CHAPTER 5

Sample Implementation in TIMSS Advanced 2015

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Overview

Rigorous sampling of schools and students was a key component of the TIMSS Advanced 2015 project. Implementing the sampling plan was the responsibility of the National Research Coordinator (NRC) in each participating country. NRCs were supported in this endeavor by the TIMSS Advanced 2015 sampling consultants, Statistics Canada and the sampling unit of the IEA Data Processing and Research Center. Sampling consultants conducted the school sampling for most countries and trained NRCs using the Windows® Within-school Sampling Software (WinW3S) provided by the IEA DPC to implement within-school sampling. As an essential part of their sampling activities, NRCs were responsible for providing detailed documentation describing their national sampling plans (sampling data, school sampling frames, and school sample selections). The documentation for each TIMSS Advanced participant was reviewed and completed by the sampling consultants, including detailed information on coverage and exclusion levels, stratification variables, sample selection, participation rates, and variance estimates. The TIMSS & PIRLS International Study Center and the TIMSS Advanced 2015 Sampling Referee, Dr. Keith Rust of Westat, Inc., used this information to evaluate the quality of the samples.

This chapter gives a summary of the major characteristics of the national samples for TIMSS Advanced 2015. More detailed summaries of the sample design for each country, including details of population coverage and exclusions, stratification variables, and schools' sampling allocations, are provided in Appendix 5A: Characteristics of National Samples.

Target Population

As described in Chapter 3 (Sample Design), the TIMSS Advanced 2015 international target population for the advanced mathematics assessments was defined as students in the final year of secondary schooling who have taken courses in advanced mathematics, and for physics students in the final year of secondary schooling who have taken courses in physics.

National Coverage and Exclusions

All participating countries were able to provide full coverage of their defined target populations of advanced mathematics students and physics students. However, countries were allowed specific types of exclusions of schools and students that would have been either too difficult or too costly to assess. For example, very small or remote schools were sometimes excluded. Within some selected schools, students with special needs or students not fluent in the language of the test were sometimes excluded. Exhibits 5.1 and 5.2 summarize population coverage and exclusions for the TIMSS Advanced 2015 advanced mathematics and physics populations. For every participant, the overall percentage of excluded students (combining school-level and within-sample exclusions) was less than 5 percent. Some TIMSS Advanced 2015 participants had no within-school exclusions. Details on national exclusion categories are presented in Appendix 5A: Characteristics of National Samples.

Exhibit 5.1: Coverage of the TIMSS Advanced 2015 Target Population for Advanced Mathematics

Country	International Target Population Coverage	Exclusions from National Target Population		
		School-Level Exclusions	Within-Sample Exclusions	Overall Exclusions
France	100%	4.6%	0.1%	4.7%
Italy	100%	0.5%	0.7%	1.1%
Lebanon	100%	1.3%	0.0%	1.3%
Norway	100%	1.4%	0.0%	1.4%
Portugal	100%	0.0%	0.3%	0.3%
Russian Federation	100%	0.2%	0.1%	0.3%
Russian Federation 6hr+	100%	1.0%	0.1%	1.1%
Slovenia	100%	0.3%	2.2%	2.5%
Sweden	100%	1.6%	0.1%	1.7%
United States	100%	0.0%	0.1%	0.1%

Exhibit 5.2: Coverage of the TIMSS Advanced 2015 Target Population for Physics

Country	International Target Population Coverage	Exclusions from National Target Population		
		School-Level Exclusions	Within-Sample Exclusions	Overall Exclusions
France	100%	4.6%	0.1%	4.7%
Italy	100%	0.4%	0.4%	0.8%
Lebanon	100%	1.3%	0.0%	1.3%
Norway	100%	3.3%	0.1%	3.4%
Portugal	100%	0.4%	0.1%	0.6%
Russian Federation	100%	0.2%	0.2%	0.4%
Slovenia	100%	1.1%	0.9%	2.0%
Sweden	100%	1.9%	0.0%	2.0%
United States	100%	0.0%	0.1%	0.1%

Target Population Size

Exhibits 5.3 and 5.4 show the number of schools and students in each participant's target population[1] and sample, as well as an estimate of the student population size based on the sample data. The target population figures are derived from the sampling frame used to select the TIMSS Advanced 2015 samples, while the sample figures are based on the number of sampled schools and students that participated in the assessments. The sample figures were computed using sampling weights, which are explained in more detail in Chapter 3. The student population size based on the sampling frame did not take into account the portion of the population excluded within sampled schools and made no adjustment for changes in the population between the date when the information in the sampling frame was collected and the date of the TIMSS Advanced 2015 data collection—usually a 2-year interval. Nevertheless, a comparison of the two estimates of population size can be seen as a validity check on the sampling procedure. In most cases, the population size estimated from the sample closely matched the population size from the sampling frame.

The minimum school sample size required to meet the TIMSS Advanced sampling standards was 150 schools for each study population. Four out of nine countries met this requirement. The sample size in France was very close with 146 sampled schools. Italy was given permission to select 120 schools for each target populations. In Norway all schools were selected, each school being selected for only one study. Due to the relatively small number of eligible schools, the sample sizes were 136 and 130 for advanced mathematics and physics respectively. Sweden was given permission to select slightly smaller school sample sizes of 143 and 134 schools, for the advanced mathematics and physics target population respectively. In Slovenia, there were only 80 schools with advanced

1 After school-level exclusions.

mathematics students, of which 59 also had physics students; all 80 schools were sampled. Most countries sampled one or two classes per sampled school. Details on the national samples of schools and classes are provided in Appendix 5A: Characteristics of National Samples.

Exhibit 5.3: Population and Sample Sizes – TIMSS Advanced 2015 – Advanced Mathematics

Country	Population		Sample		
	Schools	Students	Schools	Students	Student Population Size Estimated From Population
France	2,106	162,106	144	3,967	172,309
Italy	1,820	149,637	113	3,318	142,350
Lebanon	1,635	62,121	251	1,161	4,457
Norway	266	6,903	133	2,537	6,752
Portugal	520	35,428	221	4,068	31,413
Russian Federation	5,534	141,903	346	7,558	138,733
Russian Federation 6hr+	672	26,134	163	3,431	25,855
Slovenia	80	7,138	69	2,922	6,888
Sweden	413	16,283	139	3,937	15,294
United States	33,411	3,816,235	241	2,954	473,872

Exhibit 5.4: Population and Sample Sizes – TIMSS Advanced 2015 – Physics

Country	Population		Sample		
	Schools	Students	Schools	Students	Student Population Size Estimated From Population
France	2,106	162,106	144	3,958	172,309
Italy	1,277	106,005	114	3,424	105,084
Lebanon	1,635	62,121	250	1,156	4,464
Norway	216	4,394	127	2,472	4,166
Portugal	283	6,084	149	1,783	5,669
Russian Federation	3,364	71,009	193	3,822	66,886
Slovenia	59	1,557	50	1,106	1,505
Sweden	407	15,387	133	3,727	15,430
United States	33,411	3,816,235	165	2,932	200,235

Meeting TIMSS Advanced 2015 Standards for Sampling Participation

TIMSS Advanced 2015 participants understood that the goal for sampling participation was 100 percent for all sampled schools, classrooms, and students. Guidelines for reporting achievement data for participants securing less than full participation were modeled after IEA's previous TIMSS Advanced assessment cycles. As summarized in Exhibit 5.5, countries were assigned to one of three categories on the basis of their sampling participation. Countries in Category 1 were considered to have met all TIMSS Advanced 2015 sampling requirements and to have acceptable participation rates. Countries in Category 2 met the participation 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 data quality in TIMSS Advanced 2015 was to have as many countries as possible achieve Category 1 status.

