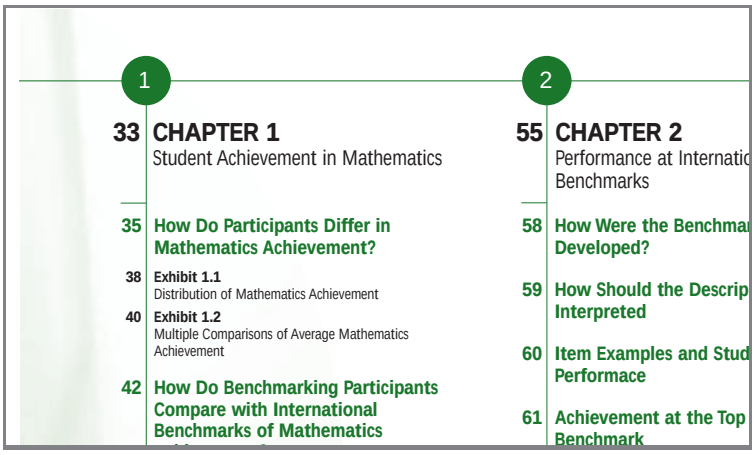
click on chapter number



Text Pages

click on section title to return to table of contents

click on first mention of exhibit to jump to exhibit

click on arrow to jump to indicated page of text

click on exhibit number to jump to text discussion of that exhibit

Achievement at the Top 10% Benchmark

Exhibit 2.1 describes performance at the Top 10% Benchmark. Students reaching this benchmark demonstrated the ability to organize information in problem-solving situations and to apply their understanding of mathematical relationships. They typically demonstrated success on the knowledge and skills represented by this benchmark, as well as those demonstrated at the Upper Quarter, Median, and Lower Quarter benchmarks.

Example Item 1 in Exhibit 2.2 illustrates the type of measurement item a student performing at the Top 10% Benchmark generally answered correctly. As can be seen, students had to apply their knowledge of the area of rectangles and inscribed shapes to solve a two-step problem about the area of a garden path. The international average for this item was 42 percent correct. Nevertheless, more than two-thirds of the students answered the item correctly in Hong Kong, Singapore, Japan, Chinese Taipei, and Korea. On average internationally, more than 20 percent of students


A

Executive Summary

timss 1999, a successor to the acclaimed 1995 Third International Mathematics and Science Study (timss), focused on the mathematics and science achievement of eighth-grade students. Thirty-eight countries including the United States participated in timss 1999 (also known as timss-repeat or timss-r).[1] Even more significantly for the United States, however, timss 1999 included a voluntary Benchmarking Study. Twenty-seven jurisdictions from all across the nation, including 13 states and 14 districts or consortia (see below), participated in the Benchmarking Study.

Each jurisdiction had its own reasons for taking part in the timss 1999 Benchmarking Study. In general, participation provided an unprecedented opportunity for jurisdictions to assess the comparative international standing of their students' achievement and to evaluate their mathematics and science programs in an international context. Participants were also able to compare their achievement with that of the United States as a whole,[2] and in the cases where they both participated, school districts could compare with the performance of their states.

