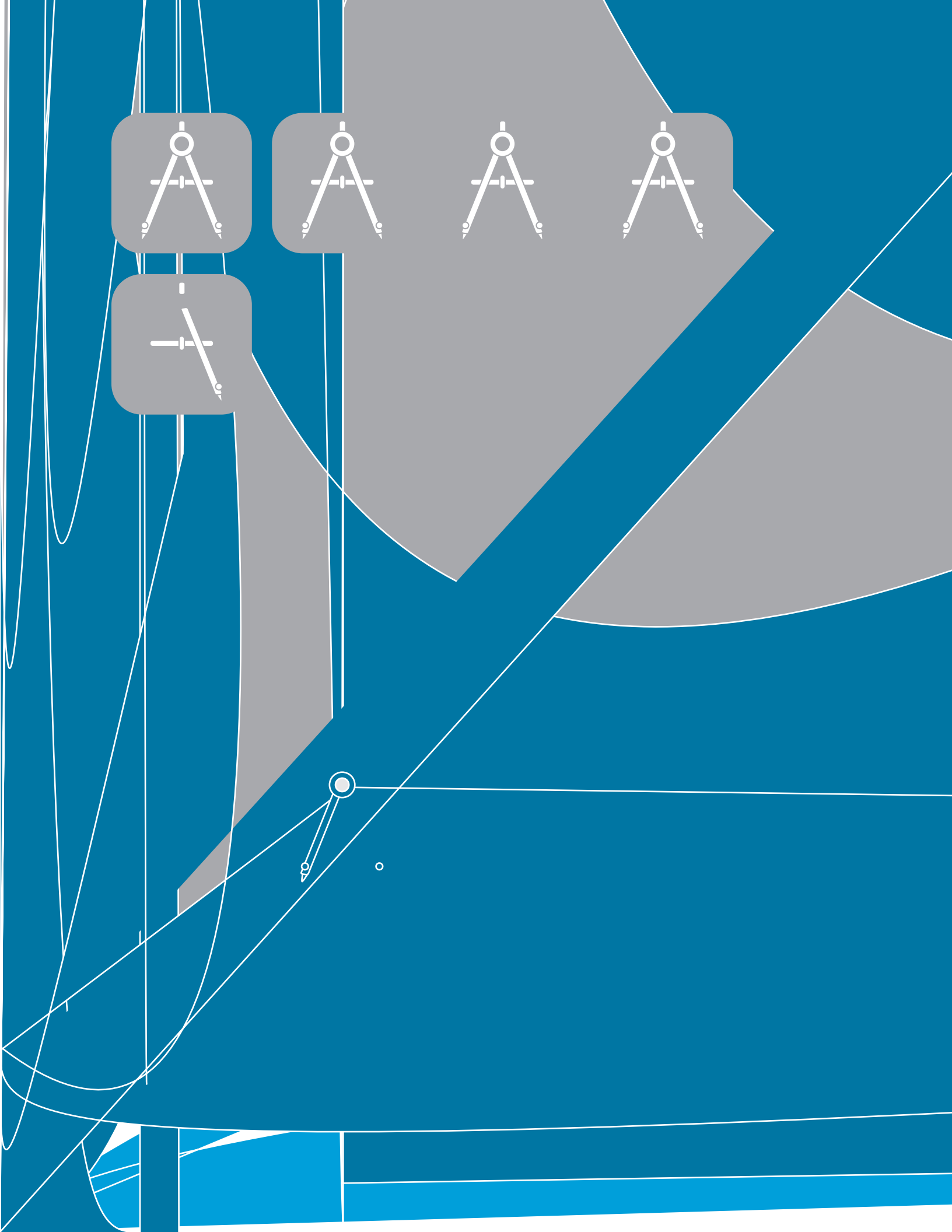

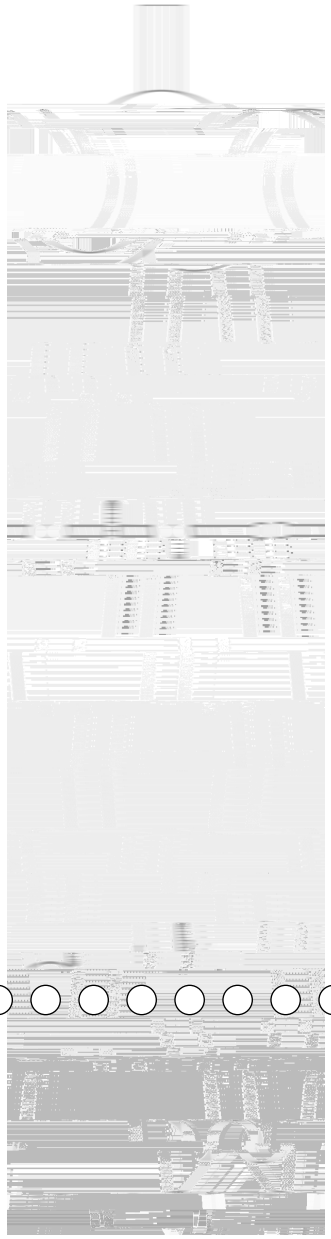

6 Sampling Design and Implementation for TIMSS 1999 Benchmarking

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Keith Rust

6.1 Overview

- 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 selec-

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 substi-

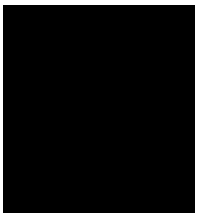
E [illegible] 6.1 (c [illegible] d) TIMSS 1999 B [illegible] a [illegible] Sc [illegible] Sa [illegible] S a

E b 6.2 TIMSS 1999 B d a Sd Pa c a Ra

J	S	I	b	S	a	S b	a	S b I	S b I	S b I	S b I
	54	0	2	52	0	52	6.30	6.30	5.	5.
	54	0	7	47	0	47	7.04	7.04	7.16	7.16
	0	0	5	5	0	5	4.44	4.44	5.4	5.4
	61	0	22	3	13	52	63. 3	5.25	62.42	3.01
	7	2	4	73	0	73	4. 1	4. 1	3.54	3.54
	5	1	1	57	0	57	.2	.2	.22	.22
	66	4	7	55	2	57	.71	1. 4	.67	1. 3
	57	2	12	43		51	7 .1	2.73	7 .73	3.3
	71	3	1	67	0	67	.53	.53	.01	.01
	51	0	6	45	0	45	.24	.24	. 3	. 3
	116	3	33	0	0	0	70. 0	70. 0	66.12	66.12
	53	0	4	4	0	4	2.45	2.45	2.25	2.25
	71	1	1	51	1	52	72. 6	74.2	72.3	73. 4