Exhibit 5.5: 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 would appear in the tables and figures in international reports without annotation, and will be ordered by achievement as appropriate.
Category 2	Acceptable sampling participation rate **only when replacement schools are included**. A country would be placed in this category if: • It failed to meet the requirements for Category 1 but had a weighted school response rate **without** replacement of at least 50% (after rounding to the nearest percent) AND HAD EITHER • 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 would be annotated with a "†" 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 would be placed in Category 3. Countries in this category would be annotated with a "‡" if they nearly met the requirements for Category 2. Countries would be annotated with a "‡" if they failed to meet the participation requirements but had a school participation rate of at least 50% before the use of replacement schools. At last, if none of these conditions are met, countries would appear in a separate section of the achievement tables, below the other countries, in international reports. These countries would be presented in alphabetical order.

Exhibits 5.6 through 5.9 present the school, classroom, student, and overall weighted and unweighted participation rates for each of the participants in the TIMSS Advanced 2015 study, for advanced mathematics and physics, respectively. All but three participants had excellent participation rates and belonged in Category 1. In advanced mathematics, Portugal met the minimum acceptable participation rate only after including replacement schools, and therefore their results were annotated with a dagger (†) in the achievement exhibits of the international reports (Category 2). Despite efforts to secure full participation, Lebanon and the United States

did not meet the required sampling participation rate for either subject, even with the use of replacement schools and were annotated with a triple-dagger (‡) in the achievement exhibits of the international reports (Category 3).

Exhibit 5.6: Participation Rates (Weighted) – TIMSS Advanced 2015 – Advanced Mathematics

	Country	School Participation		Class Participation	Student Participation	Overall Participation	
		Before Replacement	After Replacement			Before Replacement	After Replacement
	France	99%	99%	100%	96%	95%	95%
	Italy	88%	94%	99%	97%	85%	90%
‡	Lebanon	70%	70%	100%	98%	68%	68%
	Norway	100%	100%	100%	93%	93%	93%
†	Portugal	80%	87%	98%	93%	73%	80%
	Russian Federation	100%	100%	100%	98%	98%	98%
	Russian Federation 6hr+	100%	100%	100%	98%	98%	98%
	Slovenia	89%	89%	96%	87%	75%	75%
	Sweden	99%	99%	99%	90%	88%	88%
‡	United States	72%	76%	100%	87%	63%	66%

TIMSS Advanced guidelines for sampling participation: The minimum acceptable participation rates were 85% of both schools and students, or a combined rate (the product of school and student participation) of 75%. Participants not meeting these guidelines were annotated as follows:

† Met guidelines for sample participation rates only after replacement schools were included.

‡ Nearly satisfied guidelines for sample participation rates after replacement schools were included.

‡ Did not satisfy guidelines for sample participation rates.

Exhibit 5.7: Participation Rates (Weighted) – TIMSS Advanced 2015 – Physics

	Country	School Participation		Class Participation	Student Participation	Overall Participation	
		Before Replacement	After Replacement			Before Replacement	After Replacement
	France	99%	99%	100%	96%	95%	95%
	Italy	89%	95%	99%	97%	85%	91%
‡	Lebanon	70%	70%	100%	98%	68%	68%
	Norway	98%	98%	100%	94%	93%	93%
	Portugal	83%	87%	100%	93%	78%	81%
	Russian Federation	97%	100%	100%	98%	95%	98%
	Slovenia	86%	86%	100%	86%	74%	74%
	Sweden	99%	100%	99%	90%	88%	89%
‡	United States	65%	68%	100%	85%	55%	58%

TIMSS Advanced guidelines for sampling participation: The minimum acceptable participation rates were 85% of both schools and students, or a combined rate (the product of school and student participation) of 75%. Participants not meeting these guidelines were annotated as follows:

† Met guidelines for sample participation rates only after replacement schools were included.

‡ Nearly satisfied guidelines for sample participation rates after replacement schools were included.

‡ Did not satisfy guidelines for sample participation rates.

Exhibit 5.8: Participation Rates (Unweighted) – TIMSS Advanced 2015 – Advanced Mathematics

Country	School Participation		Class Participation	Student Participation	Overall Participation	
	Before Replacement	After Replacement			Before Replacement	After Replacement
France	99%	99%	100%	93%	92%	92%
Italy	87%	94%	99%	95%	82%	89%
Lebanon	71%	71%	100%	95%	67%	67%
Norway	99%	99%	100%	93%	92%	92%
Portugal	82%	88%	98%	91%	73%	79%
Russian Federation	100%	100%	100%	98%	98%	98%
Russian Federation 6hr+	100%	100%	100%	97%	97%	97%
Slovenia	90%	90%	95%	88%	75%	75%
Sweden	99%	99%	99%	90%	88%	88%
United States	73%	76%	100%	86%	63%	66%

Exhibit 5.9: Participation Rates (Unweighted) – TIMSS Advanced 2015 – Physics

Country	School Participation		Class Participation	Student Participation	Overall Participation	
	Before Replacement	After Replacement			Before Replacement	After Replacement
France	99%	99%	100%	93%	92%	92%
Italy	88%	95%	99%	95%	83%	89%
Lebanon	70%	70%	100%	95%	67%	67%
Norway	98%	98%	100%	94%	92%	92%
Portugal	82%	86%	100%	92%	75%	79%
Russian Federation	97%	100%	100%	98%	95%	98%
Slovenia	85%	85%	100%	86%	73%	73%
Sweden	99%	99%	100%	89%	88%	88%
United States	66%	70%	100%	86%	56%	60%

Exhibits 5.10 through 5.13 show the achieved sample sizes in terms of schools and students for each of the participants in the TIMSS Advanced 2015, for advanced mathematics and physics, respectively.