TIMSS 1999 Benchmarking Participants

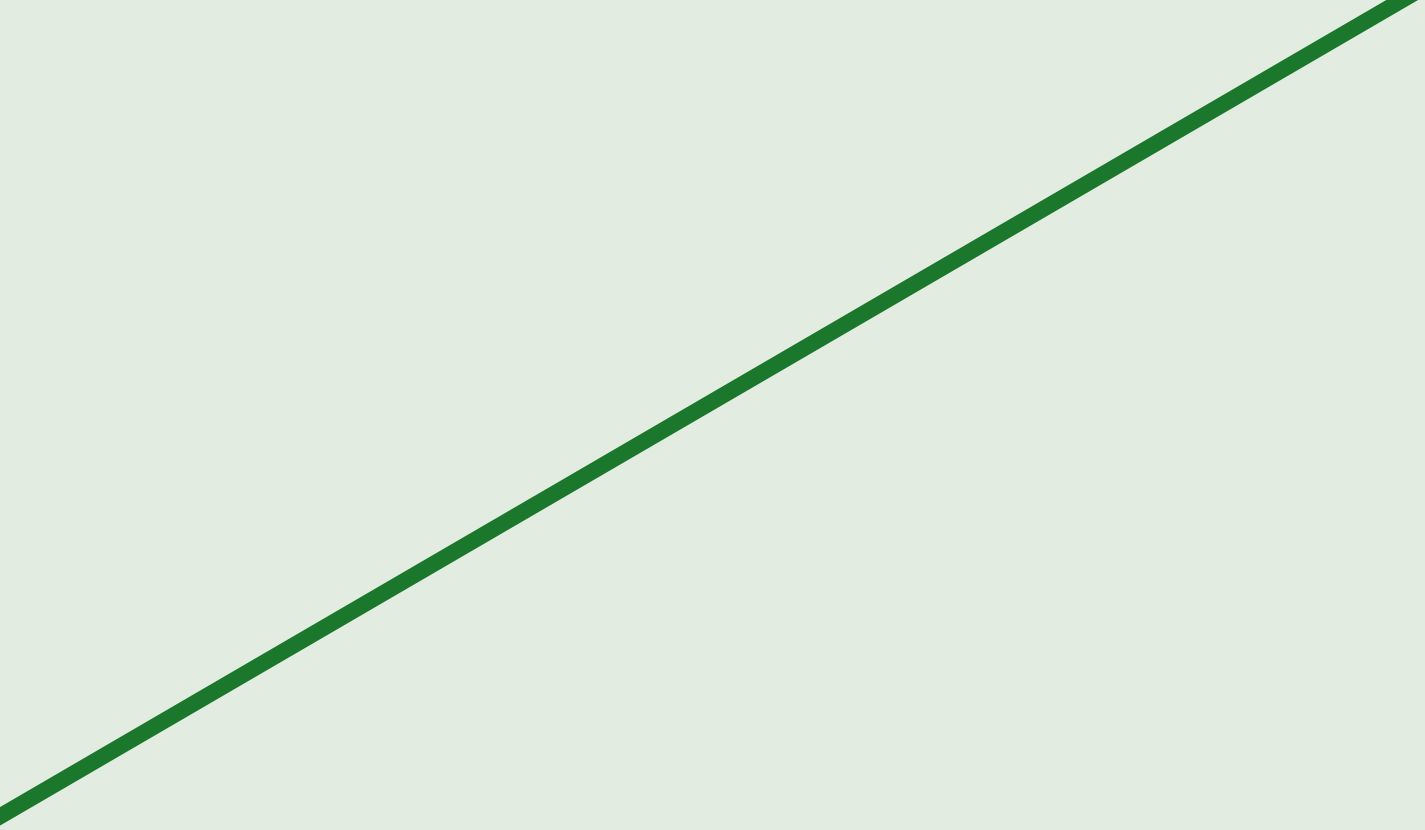
States	Districts and Consortia
Connecticut	Academy School District #20, Colorado Springs, CO
Idaho	Chicago Public Schools, IL
Illinois	Delaware Science Coalition, DE
Indiana	First in the World Consortium, IL
Maryland	Fremont/Lincoln/Westside Public Schools, NE
Massachusetts	Guilford County, NC
Michigan	Jersey City Public Schools, NJ
Missouri	Miami-Dade County Public Schools, FL
North Carolina	Michigan Invitational Group, MI
Oregon	Montgomery County, MD
Pennsylvania	Naperville School District #203, IL
South Carolina	Project SMART Consortium, OH
Texas	Rochester City School District, NY
	Southwest Pennsylvania Math and Science Collaborative, PA

Each participating entity invested valuable resources in this effort, primarily for data collection and team building, but also for staff development to facilitate use of the timss 1999 results as an effective tool for school improvement. Despite each participant's deep commitment to educational improvement by virtue of its participation in such a venture, it took courage and initiative to join such a high profile enterprise as the timss 1999 Benchmarking Study. Whether students' achievement fell at the top, middle, or bottom of the range of results for countries internationally, each participant will be asked to explain the results to its parents and communities.

1 IEA's International Study Center at Boston College reported the international results for TIMSS 1999 as well as trends between 1995 and 1999 in two companion volumes – the *TIMSS 1999 International Mathematics Report* and the *TIMSS 1999 International Science Report*. Performance in the United States relative to that of other nations was reported by the U.S. National Center for Education Statistics in *Pursuing Excellence: Comparisons of International Eighth-Grade Mathematics and Science Achievement from a U.S. Perspective, 1995 and 1999*. (See the Introduction for full citations.)

2 For the most part, the U.S. TIMSS national sample was separate from the students assessed in each of the Benchmarking jurisdictions.

Major Findings



Over the last decade, many states and school districts have created content and performance standards targeted at improving students' achievement in mathematics and science. In mathematics, in particular, most states are in the process of updating and revising their standards. All states except Iowa (which as a matter of policy publishes no state standards) now have content or curriculum standards in mathematics, and many educational jurisdictions have worked successfully to improve their initial standards in clarity and content.[1] Much of this effort has been based on work done at the national level during this period to develop standards aimed at increasing the mathematics competencies of all students. Since 1989, when the National Council of Teachers of Mathematics (nctm) published *Curriculum and Education Standards for School Mathematics*, the mathematics education community has had the benefit of a unified set of goals for mathematics teaching and learning. The nctm standards have been a springboard for state and local efforts to focus and improve mathematics education.[2]

Particularly during the past decade, there has been an enormous amount of energy expended in states and school districts not only on developing mathematics content standards but also on improving teacher quality and school environments as well as on developing assessments and accountability measures.[3] Participating in an international assessment provides states and school districts a global context for evaluating the success of their policies and practices aimed at raising students' academic achievement.

What Is TIMSS 1999 Benchmarking?