#20,	4	0	0	4	0	4	100.00	100.00	100.00	

E b 6.3 TIMSS 1999 B d a Pa c a Ra b Sd T

[redacted]



E b 6.4 TIMSS 1999 B d a W d Sc Pa c a Ra : A a M d

J	S l	S l
	6%	6%
	%	%
	5%	5%
	61%	3%
	4%	4%
	%	%
	%	2%
	7 %	4%
,	%	%
	%	%
,	66%	66%
	2%	2%
	73%	74%
#20,	100%	100%
& .,	100%	100%
,	100%	

E b 6.6 TIMSS 1999 B d a S d Sa S b J d c a d Sd T

J	S	E a S a	Sa S	Sa S
	36775	3 742	54	21 0
	747	72	2	26
	1 430	1 1 5	52	1 42
		1 14	54	1 6
		147621	0	5144
7 236.375 64 .333 0 0 0 . 0. 0.	72 575 15 .375 -17 6 7 7. 0.	72 575 15 .32 4 . 375 -17	65410.14 -17	4 . -17

E [illegible] 6.6 (c [illegible] d) TIMSS 1999 B [illegible] a [illegible] S d Sa [illegible] S [illegible] b J [illegible] d c [illegible] a d Sc [illegible] T

Exhibit 6.8 TIMSS 1999 Benchmarking Student Participation Rates

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

E b 6.10 TIMSS 1999 B d a C b d Pa c a Ra b Sc T

J	S	Ra	Ra
	S b	S b	S b	S b
	4 %	4 %	4 %	4 %
	4%	4%	4%	4%
	0%	0%	71%	71%
	5 %	1%	5 %	0%
	6%	6%	7%	7%
	2%	6%	3%	7%
	4 %	4 %	34%	34%
	71%	71%	70%	70%
& . ,	%	%	%	%
	73%	73%	73%	73%