Exhibit 5.10: School Sample Sizes – TIMSS Advanced 2015 – Advanced Mathematics

Country	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
France	146	145	144	0	144
Italy	120	120	104	9	113
Lebanon	355	354	251	0	251
Norway	136	134	133	0	133
Portugal	251	251	206	15	221
Russian Federation	346	346	346	0	346
Russian Federation 6hr+	181	163	163	0	163
Slovenia	80	77	69	0	69
Sweden	143	141	139	0	139
United States	348	316	230	11	241

Exhibit 5.11: School Sample Sizes – TIMSS Advanced 2015 – Physics

Country	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
France	146	145	144	0	144
Italy	120	120	106	8	114
Lebanon	356	355	250	0	250
Norway	130	130	127	0	127
Portugal	251	173	142	7	149
Russian Federation	193	193	187	6	193
Slovenia	59	59	50	0	50
Sweden	134	134	132	1	133
United States	348	237	156	9	165

Exhibit 5.12: Student Sample Sizes – TIMSS Advanced 2015 – Advanced Mathematics

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 Eligible Students	Number of Students Absent	Number of Students Assessed
France	96%	4,310	41	7	4,262	295	3,967
Italy	97%	3,547	28	30	3,489	171	3,318
Lebanon	98%	1,222	0	0	1,222	61	1,161
Norway	93%	2,756	31	1	2,724	187	2,537
Portugal	93%	4,581	109	15	4,457	389	4,068
Russian Federation	98%	7,758	2	12	7,744	186	7,558
Russian Federation 6hr+	98%	3,530	0	3	3,527	96	3,431
Slovenia	87%	3,360	1	42	3,317	395	2,922
Sweden	90%	4,450	85	2	4,363	426	3,937
United States	87%	3,488	57	2	3,429	475	2,954

Students attending a sampled class at the time the sample was chosen but leaving the class before the assessment was administered were classified as "withdrawn."
Students with a disability or language barrier that prevented them from participating in the assessment were classified as "excluded."
Students not present when the assessment was administered, and not subsequently assessed in a make-up session, were classified as "absent."

Exhibit 5.13: Student Sample Sizes – TIMSS Advanced 2015 – Physics

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 Eligible Students	Number of Students Absent	Number of Students Assessed
France	96%	4,297	41	7	4,249	291	3,958
Italy	97%	3,652	25	20	3,607	183	3,424
Lebanon	98%	1,215	0	0	1,215	59	1,156
Norway	94%	2,674	44	2	2,628	156	2,472
Portugal	93%	1,968	21	4	1,943	160	1,783
Russian Federation	98%	3,925	2	8	3,915	93	3,822
Slovenia	86%	1,302	6	12	1,284	178	1,106
Sweden	90%	4,236	65	3	4,168	441	3,727
United States	85%	3,539	114	6	3,419	487	2,932

Students attending a sampled class at the time the sample was chosen but leaving the class before the assessment was administered were classified as "withdrawn."
Students with a disability or language barrier that prevented them from participating in the assessment were classified as "excluded."
Students not present when the assessment was administered, and not subsequently assessed in a make-up session, were classified as "absent."

TIMSS Advanced 2015 Trends in Student Populations

Because an important goal of the TIMSS Advanced 2015 assessment was to measure changes in students' advanced mathematics and physics achievement across assessment cycles, it was important to track any changes over time in population composition and coverage that might be related to student achievement. Exhibits 5.14 and 5.15 present, for each country, trends across the TIMSS Advanced cycles (2015, 2008, and 1995) in five important characteristics of the assessment populations: number of years of formal schooling, average student age, percent of students in the national target population excluded from the assessment, TIMSS Advanced coverage indices, and overall participation rates after using replacements. Most countries were very similar with regard to these characteristics across the three assessment cycles, although there have been changes in some countries in the number of years of schooling, the TIMSS Advanced coverage indices of the assessed populations, and in the exclusion rate.

Eight of the countries that participated in TIMSS Advanced 2015 also participated in the assessments of advanced mathematics and physics students in their final year of schooling in 1995 or 2008. The Russian Federation, Slovenia, and Sweden participated in all three TIMSS Advanced assessments, in 1995, 2008, and 2015. In 1995, Italy participated only in advanced mathematics while Norway participated only in physics. France and the United States participated in both assessments in 1995 and 2015. For advanced mathematics, the Russian Federation trend results are available only for the Intensive stream students (6hr+).

The Russian Federation and Slovenia have undergone structural changes in the age at which children enter schools that are reflected in their samples. With regards to the number of years of schooling, the shift from ten years to eleven years of schooling in the Russian Federation was the result of a change in the structure of the education system from 1995 to 2015. Half of the students were still under the older system in 2008. Slovenia has completed a transition toward having all children begin school at an earlier age. For this reason, in 2015 Slovenian students had thirteen years of schooling in their final year of general and technical gymnasia, whereas the 2008 students had twelve years of schooling in their final year.

In 1995, exclusion rates for Advanced Mathematics and Physics were computed based on exclusion rates among all students in the final year of schooling. In the case of the Russian Federation, the figure presented in the 1995 International Report (43.0%) greatly overstated the level of exclusions in the advanced mathematics and physics populations.

The 1995 Advanced Mathematics Coverage Index for Italy was recomputed and is different than from the percentage reported in the 1995 International Report. The 1995 sample for the United States was adjusted to correspond with the course-taking definitions used in 2015, and the 1995 results were recomputed for trend purposes.

Exhibit 5.14: Trends in Student Populations – TIMSS Advanced 2015 – Advanced Mathematics

Country	Years of Formal Schooling*			Average Age at Time of Testing			Overall Exclusion Rates**			Advanced Mathematics Coverage Index			Overall Participation Rates		
	2015	2008	1995	2015	2008	1995	2015	2008	1995	2015	2008	1995	2015	2008	1995
France	12		12	18.0		18.2	4.7%		1.0%	21.5%		19.9%	95%		77%
Italy	13	13	13	18.9	19.0	19.1	1.1%	0.5%	3.8%	24.5%	19.7%	14.1%	90%	95%	68%
Lebanon	12	12		17.8	17.9		1.3%	1.3%		3.9%	5.9%		68%	83%	
Norway	13	13		18.7	18.8		1.4%	1.0%		10.6%	10.9%		93%	83%	
Russian Federation 6hr+	11	10/11	10	17.7	17.0	16.9	1.1%	0.0%	2.0%	1.9%	1.4%	2.%	98%	98%	96%
Slovenia	13	12	12	18.8	18.8	18.9	2.5%	1.3%	6.0%	34.4%	40.5%	75.4%	75%	81%	42%
Sweden	12	12	12	18.8	18.8	18.9	1.7%	1.7%	0.2%	14.1%	12.8%	16.2%	88%	84%	89%
United States	12		12	18.1		18.0	0.1%		3.7%	11.4%		6.4%	66%		71%

* Represents years of schooling counting from the first year of ISCED Level 1.

** In 1995 exclusion rates for Advanced Mathematics were computed based on exclusion rates among all students in the final year of schooling. In the case of the Russian Federation, the figure presented in the 1995 International Report (43.0%) greatly overestimates the level of exclusions in the advanced mathematics population. The figure presented above (2.0%) includes two regions, North Ossetia and Chechen Republic, as well as non-Russian speaking students.