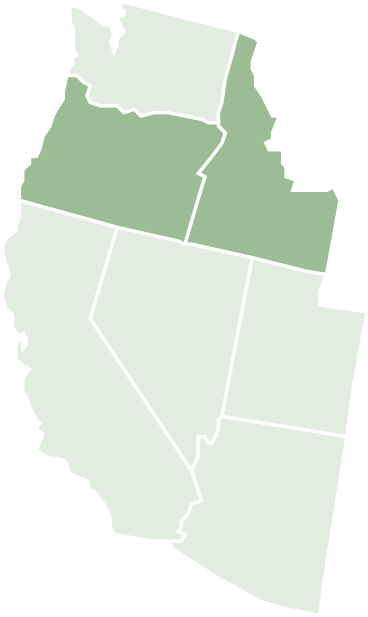
timss 1999, a successor to the 1995 Third International Mathematics and Science Study (timss), focused on the mathematics and science achievement of eighth-grade students. Thirty-eight countries including the United States participated in timss 1999 (also known as timss-Repeat or timss-r). Even more significantly for the United States, however, timss 1999 included a voluntary Benchmarking Study. Participation in the timss 1999 Benchmarking Study at the eighth grade provided states, districts, and consortia an unprecedented opportunity to assess the comparative international standing of their students' achievement and evaluate their mathematics and science programs in an international context. Participants were also able to

Which Countries, States, Districts, and Consortia Participated?

Exhibit 1 shows the 38 countries, 13 states, and the 14 districts and consortia that participated in timss 1999 and the Benchmarking Study.

The consortia consist of groups of entire school districts or individual schools from several districts that organized together either to participate in the Benchmarking Study or to collaborate across a range of educational issues. Descriptions of the consortia that participated in the

Project SMART Consortium. smart (Science & Mathematics Achievement Required For Tomorrow) is a consortium of 30 diverse



What Is the Relationship Between the TIMSS 1999 Data for the United States and the Data for the Benchmarking Study?

The results for the 38 countries participating in timss 1999, including those for the United States, were reported in December 2000 in two companion reports – the *TIMSS 1999 International Mathematics Report* and the *TIMSS 1999 International Science Report*.[5] Performance in the United States relative to that of other nations was reported by the U.S. National Center for Education Statistics in *Pursuing Excellence*.[6] The results for the United States in those reports, as well as in this volume and its companion science report,[7] were based on a nationally representative sample of eighth-grade students drawn in accordance with timss guidelines for all participating countries.

Because having valid and efficient samples in each country is crucial to the quality and integrity of timss, procedures and guidelines have been developed to ensure that the national samples are of the highest quality possible. Following the timss guidelines, representative samples were also drawn for the Benchmarking entities. Sampling statisticians at Westat, the organization responsible for sampling and data collection for the United States, worked in accordance with timss standards to design procedures that would coordinate the assessment of separate representative samples of students within each Benchmarking entity.

For the most part, the U.S. timss 1999 national sample was separate from the students assessed in each of the Benchmarking jurisdictions. Each Benchmarking participant had its own sample to provide comparisons with each of the timss 1999 countries including the United States. In general, the Benchmarking samples were drawn in accordance with the timss standards, and achievement results can be compared with confidence. Deviations from the guidelines are noted in the exhibits in the reports. The timss 1999 sampling requirements and the outcomes of the sampling procedures for the participating countries and Benchmarking jurisdictions are described in Appendix A. Although taken collectively the Benchmarking participants are not representative of the United States, the effort was substantial in scope involving approjlandTIMSS 199lI4sg couaf theyn

How Was the TIMSS 1999 Benchmarking Study Conducted?

The timss 1999 Benchmarking Study was a shared venture. In conjunction with the Office of Educational Research and Improvement (oeri) and the National Science Foundation (nsf), the National Center for Education Statistics (nces) worked with the International Study Center at Boston College to develop the study. Each participating jurisdiction invested valuable resources in the effort, primarily for data collection including the costs of administering the assessments at the same time and using identical procedures as for timss in the United States. Many participants have also devoted considerable resources to team building as well as to staff development to facilitate use of the timss 1999 results as an effective tool for school improvement.

The timss studies are conducted under the auspices of the International Association for the Evaluation of Educational Achievement (iea), an independent cooperative of national and governmental research agencies with a permanent secretariat based in Amsterdam, the Netherlands. Its primary purpose is to conduct large-scale comparative studies of educational achievement to gain a deeper understanding of the effects of policies and practices within and across systems of education.

timss is part of a regular cycle of international assessments of mathematics and science that are planned to chart trends in achievement over time, much like the regular cycle of national assessments in the U.S. conducted by the National Assessment of Educational Progress (naep). Work has begun on timss 2003, and a regular cycle of studies is planned for the years beyond.

The iea delegated responsibility for the overall direction and management of timss 1999 to the International Study Center in the Lynch School of Education at Boston College, headed by Michael O. Martin and Ina V.S. Mullis. In carrying out the project, the International Study Center worked closely with the iea Secretariat, Statistics Canada in Ottawa, the iea Data Processing Center in Hamburg, Germany, and Educational Testing Service in Princeton, New Jersey. Westat in Rockville, Maryland, was responsible for sampling and data collection for the Benchmarking Study as well as the U.S. component of timss 1999 so that procedures would be coordinated and comparable.

Testing was designed so that no one student took all the items, which would have required more than three hours of testing time. Instead,

How Do Country Characteristics Differ?