E b 6.11 TIMSS 1999 B d a W d C b d Pa c a Ra A a M d

E b 6.11 (c d) TIMSS 1999 B d a W d C b d Pa c a Ra A a M d

J	S b l	S b l
, .	0%	0%
#203, .	6%	6%
,	4%	4%
. , .	1%	1%
/ / . .,	5%	5%
,	1%	1%
. .,	4%	4%
,	2%	2%
,	4%	4%
& . ,	75%	75%

E b 6.12 TIMSS 1999 B d a W d C b d Pa c a Ra : A a M d

J	S	S b l	S b l
.		4 %	4 %
		5%	5%
.		71%	71%
		56%	0%
		7%	7%
		3%	7%
,		34%	34%
		6 %	6 %
& . ,		%	%
		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;

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

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 $^{(B)}$.

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

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

$$SCNRA_a = \frac{\sum_{a} \cdot G}{\sum_{a\ c\ a} \cdot G}$$

where is the school base weight defined in Section 6.11.1, G 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 cells were defined by classes within schools. This is described in section 5.5.5.

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.

E b 6.12 D b TIMSS 1999 B a F a S d W

J	M	25	M a	75	Ma
	4.7 03	15.3726	17. 114	20.3611	3 .1346
	6.54 7	7.3725	.5156	10.7137	30.5 1
,	3.2342	17.31 6	22.1 4	27.5666	42.645
,	1.0000	2. 26	3.3 51	3.7372	6.6755
#203,	1.0000	1.0256	1.1 1	1.2273	1.3016
	1.0000	1.3016	1 .2 31	56.3 14	154.306
	15. 424	30.35 4	33.2721	3 . 407	261.3641
,	2.57 3	5.4 5	6.7 6	7.6230	11.47 1
	2.57 3	7.4 33	1 .3411	22.60 4	37.7517
	10.7310	21.3 2	26.4631	32.254	57.6235
	12. 524	43.741	4 . 401	57.5453	302.1111
	13.7 07	26.3760	2 .4220	34. 6 5	4.73 1
	6.0000	33.3203	37.1670	44.344	7.3 30
,	2.6744	3.46 0	4.4103	5.31 1	10.0000
,	2.6744	5.31 1	33.3745	41.113	7.3 30
	13.5 71	15.1030	1 .1235	23.3453	6 .5553
	.2000	4 .43	5 .4357	2.3 0	2 .465
& ,	. 3	14.2627	1 .5 46	25.7 6	36.251
,	.2000	16.4507	32.6016	66.03 4	2 .465
	4.0663	20.2412	24.20 4	2 .0 1	5 .3424
	27.5546	112.7242	133.6627	171.0004	3 6.1602
#20,	1.0000	1.0333	1.0435	1.0 33	1.2667
& ,	2.6563	4.5776	6.0000	7.5122	.7347
,	7.511	13.4 4	17.5315	20. 744	30.4205
,	1.0000	2.2623	3.0000	3.4167	6.7273
/ / . .,	1.0000	1.0455	1.0 52	4.2 57	10.0000
,	1.0357	1.10 1	1.6216	2.1053	2.6500
. .,	1.503	1. 107	1. 402	2.227	3.2464
,	1.5 2	4.2 27	5.6667	6.3750	. 000

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:

$$( ) = \sum_{= 1}^{K} (\quad - \quad)^2,$$

where

= the full-sample statistic of interest

= the statistic of interest for the 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.

E b 6.13 TIMSS 1999 B d a Va c S a a

G	IDG	E	a a S a	a a
	10 01	1-4	( )	-
	11001	1-25		
	11701	1-21 22-34	( )	-
	11702	1 1	7 0 0 1 0. 7 0. 1(2) 1 0 7 2 612 -7 1. 5 0 0 0 2 0 0.5 465. 7 635.332 0 0 0	
	12601	1-7		

E [illegible] 6.13 (c [illegible] d) TIMSS 1999 B [illegible] a [illegible] Va [illegible] c S [illegible] a a

G	IDG [illegible]	E [illegible]	a a [illegible] S a		a a [illegible]
	14100		1-22		
	14200		1 2-20 21-23 24-3	( ) ( ) ( ) ( )	
	14500		1-24		
	15 00		1-26		