Russian Federation trend results are available only for the Intensive stream students (6hr+). The United States adjusted the 1995 sample to correspond with the course-taking definitions used in 2015, and the 1995 results were recomputed.

An empty cell indicates a country did not participate in that year's assessment.

Exhibit 5.15: Trends in Student Populations – TIMSS Advanced 2015 – Physics

Country	Years of Formal Schooling*			Average Age at Time of Testing			Overall Exclusion Rates**			Physics Coverage Index			Overall Participation Rates		
	2015	2008	1995	2015	2008	1995	2015	2008	1995	2015	2008	1995	2015	2008	1995
France	12		12	18.0		18.2	4.7%		1.0%	21.5%		19.9%	95%		77%
Italy	13	13		18.9	18.9		0.8%	0.9%		18.2%	3.8%		91%	97%	
Lebanon	12	12		17.8	17.9		1.3%	1.3%		3.9%	5.9%		68%	82%	
Norway	13	12	12	18.8	18.8	19.0	3.4%	0.5%	3.8%	6.5%	6.8%	8.4%	93%	73%	83%
Russian Federation	11	10/11	10	17.7	17.1	16.9	0.4%	0.0%	2.0%	4.9%	2.6%	1.5%	98%	97%	95%
Slovenia	13	12	12	18.8	18.7	18.8	2.0%	0.5%	6.0%	7.6%	7.5%	38.6%	74%	67%	43%
Sweden	12	12	12	18.8	18.8	18.9	2.0%	2.3%	0.2%	14.3%	11.0%	16.3%	89%	89%	89%
United States	12		12	18.1		18.0	0.1%		3.7%	4.8%		2.7%	58%		64%

* Represents years of schooling counting from the first year of ISCED Level 1.

** In 1995 exclusion rates for Physics were computed based on exclusion rates among all students in the final year of schooling. In the case of the Russian Federation, the figure presented in the 1995 International Report (43.0%) greatly overestimates the level of exclusions in the advanced mathematics population. The figure presented above (2.0%) includes two regions, North Ossetia and Chechen Republic, as well as non-Russian speaking students.

The United States adjusted the 1995 sample to correspond with the course-taking definitions used in 2015, and the 1995 results were recomputed.

An empty cell indicates a country did not participate in that year's assessment.

Appendix 5A: Characteristics of National Samples

France

A single school sample was used for both advanced mathematics and physics.

Coverage and Exclusions

- Coverage of the national desired target population was 100 percent
- School-level exclusions consisted of overseas territories and private schools without contract
- Within-school exclusions consisted of students with intellectual disabilities and students with functional disabilities

Sample Design

- Explicit stratification by school type (Lycée general et technologique—upper secondary schools with general and technologic streams, Lycée polyvalent—the remaining upper secondary schools) and success rate in the scientific baccalaureate during the 2012 session (3 or 5 success rate levels depending on the school type)
- No implicit stratification
- Schools sampled using probability proportional to (school) size systematic sampling
- Two classes in the selected schools were sampled whenever possible
- Half of the students in the selected classes were randomly assigned an advanced mathematics booklet, and the other half were assigned a physics booklet

Field Test Sample

- 32 schools were sampled for the field test at the same time as the data collection sample, thus no schools were selected for both activities

Allocation of Advanced Mathematics and Physics School Sample in France

			Participating Schools				
Explicit Stratum	Total Sampled Schools	Ineligible Schools	Original Schools	1st Replacement	2nd Replacement	Refusal Schools	Excluded Schools
Upper secondary schools with general and technologic streams, with success rate level I	22	0	22	0	0	0	0
Upper secondary schools with general and technologic streams, with success rate level II	22	0	22	0	0	0	0
Upper secondary schools with general and technologic streams, with success rate level III	22	0	22	0	0	0	0
Upper secondary schools with general and technologic streams, with success rate level IV	22	0	22	0	0	0	0
Upper secondary schools with general and technologic streams, with success rate level V	22	0	21	0	0	1	0
Other upper secondary schools, with success rate level I	12	1	11	0	0	0	0
Other upper secondary schools, with success rate level II	12	0	12	0	0	0	0
Other upper secondary schools, with success rate level III	12	0	12	0	0	0	0
Total	**146**	**1**	**144**	**0**	**0**	**1**	**0**

Italy

The sample design for Italy consisted of a mix of the two main designs. Some schools were sampled for advanced mathematics only, some were sampled for physics only, and some were sampled for both subjects.

Coverage and Exclusions

- Coverage of the national desired target population was 100 percent
- School-level exclusions consisted of very small schools (less than 5 eligible students), Slovenian language schools, and German language schools
- Within-school exclusions consisted of students with functional disabilities

Sample Design

- Explicit stratification by school type (technical institute, scientific lyceum) and region (center, southern peninsulas and islands, northeast, northwest, south)
- No implicit stratification
- Courses of interest were found in two types of schools: technical institutes with advanced mathematics classes only and scientific lyceum in which both subjects are compulsory
- A total of 32 schools were sampled from the technical-institute strata for the advanced mathematics sample. From the scientific-lyceum strata, a total of 120 schools were first sampled, from which a subsample of 88 schools was randomly selected for advanced mathematics and physics. The other 32 schools were sampled only for the physics assessment.
- In schools with advanced mathematics classes only, one class was sampled per school, and two classes were sampled in larger schools of 80 or more students
- In schools selected only for the physics target population, one class was sampled per school, and two classes were sampled in larger schools (80 or more students)
- In schools selected for both advanced mathematics and physics target populations, three classes were sampled whenever possible and advanced mathematics and physics booklets were rotated within sampled classes

Field Test Sample

- 34 schools were sampled for the field test. The data collection sample was selected after the field test sample, without controlling for overlap.

Allocation of Advanced Mathematics School Sample in Italy

			Participating Schools				
Explicit Stratum	Total Sampled Schools	Ineligible Schools	Original Schools	1st Replacement	2nd Replacement	Refusal Schools	Excluded Schools
Technical institute with advanced mathematics program only - Center	6	0	4	2	0	0	0
Technical institute with advanced mathematics program only - Southern Peninsulas and Islands	6	0	5	0	0	1	0
Technical institute with advanced mathematics program only - Northeast	6	0	5	1	0	0	0
Technical institute with advanced mathematics program only - Northwest	8	0	8	0	0	0	0
Technical institute with advanced mathematics program only - South	6	0	6	0	0	0	0
Scientific lyceum with advanced mathematics and physics program - Center	18	0	17	1	0	0	0
Scientific lyceum with advanced mathematics and physics program - Southern Peninsulas and Islands	16	0	13	2	0	1	0
Scientific lyceum with advanced mathematics and physics program - Northeast	14	0	14	0	0	0	0
Scientific lyceum with advanced mathematics and physics program - Northwest	18	0	15	0	1	2	0
Scientific lyceum with advanced mathematics and physics program - South	22	0	17	1	1	3	0
Total	**120**	**0**	**104**	**7**	**2**	**7**	**0**

Allocation of Physics School Sample in Italy

			Participating Schools				
Explicit Stratum	Total Sampled Schools	Ineligible Schools	Original Schools	1st Replacement	2nd Replacement	Refusal Schools	Excluded Schools
Scientific lyceum with advanced mathematics and physics program - Center	22	0	21	1	0	0	0
Scientific lyceum with advanced mathematics and physics program - Southern Peninsulas and Islands	20	0	17	2	0	1	0
Scientific lyceum with advanced mathematics and physics program - Northeast	20	0	20	0	0	0	0
Scientific lyceum with advanced mathematics and physics program - Northwest	26	0	23	0	1	2	0
Scientific lyceum with advanced mathematics and physics program - South	32	0	25	2	2	3	0
Total	**120**	**0**	**106**	**5**	**3**	**6**	**0**

Lebanon

A single school sample was selected for both advanced mathematics and physics.