International studies of student achievement provide valuable comparative information about student performance, instructional practice, and curriculum. Accompanying the benefits of international studies, though, are challenges associated with making comparisons across countries, cultures, and languages. timss attends to these issues through careful planning and documentation, cooperation among the participating countries, standardized procedures, and rigorous attention to quality control throughout.[10]

It is extremely important, nevertheless, to consider the timss 1999 results in light of countrywide demographic and economic factors. Some selected demographic characteristics of the timss 1999 countries are presented in Exhibit 2. Countries ranged widely in population, from almost 270 million in the United States to less than one million in Cyprus, and in size, from almost 17 million square kilometers in the Russian Federation to less than one thousand in Hong Kong SAR and Singapore. Countries also varied widely on indicators of health, such as life expectancy at birth and infant mortality rate, and of literacy, including adult literacy rate and daily newspaper circulation. Exhibit 3 shows information for selected economic indicators, such as gross national product (gnp) per capita, expenditure on education and research, and development aid. The data reveal that there is great disparity in the economic resources available to participating countries.

[10] Appendix A contains an overview of the procedures used. More detailed information is provided in Martin, M.O., Gregory, K.A., and Stemler, S.E., eds., (2000), *TIMSS 1999 Technical Report*, Chestnut Hill, MA: Boston College.

	Population Size (in millions)[1]	Area of Country (1000 square kilometers)[2]	Life Expectancy at Birth[3]	Infant Mortality Rate (per 1000 live births)[4]	Adult Literacy Rate (%)[5]	Daily Newspaper Circulation (per 1000)[6]
United States	267.6	9159	76	7	99.0	212
Australia	18.5	7682	78	5	99.0	296
Belgium (Flemish) [7]	10.2	33	77	6	99.0	161
Bulgaria	8.3	111	71	18	98.2	254
Canada	30.3	9221	79	6	99.0	158
Chile	14.6	749	75	11	95.2	98
Chinese Taipei [8]	22.1	36	75	8	–	–
Cyprus [9]	0.8	9	–	6	95.9	111
Czech Republic	10.3	77	74	6	99.0	254
England [10]	50.0	130	–	–	99.0	–
Finland	5.1	305	77	4	99.0	455
Hong Kong	6.5	1	79	5	92.4	786
Hungary	10.2	92	71	10	99.0	186
Indonesia	200.4	1812	65	47	85.0	23
Iran, Islamic Rep.	60.9	1622	69	32	73.3	26
Israel [11]	6.1	21	78	7	95.4	288
Italy	57.5	294	78	5	98.3	104
Japan	126.1	377	80	4	99.0	578
Jordan	4.4	89	71	29	87.2	42
Korea, Rep.	46.0	99	72	9	97.2	394
			69	40	83.2	110

	Gross National Product per Capita (in US dollars)[1]	GNP per Capita (Purchasing Power Parity)[2]	Expenditure on Education as % of Gross National Product[3]	Expenditure on Research and Development		

How Do the Benchmarking Jurisdictions Compare on Demographic Indicators?

Together, the indicators in Exhibits 2 and 3 highlight the diversity of the timss 1999 countries. Although the factors the indicators reflect do not necessarily determine high or low performance in mathematics, they do provide a context for considering the challenges involved in the educational task from country to country. Similarly, there was great diversity among the timss 1999 Benchmarking participants. Exhibit 4 presents information about selected characteristics of the states, districts, and consortia that took part in the timss 1999 Benchmarking Study.

As illustrated previously in Exhibit 1, geographically the Benchmarking jurisdictions were from all across the United States, although there was a concentration of east coast participants with six of the states and several of the districts and consortia from the eastern seaboard. Illinois was well represented, by the state as a whole and by three districts or consortia – the Chicago Public Schools, the Naperville School District, and the First in the World Consortium. Several other districts and consortia also had the added benefit of a state comparison – the Michigan Invitational Group and Michigan, Guilford County and North Carolina, Montgomery County and Maryland, and the Southwest Pennsylvania Math and Science Collaborative and Pennsylvania.

As shown in Exhibit 4, demographically the Benchmarking participants varied widely. They ranged greatly in the size of their total public school enrollment, from about 244,000 in Idaho to nearly four million in Texas among states, and from about 11,000 in the Michigan Invitational Group to about 430,000 in the Chicago Public Schools among districts and consortia.

It is extremely important to note that the Benchmarking jurisdictions had widely differing percentages of limited English proficient and minority student populations. They also had widely different percentages of students from low-income families (based on the percentage of students eligible to receive free or reduced-price lunch). Among states, Texas had more than half minority students compared with less than one-fifth in Idaho, Indiana, and Michigan. Among the school districts, those in urban areas had more than four-fifths minority students, including the Chicago Public Schools (89 percent), the Jersey City Public Schools (93 percent), the Miami-Dade County Public Schools (93 percent), and the Rochester City School District (84 percent).

