicago PS IL	1-13	School pair	School
B	12401	Montgomery Co MD	1-8 9-16	School (certainty) School pair	Class School
B	14201	SW PA Science & Math Collaborative	1-3 4-19	School pair (private) School pair (public)	School School
C	10900	CT	1-26	School pair	School
C	11600	ID	1 2-5 6-25	School pair (private) School (certainty; public) School pair (public)	School Class School
C	11700	IL	1-6 1-6 7-32 33 34-47 48-68 69-75	School pair (IDSTRATE=1) Class pair (IDSTRATE=5) School pair Class (certainty) Class pair Class (certainty) Class pair	School Class School Half-class Class Half-class Class
C	11800	IN	1-3 4-26	School pair (private) School pair (public)	School School
C	12400	MD	1-24 25-32 33-40	School pair School (certainty) School pair	School Class School
C	12500	MA	28	School pair	School
C	12600	MI	1-4 5-28	School pair (private) School pair (public)	School School
C	12900	MO	1-25	School pair	School
C	13700	NC	1-2 3-25 26-47	School (certainty) School pair Class pair	Class School class

Exhibit 6.13 (continued) TIMSS 1999 Benchmarking Variance Strata

Group	IDCNTRY	Entity	Variance Stratum		Variance Unit
C	14100	OR	1-22	School pair	School
C	14200	PA	1 2-20 21-23 24-39	School pair (private) School pair (public) School pair (private) School pair (public)	School School School School
C	14500	SC	1-24	School pair	School
C	15800	TX	1-26	School pair	School