Coverage and Exclusions

- Coverage of the national desired target population was 100 percent
- School-level exclusions consisted of very small schools (less than 8 eligible students)
- No within-school exclusions

Sample Design

- Explicit stratification by school type (private, public)
- Implicit stratification by region (7)
- All schools with eligible students were selected for the data collection
- All eligible classes in a school were expected to be sampled. However, a problem during data collection resulted in only one class being sampled per school, leading to a reduced sample size for both target populations.
- Half of the students in the selected classes were randomly assigned an advanced mathematics booklet, and the remaining half were assigned a physics booklet
- In the public school stratum, classes were used as variance estimation strata and half classes were used to build jackknife replicates

Field Test Sample

- A sample of 48 schools was selected for the field test and used for both populations. All schools selected for the field test were also included in the data collection sample.

Allocation of Advanced Mathematics and Physics School Sample in Lebanon

			Participating Schools				
Explicit Stratum	Total Sampled Schools	Ineligible Schools	Original Schools	1st Replacement	2nd Replacement	Refusal Schools	Excluded Schools
Private	211	1	121	0	0	89	0
Public	144	0	130	0	0	14	0
Total	**355**	**1**	**251**	**0**	**0**	**103**	**0**

Norway

All eligible schools in Norway were selected for TIMSS Advanced 2015, but each school was selected for only one population, resulting in two separate school samples for advanced mathematics and physics.

Coverage and Exclusions

- Coverage of the national desired target population was 100 percent
- School-level exclusions consisted of very small schools (less than 6 eligible students)
- Within-school exclusions consisted of students with intellectual disabilities

Sample Design

- Explicit stratification by classes taught for each subject (advanced mathematics classes only, both advanced mathematics and physics classes) and the number of eligible physics students (between 6 and 9, between 10 and 19, between 20 and 34, 35 or more). Schools with less than 6 physics students were sampled for advanced mathematics only.
- No implicit stratification
- All schools from the advanced mathematics explicit stratum were selected
- From the remaining advanced mathematics and physics strata, all schools were randomly sampled either for advanced mathematics or for physics through a disproportional allocation procedure. This procedure ensured that sample size requirements for each study population were reached by sampling a higher proportion of schools for physics from the strata of schools with larger numbers of physics students and sampling a higher proportion of schools for advanced mathematics in the strata of schools with less physics students.
- In schools selected for advanced mathematics, all eligible advanced mathematics classes were sampled
- In schools selected for physics, all eligible physics classes were sampled
- In the advanced mathematics school stratum, classes were used as variance estimation strata and half classes were used to build jackknife replicates

Field Test Sample

- A convenience sample of 21 international baccalaureate schools was selected for the field test

Allocation of Advanced Mathematics School Sample in Norway

			Participating Schools				
Explicit Stratum	Total Sampled Schools	Ineligible Schools	Original Schools	1st Replacement	2nd Replacement	Refusal Schools	Excluded Schools
Schools with advanced mathematics classes	50	2	48	0	0	0	0
Schools with advanced mathematics and physics classes and 35 or more physics students	12	0	12	0	0	0	0
Schools with advanced mathematics and physics classes and 20 to 34 physics students	14	0	14	0	0	0	0
Schools with advanced mathematics and physics classes and 10 to 19 physics students	36	0	36	0	0	0	0
Schools with advanced mathematics and physics classes and less than 10 physics students	24	0	23	0	0	1	0
Total	**136**	**2**	**133**	**0**	**0**	**1**	**0**

Allocation of Physics School Sample in Norway

			Participating Schools				
Explicit Stratum	Total Sampled Schools	Ineligible Schools	Original Schools	1st Replacement	2nd Replacement	Refusal Schools	Excluded Schools
Schools with advanced mathematics and physics classes and 35 or more physics students	24	0	24	0	0	0	0
Schools with advanced mathematics and physics classes and 20 to 34 physics students	32	0	31	0	0	1	0
Schools with advanced mathematics and physics classes and 10 to 19 physics students	58	0	58	0	0	0	0
Schools with advanced mathematics and physics classes and less than 10 physics students	16	0	14	0	0	2	0
Total	**130**	**0**	**127**	**0**	**0**	**3**	**0**

Portugal

The sample design for Portugal differed from the standard TIMSS Advanced design. It consisted of a mix of the two primary TIMSS Advanced designs described in Chapter 3. Some schools were sampled for advanced mathematics only, some for physics only, and some for both subjects.

Coverage and Exclusions

- Coverage of the national desired target population was 100 percent
- For advanced mathematics, there was no school-level exclusions. For physics, school-level exclusions consisted of very small schools (less than 5 eligible students).
- Within-school exclusions consisted of students with intellectual disabilities and students with functional disabilities

Sample Design

- Explicit stratification by the presence of eligible students from the two study populations based on the sample frame information (schools with only advanced mathematics students, schools with advanced mathematics and physics students), school type (private, public), and region within the public schools strata (7)
- No implicit stratification
- Schools were sampled using probability proportional to school size systematic sampling
- Some sampled schools were composed of classes of advanced mathematics students only. Other sampled schools were composed of some classes that had advanced mathematics students only and other classes that had both advanced mathematics and physics students.
- Classes within the sampled schools were split into 2 class groups where appropriate: classes with students eligible for advanced mathematics only and classes with students eligible for both subjects
- For advanced mathematics, classes were sampled from both class groups
- From the advanced mathematics only class group, one class was sampled and advanced mathematics booklets were distributed
- From the advanced mathematics and physics class group, all classes were expected to be selected. However, a problem during data collection resulted in only one class being selected per school. In each selected class, one out of every six students was randomly assigned an advanced mathematics booklet and the remaining students were assigned a physics booklet.
- During data collection, physics students were found in a number of schools assigned to the advanced mathematics only strata. Also, some schools assigned to the advanced

mathematics and physics strata did not have any physics students. Therefore, all sampled schools were considered eligible for both populations regardless of their classification to one group or the other.