	Total Public Enrollment (All Grades)	Percentage of Students				Per Pupil Expenditure[3]
		Special Needs	Limited English Proficient	Minority[1]	Low Income[2]	
States						
Connecticut			4			
Idaho			7			
Illinois			6			
Indiana			3			
Maryland			2			
Massachusetts			13			
Michigan			–			
Missouri			1			
North Carolina			2			
Oregon			7			
Pennsylvania			–			
South Carolina			0			
Texas			14			
Districts and Consortia						
Academy School Dist. #20, CO		7	–			4767
Chicago Public Schools, IL		12	16			5784
Delaware Science Coalition, DE [4]						
First in the World Consort., IL		13	8			8924
Fremont/Lincoln/WestSide PS, NE		15	2			5915
Guilford County, NC		14	3			5431
Jersey City Public Schools, NJ		9	–			9653
Miami-Dade County PS, FL			14			5845
Michigan Invitational Group, MI [4]						
Montgomery County, MD			6			8223
Naperville Sch. Dist. #203, IL			1			5988
Project SMART Consortium, OH [4]						
Rochester City Sch. Dist., NY			–			8490
SW Math/Sci. Collaborative, PA [5]			–			6858

How Is the Report Organized?

This report provides a preliminary overview of the mathematics results for the Benchmarking Study. The real work will take place as policy makers, administrators, and teachers in each participating entity begin to examine the curriculum, teaching force, instructional approaches, and school environment in an international context. As those working on school improvement know full well, there is no "silver bullet" or single factor that is the answer to higher achievement in mathematics or any other school subject. Making strides in raising student achievement requires tireless diligence in all of the various areas related to educational quality.

The report is in two sections. Chapters 1 through 3 present the achievement results. Chapter 1 presents overall achievement results. Chapter 2 shows international benchmarks of mathematics achievement illustrated by results for individual mathematics questions. Chapter 3 gives results for

chapter 1

Student Achievement in Mathematics

Chapter 1 summarizes eighth-grade achievement on the timss 1999 mathematics assessment for each of the Benchmarking states, districts, and consortia, as well as for each participating country. Comparisons of participants' performance against international benchmarks, as well as gender differences in performance, are also provided.

How Do Participants Differ in Mathematics Achievement?

Exhibit 1.1 presents the distribution of student achievement for the 38 timss 1999 countries and the 27 Benchmarking participants in a two-page display.[1] The left-hand page shows countries and Benchmarking participants together, in decreasing order of average (mean) scale score, and indicates whether the average for each participant is significantly higher or lower than the international average of 487. The international average was obtained by averaging across the mean scores for each of the 38 participating countries. On the right-hand page is a tabular display of average achievement, along with the number of years of formal schooling and the average age of students tested.

Many of the Benchmarking participants performed fairly well on the timss 1999 mathematics assessment. Average performance for the 13 Benchmarking states was clustered in the middle of the international distribution of results for the 38 countries. All of the Benchmarking states performed either significantly above or similar to the international average. The United States as a whole also had average mathematics achievement just above the international average.

The Benchmarking Study underscores the extreme importance of looking beyond the averages to the range of performance found across the nation. Performance across the participating school districts and consortia reflected nearly the full range of achievement internationally. The two highest-achieving Benchmarking participants were the Naperville School District and the First in the World Consortium. These were two of the Benchmarking participants with the lowest percentages of students from low-income families (Naperville, 2 percent; First in the World, 14 percent).[2] Benchmarking participants with the lowest average mathematics achievement included four urban school districts with high percentages of students from low-income families – the Jersey City Public Schools (89 percent), the Chicago Public Schools (71 percent), the Rochester City School District (73 percent), and the Miami-Dade County Public Schools (59 percent). Although not quite as high as Singapore, Korea, and Chinese Taipei nor as low as the lowest-scoring countries in timss 1999, the range of average performance across the Benchmarking districts and consortia was almost as broad as across all the timss 1999 countries.