- Out of the 73 schools originally sampled as advanced mathematics only schools, 14 schools ended up having physics students. Out of the 178 schools selected for advanced mathematics and physics, 25 schools ended up having only advanced mathematics students.
- For physics, adjacent advanced mathematics only strata were collapsed to create the jackknife zones and replicates

Field Test Sample

- For the field test, a sample of 40 schools was selected for advanced mathematics and a sample of 24 schools was selected for physics. Only one subject was tested in the sampled schools and 2 classes were sampled whenever possible.

Allocation of Advanced Mathematics School Sample in Portugal

			Participating Schools				
Explicit Stratum	Total Sampled Schools	Ineligible Schools	Original Schools	1st Replacement	2nd Replacement	Refusal Schools	Excluded Schools
Private schools with advanced mathematics program - All regions	2	0	2	0	0	0	0
Public schools with advanced mathematics classes - Alentejo	18	0	15	0	0	3	0
Public schools with advanced mathematics classes - Algarve	2	0	2	0	0	0	0
Public schools with advanced mathematics classes - Centro	18	0	18	0	0	0	0
Public schools with advanced mathematics classes - Lisboa	8	0	6	0	0	2	0
Public schools with advanced mathematics classes - Norte	21	0	15	4	0	2	0
Public schools with advanced mathematics classes - R. A. Açores	2	0	0	2	0	0	0
Public schools with advanced mathematics classes - R. A. Madeira	2	0	1	1	0	0	0

Allocation of Advanced Mathematics School Sample in Portugal (Continued)

			Participating Schools				
Explicit Stratum	Total Sampled Schools	Ineligible Schools	Original Schools	1st Replacement	2nd Replacement	Refusal Schools	Excluded Schools
Private schools with advanced mathematics classes and advanced mathematics and physics classes - All regions	10	0	10	0	0	0	0
Public schools with advanced mathematics classes and advanced mathematics and physics classes - Alentejo	13	0	11	0	0	2	0
Public schools with advanced mathematics classes and advanced mathematics and physics classes - Algarve	6	0	5	1	0	0	0
Public schools with advanced mathematics classes and advanced mathematics and physics classes - Centro	48	0	42	2	0	4	0
Public schools with advanced mathematics classes and advanced mathematics and physics classes - Lisboa	32	0	24	1	0	7	0
Public schools with advanced mathematics classes and advanced mathematics and physics classes - Norte	57	0	45	3	0	9	0
Public schools with advanced mathematics classes and advanced mathematics and physics classes - R. A. Açores	6	0	5	1	0	0	0
Public schools with advanced mathematics classes and advanced mathematics and physics classes - R. A. Madeira	6	0	5	0	0	1	0
Total	**251**	**0**	**206**	**15**	**0**	**30**	**0**

Allocation of Physics School Sample in Portugal

			Participating Schools				
Explicit Stratum	Total Sampled Schools	Ineligible Schools	Original Schools	1st Replacement	2nd Replacement	Refusal Schools	Excluded Schools
Private schools with advanced mathematics program - All regions	2	1	1	0	0	0	0
Public schools with advanced mathematics classes - Alentejo	18	11	5	0	0	2	0
Public schools with advanced mathematics classes - Algarve	2	1	1	0	0	0	0
Public schools with advanced mathematics classes - Centro	18	14	4	0	0	0	0
Public schools with advanced mathematics classes - Lisboa	8	6	0	0	0	2	0
Public schools with advanced mathematics classes - Norte	21	16	1	2	0	2	0
Public schools with advanced mathematics classes - R. A. Açores	2	2	0	0	0	0	0
Public schools with advanced mathematics classes - R. A. Madeira	2	2	0	0	0	0	0
Private schools with advanced mathematics classes and advanced mathematics and physics classes - All regions	10	2	8	0	0	0	0
Public schools with advanced mathematics classes and advanced mathematics and physics classes - Alentejo	13	3	8	0	0	2	0
Public schools with advanced mathematics classes and advanced mathematics and physics classes - Algarve	6	1	4	0	0	1	0

Allocation of Physics School Sample in Portugal (Continued)

			Participating Schools				
Explicit Stratum	Total Sampled Schools	Ineligible Schools	Original Schools	1st Replacement	2nd Replacement	Refusal Schools	Excluded Schools
Public schools with advanced mathematics classes and advanced mathematics and physics classes - Centro	48	8	37	1	0	2	0
Public schools with advanced mathematics classes and advanced mathematics and physics classes - Lisboa	32	1	26	0	0	5	0
Public schools with advanced mathematics classes and advanced mathematics and physics classes - Norte	57	10	37	3	0	7	0
Public schools with advanced mathematics classes and advanced mathematics and physics classes - R. A. Açores	6	0	5	1	0	0	0
Public schools with advanced mathematics classes and advanced mathematics and physics classes - R. A. Madeira	6	0	5	0	0	1	0
Total	**251**	**78**	**142**	**7**	**0**	**24**	**0**

Russian Federation

Two separate school samples were selected for advanced mathematics and physics.

For advanced mathematics, the Russian Federation assessed students from two programs: the Profile and Intensive streams. The summary below describes the samples from both programs.

Advanced Mathematics results were published separately for the students in the Intensive stream. Sampling characteristics for this group of students are described in the Russian Federation 6hr+ section on page 5.29.

Coverage and Exclusions

- Coverage of the national desired target population was 100 percent
- School-level exclusions consisted of very small schools (less than 4 eligible students)
- Within-school exclusions consisted of students with intellectual disabilities and students with functional disabilities

Sample Design

- In a preliminary sampling stage, a sample of 42 regions out of 83 was selected with probabilities proportional to school size. The 14 largest regions were selected with certainty.
- A school sample for advanced mathematics was selected first from the certainty regions and the sampled regions. More details on the sample design for advanced mathematics are given below.
- Following the selection of the advanced mathematics sample, a school sample for physics was selected from the same certainty and sampled regions, minimizing the overlap with the selected advanced mathematics sample using the Chowdhury overlap control method. Additional details on the sample design for physics are provided below.
- School weights were adjusted to take into account the sampling of regions
- Within the strata of certainty regions, schools were paired for variance calculation purposes. Otherwise, selected regions were paired for variance purposes.

Additional details for advanced mathematics

- Schools from the 14 certainty regions were grouped together and were explicitly stratified by the presence of classes from the two advanced mathematics streams: schools with classes from the Intensive stream only, schools with classes from the Profile stream only, and schools with classes from both streams. They also were stratified implicitly by the 14 regions and 9 levels of urbanization.

- Each of the remaining 28 sampled regions became explicit strata and were further stratified by the presence of classes from the two advanced mathematics streams, as was the group of certainty regions
- Classes within schools were split into two class groups: Intensive advanced mathematics classes and Profile advanced mathematics classes, and one class was sampled from each group

Additional details for physics

- The 14 certainty regions were grouped into one large stratum and schools were stratified implicitly by region and 9 levels of urbanization
- Each of the remaining 28 sampled regions became explicit strata
- One eligible physics class was sampled from each selected school

Field Test Sample

- A convenience sample of 45 schools was selected for the field test. Of these, 29 schools were selected for physics only, and 16 schools were selected for advanced mathematics and physics.

Allocation of Advanced Mathematics School Sample in Russian Federation

			Participating Schools				
Explicit Stratum	Total Sampled Schools	Ineligible Schools	Original Schools	1st Replacement	2nd Replacement	Refusal Schools	Excluded Schools
Schools with Intensive stream classes in certainty regions	54	0	54	0	0	0	0
Schools with Intensive stream classes in sampled regions	89	0	89	0	0	0	0
Schools with Profile stream classes in certainty regions	56	0	56	0	0	0	0
Schools with Profile stream classes in sampled regions	119	0	119	0	0	0	0
Schools with Intensive and Profile streams classes in certainty regions	7	0	7	0	0	0	0
Schools with Intensive and Profile streams classes in sampled regions	21	0	21	0	0	0	0
Total	**346**	**0**	**346**	**0**	**0**	**0**	**0**

Allocation of Physics School Sample in Russian Federation

			Participating Schools				
Explicit Stratum	Total Sampled Schools	Ineligible Schools	Original Schools	1st Replacement	2nd Replacement	Refusal Schools	Excluded Schools
Schools in certainty regions	70	0	70	0	0	0	0
Schools in sampled regions	123	0	117	6	0	0	0
Total	**193**	**0**	**187**	**6**	**0**	**0**	**0**

Russian Federation 6hr+

For advanced mathematics, the Russian Federation assessed students from two programs: the Profile and Intensive streams. Results are provided separately for the students in the Intensive stream since this group corresponds to the group of students assessed in TIMSS Advanced 1995 and 2008. The following summary is for the Intensive stream, designated as Russian Federation 6hr+.

Coverage and Exclusions

- Coverage of the national desired target population was 100 percent
- School-level exclusions consisted of very small schools (less than 4 eligible students)
- Within-school exclusions consisted of students with intellectual disabilities and students with functional disabilities

Sample Design

- In a preliminary sampling stage, a sample of 42 regions out of 83 was selected with probabilities proportional to (school) size. The 14 largest regions were selected with certainty.
- Schools from the 14 certainty regions were grouped together and were explicitly stratified by the presence of classes from the two advanced mathematics streams: schools with classes from the Intensive stream only, schools with classes from both the Profile and Intensive streams. They also were stratified implicitly by the 14 regions and 9 levels of urbanization.
- Each of the remaining 28 sampled regions became explicit strata and were further stratified by the presence of classes from the two advanced mathematics streams
- One class sampled among the Intensive stream classes within each school
- School weights were adjusted to take into account the sampling of regions
- Within the strata of certainty regions, schools were paired for variance calculation purposes. Otherwise, selected regions were paired for variance purposes.

Field Test Sample

- A convenience sample of 34 schools was selected for the field test. Of these, 18 schools were selected for advanced mathematics only and 16 schools were selected for advanced mathematics and physics.

Allocation of Advanced Mathematics School Sample in Russian Federation 6hr+

			Participating Schools				
Explicit Stratum	Total Sampled Schools	Ineligible Schools	Original Schools	1st Replacement	2nd Replacement	Refusal Schools	Excluded Schools
Schools with Intensive stream classes in certainty regions	54	1	53	0	0	0	0
Schools with Intensive stream classes in sampled regions	89	11	78	0	0	0	0
Schools with Intensive and Profile streams classes in certainty regions	7	1	6	0	0	0	0
Schools with Intensive and Profile streams classes in sampled regions	21	5	16	0	0	0	0
Schools with Profile stream classes in certainty regions	6	0	6	0	0	0	0
Schools with Profile stream classes in sampled regions	4	0	4	0	0	0	0
Total	**181**	**18**	**163**	**0**	**0**	**0**	**0**

Slovenia

All schools in Slovenia with eligible students were selected for participation in TIMSS Advanced 2015. A total of 80 schools had eligible advanced mathematics students and 59 of these schools had eligible physics students. All eligible physics students took part in the physics assessment.

Since all 59 physics schools also were eligible for the advanced mathematics assessment, some students were selected for both assessments. The two assessments were scheduled on different days to accommodate this and a random mechanism determined which assessment was administered first in each school.

Coverage and Exclusions

- Coverage of the national desired target population was 100 percent
- School-level exclusions consisted of Italian schools and Waldorf schools. For physics, very small schools with less than 7 physics students were also excluded.
- Within-school exclusions consisted of students with intellectual disabilities, and students with functional disabilities

Sample Design

- All schools with eligible students were selected
- Explicit stratification by presence of students from the two study populations (advanced mathematics classes, advanced mathematics classes and physics classes) and the expected number of mathematics "experts" in the final year of secondary school (few, some, many). Mathematics experts were defined as students enrolled in the intensive mathematics classes, and the number of expected experts in each school was estimated based on data from the prior academic year. Schools with "many experts" were expected to have 35 percent or more of the students in the intensive classes; schools with "some experts" were expected to have between 20 and 35 percent of the students in these classes; and schools with "few experts" were those expected to have less than 20 percent of the students in these classes.
- No implicit stratification
- For advanced mathematics, eligible advanced mathematics classes were grouped by type (regular or intense mathematics classes) and one or two eligible classes from each group were sampled
- For physics, all eligible physics classes were sampled
- In strata where at least ninety percent of all schools participated, variance estimation strata and replicates were calculated in one of two ways: (1) when all classes were selected within schools, classes were used as variance strata and half-classes as replicates or (2) when classes were sampled within schools, schools were used as variance strata and classes as replicates. In all other strata, schools were paired within explicit strata for variance calculation purposes.

Field Test Sample

- A sample of 29 schools with advanced mathematics and physics classes was selected and used for both populations. Schools participating in the field test also were part of the data collection sample.

Allocation of Advanced Mathematics School Sample in Slovenia

			Participating Schools				
Explicit Stratum	Total Sampled Schools	Ineligible Schools	Original Schools	1st Replacement	2nd Replacement	Refusal Schools	Excluded Schools
Schools with advanced mathematics classes	18	0	17	0	0	1	3
Schools with advanced mathematics classes and physics classes, with few mathematics experts	20	0	17	0	0	3	0
Schools with advanced mathematics classes and physics classes, with some mathematics experts	18	0	16	0	0	2	0
Schools with advanced mathematics classes and physics classes, with many mathematics experts	21	0	19	0	0	2	0
Total	**77**	**0**	**69**	**0**	**0**	**8**	**3**

Allocation of Physics School Sample in Slovenia

			Participating Schools				
Explicit Stratum	Total Sampled Schools	Ineligible Schools	Original Schools	1st Replacement	2nd Replacement	Refusal Schools	Excluded Schools
Schools with advanced mathematics classes and physics classes, with few mathematics experts	20	0	15	0	0	5	0
Schools with advanced mathematics classes and physics classes, with some mathematics experts	18	0	16	0	0	2	0
Schools with advanced mathematics classes and physics classes, with many mathematics experts	21	0	19	0	0	2	0
Total	**59**	**0**	**50**	**0**	**0**	**9**	**0**

Sweden

Two separate school samples were selected for advanced mathematics and physics.