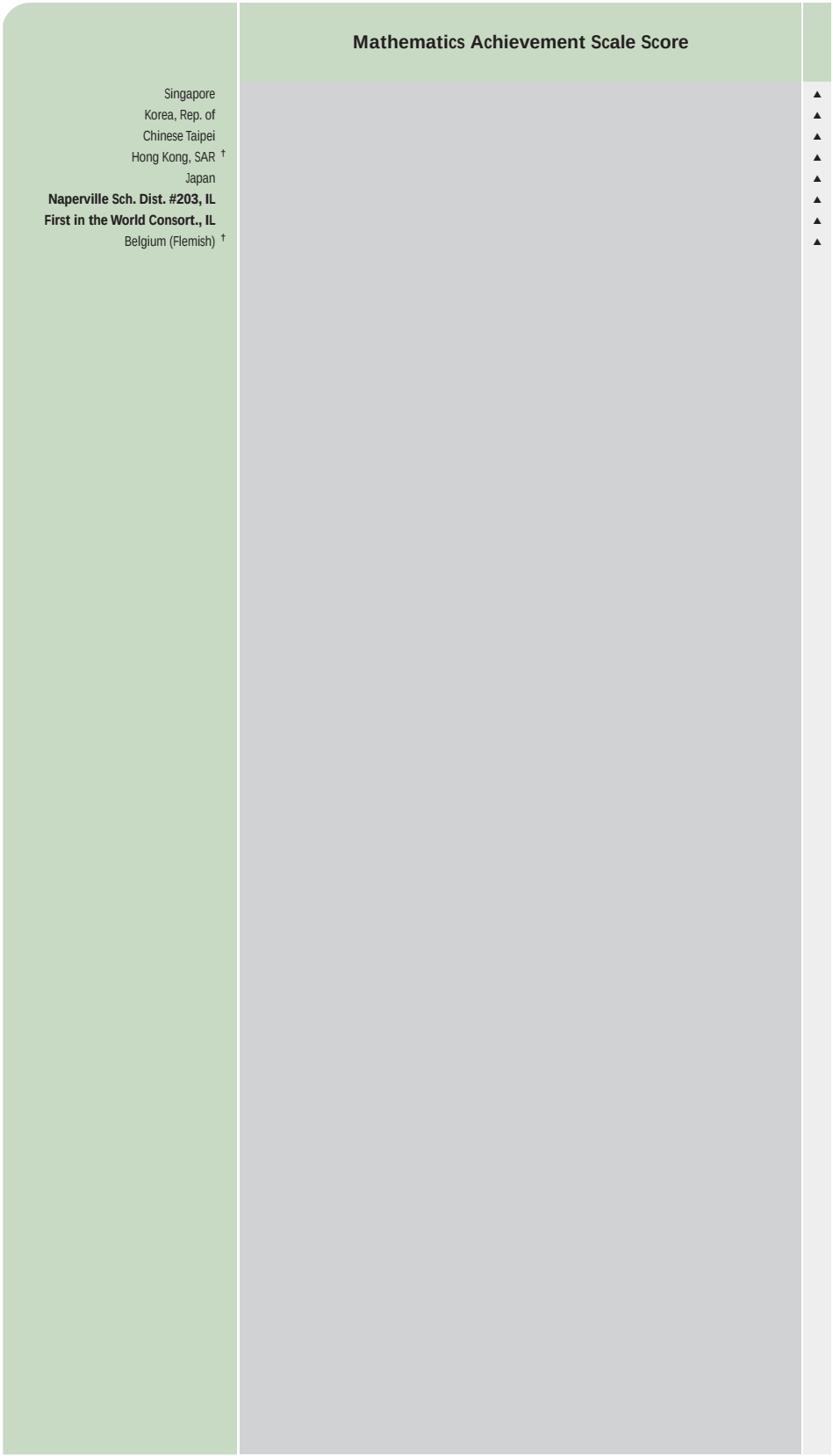
1 TIMSS used item response theory (IRT) methods to summarize the achievement results on a scale with a mean of 500 and a standard deviation of 100. Given the matrix-sampling approach, scaling averages students' responses in a way that accounts for differ

That achievement is distributed broadly within as well as across participating entities is graphically illustrated in Exhibit 1.1 showing the

Singapore, Korea, Chinese Taipei, and Hong Kong had the highest performance, closely followed by Japan, the Naperville School District, the First in the World Consortium, and Belgium (Flemish).[5] Naperville and First in the World both performed similarly to Hong Kong, Japan, and Belgium (Flemish), but significantly below Singapore, Korea, and Chinese Taipei. The difference in performance from one participant to the next was often negligible. Montgomery County, the Michigan Invitational Group, the Academy School District, the Project smart Consortium, the Southwest Pennsylvania Math and Science Collaborative, Michigan, Texas, Indiana, Oregon, Guilford County, Massachusetts, Connecticut, and Illinois were outperformed by only the top-performing eight or nine entities. These Benchmarking jurisdictions had average achievement most similar to the Netherlands, the Slovak Republic, Hungary, Canada, Slovenia, the Russian Federation, Australia, Finland, the Czech Republic, and Malaysia. Pennsylvania and South Carolina had achievement similar to that of Latvia (lss),[6] the United States, and England, closely followed by North Carolina, Idaho, Maryland, Missouri, and the Fremont/Lincoln/Westside Public Schools. The Delaware Science Coalition and the Jersey City Public Schools had average achievement similar to that of Italy, outperforming eleven and nine of the timss 1999 countries, respectively. The Chicago Public Schools had average achievement close to that in Moldova, Thailand, and Israel. The Rochester City School District and the Miami-Dade County Public Schools had average eighth-grade mathematics performance lower than most of the timss 1999 countries. Rochester had performance similar to the Republic of Macedonia, but significantly higher than Indonesia and Chile. Miami-Dade had average achievement about the same as the Islamic Republic of Iran, but significantly higher than the three lowest-scoring countries (the Philippines, Morocco, and South Africa).

5 Belgium has two separate educational systems, Flemish and French. The Flemish system participated in TIMSS 1999.

6 Because coverage of its eighth-grade population falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.


Mathematics Achievement Scale Score
Singapore
Korea, Rep. of
Chinese Taipei
Hong Kong, SAR †
Japan
Naperville Sch. Dist. #203, IL
First in the World Consort., IL
Belgium (Flemish) †

Instructions: Read across the row for a participant to compare performance with the participants listed along the top of the chart. The symbols indicate whether the average achievement of the participant in the row is significantly lower than that of the comparison participant, significantly higher than that of the comparison participant, or if there is no statistically significant difference between the average achievement of the two participants.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

How Do Benchmarking Participants Compare with International Benchmarks of Mathematics Achievement?

The timss mathematics achievement scale summarizes student performance on test items designed to measure a wide range of student knowledge and proficiency. In order to provide descriptions of what performance could mean in terms of the mathematics that students know and can do, timss identified four points on the scale for use as international benchmarks[7] or reference points, and conducted an ambitious scale anchoring exercise to describe students' performance at these benchmarks. Exhibit 1.3 shows the four international benchmarks of mathematics achievement and briefly describes what students scoring at these benchmarks typically know and can do. More detailed descriptions appear in Chapter 2, together with example test items illustrating performance at each benchmark.

The Top 10% Benchmark is defined at the 90th percentile on the timss mathematics scale, taking into account the performance of all students in all countries participating in 1999. It corresponds to a scale score of 616 and is the point abovg Pt.sesponds to a sca2.2

7 Readers should be careful not to confuse the international benchmarks, which are points on the international mathematics achievement scale chosen to describe specific achievement levels, with the benchmarking exercise itself, which is a process by which participants compare their achievement, curriculum, and instructional practices with those of the best in the world.

The Lower Quarter Benchmark is the 25th percentile and corresponds to a scale score of 396. This score point is reached by the top 75 percent of students and may be used as a benchmark of performance for lower-achieving students. Students scoring at this level typically demonstrated computational facility with whole numbers.

Exhibit 1.4 displays the percentage of students in each participating entity that reached each international benchmark, in decreasing order by the percentage reaching the Top 10% Benchmark. If student achievement in mathematics were distributed alike in every entity, then each entity would be expected to have about 10 percent of its students reaching the Top 10% Benchmark, 25 percent the Upper Quarter Benchmark, 50 percent the Median Benchmark, and 75 percent the Lower Quarter Benchmark. Although countries such as New Zealand, and Benchmarking participants such as Maryland, North Carolina, and the Delaware Science Coalition, came fairly close, no entity followed this pattern exactly. Instead, the high-performing entities generally had greater percentages of students reaching each benchmark, and the low-performing entities had lesser percentages.

Among the high performers, for example, Singapore, Chinese Taipei, Korea, Hong Kong, and Japan had one-third or more of their students reaching the Top 10% Benchmark, about two-thirds reaching the Upper Quarter Benchmark, around 90 percent reaching the Median Benchmark, and almost all (95 to 99 percent) reaching the Lower Quarter Benchmark. In comparison, the Naperville School District and the First in the World Consortium had 24 and 22 percent of their students, respectively, reaching the Top 10% Benchmark and 59 and

Philippines, and Morocco had almost no students reaching the Top 10% Benchmark, no more than one percent reaching the Upper Quarter Benchmark, less than 10 percent reaching the Median Benchmark, and no more than 31 percent reaching the Lower Quarter Benchmark.

Although Exhibit 1.4 is organized to draw particular attention to the percentage of high-achieving students in each entity, it conveys information about the distribution of middle and low performers also. For example, Canada, Australia, and Malaysia had 12 percent of their students reaching the Top 10% Benchmark, as might be expected, but 94 to 96 percent (rather than 75 percent) reaching the Lower Quarter Benchmark. Similarly, the Academy School District, the Michigan Invitational Group, and the Project smart Consortium had 11 to 12 percent of their students reaching the Top 10% Benchmark but 95 to 96 percent reaching the Lower Quarter Benchmark.

• Top 10% Benchmark

Students can organize information, make generalizations, and explain solution strategies in non-routine problem solving situations. They can organize information and make generalizations to solve problems; apply knowledge of numeric, geometric, and algebraic relationships to solve problems (e.g., among fractions, decimals, and percents; geometric properties; and algebraic rules); and find the equivalent forms of algebraic expressions.

90th Percentile: 616

• Upper Quarter Benchmark

Students can apply their understanding and knowledge in a wide variety of relatively complex situations. They can order, relate and compute with fractions and decimals to solve word problems; solve multi-step word problems involving proportions with whole numbers; solve probability problems; use knowledge of geometric properties to solve problems; identify and evaluate algebraic expressions and solve equations with one variable.

75th Percentile: 555

• Median Benchmark

Students can apply basic mathematical knowledge in straightforward situations. They can add or subtract to solve one-step word problems involving whole numbers and decimals; identify representations of common fractions and relative sizes of fractions; solve for missing terms in proportions; recognize basic notions of percents and probability; use basic properties of geometric figures; read and interpret graphs, tables, and scales; and understand simple algebraic relationships.

50th Percentile: 479

• Lower Quarter Benchmark

Students can do basic computations with whole numbers. The few items that anchor at this level provide some evidence that students can add, subtract, and round with whole numbers. When there are the same number of decimal places, they can subtract with multiple regrouping. Students can round whole numbers to the nearest hundred. They recognize some basic notation and terminology.