Coverage and Exclusions

- Coverage of the national desired target population was 100 percent
- School-level exclusions consisted of very small schools (less than 7 eligible students)
- Within-school exclusions consisted of students with intellectual disabilities and students with functional disabilities

Sample Design

- Eligible schools were initially ordered by the presence of programs offered (natural science, technological, both), by school funding (public, private), and by size. Schools were then split into two homogeneous partitions, each partition being representative of both target populations. The advanced mathematics sample was selected from one partition while the physics sample was selected from the other partition, resulting in two separate school samples for advanced mathematics and physics.
- Explicit stratification by the programs offered in school (natural science, technological, both) and by size (small, medium, large), in both the advanced mathematics partition and physics partition
- Implicit stratification by school type (public, private) in both partitions
- From each partition, a sample of schools was selected with equal probabilities, minimizing the overlap with the field test sample using the Chowdhury overlap control method
- For advanced mathematics, classes within the sampled schools were grouped by program and one or two eligible advanced mathematics classes were sampled from each program
- For physics, classes within the sampled schools were grouped by program and one or two eligible physics classes were sampled from each program

Field Test Sample

- A sample of 48 schools was selected for both populations

Allocation of Advanced Mathematics School Sample in Sweden

			Participating Schools				
Explicit Stratum	Total Sampled Schools	Ineligible Schools	Original Schools	1st Replacement	2nd Replacement	Refusal Schools	Excluded Schools
Larger schools with natural science and technical programs	28	0	28	0	0	0	0
Medium-size schools with natural science and technical programs	21	0	21	0	0	0	0
Smaller schools with natural science and technical programs	6	0	6	0	0	0	0
Larger schools with natural science program	30	1	28	0	0	1	0
Medium-size schools with natural science program	23	0	22	0	0	1	0
Smaller schools with natural science program	12	0	12	0	0	0	0
Larger schools with technical program	4	0	4	0	0	0	0
Medium-size schools with technical program	11	0	11	0	0	0	0
Smaller schools with technical program	8	1	7	0	0	0	0
Total	**143**	**2**	**139**	**0**	**0**	**2**	**0**

Allocation of Physics School Sample in Sweden

			Participating Schools				
Explicit Stratum	Total Sampled Schools	Ineligible Schools	Original Schools	1st Replacement	2nd Replacement	Refusal Schools	Excluded Schools
Larger schools with natural science and technical programs	20	0	20	0	0	0	0
Medium-size schools with natural science and technical programs	21	0	21	0	0	0	0
Smaller schools with natural science and technical programs	10	0	10	0	0	0	0
Larger schools with natural science program	31	0	31	0	0	0	0
Medium-size schools with natural science program	16	0	15	1	0	0	0
Smaller schools with natural science program	14	0	13	0	0	1	0
Larger schools with technical program	7	0	7	0	0	0	0
Medium-size schools with technical program	6	0	6	0	0	0	0
Smaller schools with technical program	9	0	9	0	0	0	0
Total	**134**	**0**	**132**	**1**	**0**	**1**	**0**

United States

A single school sample was used for both advanced mathematics and physics.

Coverage and Exclusions

- Coverage of the national desired target population was 100 percent
- No school-level exclusions
- Within-school exclusions consisted of students with intellectual disabilities and students with functional disabilities

Sample Design

- Explicit stratification by the presence of advanced program in school (yes, no), school type (public, private) and census region (4) within public schools
- Implicit stratification by urbanization (4) and ethnicity status (above 15% non-White students in a school, below 15% non-White students in a school)
- The structure of advanced mathematics and physics education required direct student sampling. Within sampled schools, students were assigned to one of three groups: advanced mathematics only, physics only, or advanced mathematics and physics. The advanced mathematics sample was composed of students sampled from the first and third group while the physics sample was composed of students sampled from the second and third group.
- Students selected from the advanced mathematics group were randomly assigned an advanced mathematics booklet
- Students selected from the physics group were randomly assigned a physics booklet
- Students selected from the advanced mathematics and physics group were randomly assigned an advanced mathematics booklet or a physics booklet. Consequently, about half of the students from this group received an advanced mathematics booklet and the other half received a physics booklet. During data collection, 32 advanced mathematics schools and 111 physics schools were found to be ineligible for assessment administration as they did not have eligible advanced mathematics and/or physics students.
- During data collection, 32 advanced mathematics schools and 111 physics schools were found to be ineligible for assessment administration as they did not have eligible advanced mathematics and/or physics students

Field Test Sample

- A sample of 72 schools from 7 states was selected and used for both populations

Allocation of Advanced Mathematics School Sample in the United States

			Participating Schools				
Explicit Stratum	Total Sampled Schools	Ineligible Schools	Original Schools	1st Replacement	2nd Replacement	Refusal Schools	Excluded Schools
Private schools with no advanced program	10	8	0	0	0	2	0
Public schools with no advanced program in census regions 1 and 2	14	5	7	0	0	2	0
Public schools with no advanced program in census region 3	10	5	4	0	0	1	0
Public schools with no advanced program in census region 4	10	7	2	0	0	1	0
Private schools with an advanced program	19	0	12	1	0	6	0
Public schools with an advanced program in census region 1	49	2	28	0	0	19	0
Public schools with an advanced program in census region 2	58	1	41	5	0	11	0
Public schools with an advanced program in census region 3	104	0	88	3	0	13	0
Public schools with an advanced program in census region 4	74	4	48	2	0	20	0
Total	**348**	**32**	**230**	**11**	**0**	**75**	**0**

Allocation of Physics School Sample in the United States

			Participating Schools				
Explicit Stratum	Total Sampled Schools	Ineligible Schools	Original Schools	1st Replacement	2nd Replacement	Refusal Schools	Excluded Schools
Private schools with no advanced program	10	8	0	0	0	2	0
Public schools with no advanced program in census regions 1 and 2	14	11	2	0	0	1	0
Public schools with no advanced program in census region 3	10	8	1	0	0	1	0
Public schools with no advanced program in census region 4	10	9	0	0	0	1	0
Private schools with an advanced program	19	5	9	0	0	5	0
Public schools with an advanced program in census region 1	49	9	20	0	0	20	0
Public schools with an advanced program in census region 2	58	14	26	4	0	14	0
Public schools with an advanced program in census region 3	104	28	64	3	0	9	0
Public schools with an advanced program in census region 4	74	19	34	2	0	19	0
Total	**348**	**111**	**156**	**9**	**0**	**72**	**0**