25th Percentile: 396

The international benchmarks are based on the combined data from the countries participating in 1999.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

	Percentages of Students Reaching International Benchmarks
Singapore	
Chinese Taipei	
Korea, Rep. of	
Hong Kong, SAR †	
Japan	
Naperville Sch. Dist. #203, IL	
Belgium (Flemish) †	
First in the World Consort., IL	
Montgomery County, MD [2]	
Hungary	
Slovenia	
Russian Federation	
Netherlands †	
Slovak Republic	
Texas	
Michigan Invitational Group, MI	
Canada	
Academy School Dist. #20, CO	
Australia	
Malaysia	
Project SMART Consortium, OH	
Czech Republic	
SW Math/Sci. Collaborative, PA	
Connecticut	
Bulgaria	
Michigan	
Guilford County, NC [2]	
Oregon	
Massachusetts	
South Carolina	
Illinois	
Indiana †	
Pennsylvania	
United States	
Maryland	
New Zealand	
Latvia (LSS) [1]	
North Carolina	
England †	
Finland	
Fremont/Lincoln/WestSide PS, NE	
Jersey City Public Schools, NJ	
Idaho	
Delaware Science Coalition, DE	
Italy	
Romania	
Israel [2]	
Missouri	
Lithuania [1‡]	
Moldova	
Thailand	
Cyprus	
Macedonia, Rep. of	
Jordan	
Chicago Public Schools, IL	
Rochester City Sch. Dist., NY	
Miami-Dade County PS, FL	
Indonesia	
Turkey	
Iran, Islamic Rep.	
Chile	
Tunisia	
Philippines	
South Africa	
Morocco	

What Are the Gender Differences in Mathematics Achievement?

Exhibit 1.5 presents average mathematics achievement separately for girls and boys for each of the participating entities, as well as the difference between the means, in increasing order of the difference. The gender difference for each entity is shown by a bar indicating the amount of the difference, whether its direction favored girls or boys, and whether it is statistically significant (a darkened bar).

It is good news that in mathematics at the eighth grade, the timss 1999 Benchmarking Study shows relatively equivalent average achievement for girls and boys in each of the Benchmarking jurisdictions. The United States as well as a number of other countries around the world appear to be making progress towards gender equity in mathematics education. On average across all timss 1999 countries, there was a modest but significant difference favoring boys, although this varied considerably from country to country. The only countries with differences large enough to be statistically significant were Israel, the Czech Republic, Iran, and Tunisia.

Although achievement differences between the genders are becoming smaller in mathematics, research indicates that they still exist in those areas involving the most complex mathematical tasks, particularly as

[8] Fennema, E. (1996), "Mathematics, Gender, and Research" in G. Hanna (ed.), *Towards Equity in Mathematics Education*, Dordrecht, the Netherlands: Kluwer Academic Publishers.

Bulgaria			
Oregon			
Macedonia, Rep. of			
Russian Federation			
Idaho			
South Carolina			
Slovenia			
Turkey			
Australia			
Hong Kong, SAR			

States in *italics*

	Upper Quarter		Median	
	Percent of Girls	Percent of Boys	Percent of Girls	Percent of Boys
States				
Connecticut	21 (3.1)	29 (3.9)	47 (4.7)	53 (4.4)
Idaho	24 (3.0)	26 (3.0)	49 (3.5)	51 (4.1)
Illinois	23 (3.1)	27 (2.9)	48 (3.7)	52 (3.1)
Indiana †	22 (3.6)	28 (3.7)	47 (4.1)	53 (5.1)
Maryland	22 (2.6)	28 (2.6)	48 (3.4)	52 (3.2)
Massachusetts	23 (2.7)	27 (2.7)	48 (3.4)	52 (3.0)
Michigan	22 (3.3)	29 (3.6) ▲	48 (4.3)	52 (3.6)
Missouri	23 (2.7)	27 (2.7)	49 (3.3)	51 (2.5)
North Carolina	24 (3.5)	26 (2.8)	49 (3.6)	51 (3.5)
Oregon	24 (2.7)	27 (2.8)	49 (3.2)	51 (3.5)
Pennsylvania	22 (3.0)	28 (2.9)	48 (3.2)	52 (3.6)
South Carolina	24 (3.2)	27 (3.2)	49 (3.8)	51 (3.3)
Texas	22 (3.1)	28 (3.7)	48 (4.4)	52 (4.7)
Districts and Consortia				
Academy School Dist. #20, CO	22 (1.6)	28 (1.9)	48 (2.3)	52 (2.1)
Chicago Public Schools,	23 (2.9)	27 (3.6)	50 (4.3)	51 (3.5)
Delaware Science Coalition, DE	22 (4.3)	29 (5.2)	47 (4.9)	53 (5.1)
First in the World Consort., IL	22 (3.8)	28 (3.7)	49 (3.6)	51 (3.9)
Fremont/Lincoln/WestSide PS, NE	24 (3.7)	26 (4.7)	50 (4.0)	50 (4.1)
Guilford County, NC [2]	22 (3.0)	28 (4.2)	47 (4.6)	54 (4.3)
Jersey City Public Schools, NJ	24 (3.8)	26 (4.7)	49 (4.6)	51 (3.5)
Miami-Dade County PS, FL	23 (4.1)	27 (3.5)	50 (3.9)	50 (5.0)
Michigan Invitational Group, MI	25 (3.6)	25 (3.6)	51 (4.2)	49 (4.5)
Montgomery County, MD [2]	24 (2.3)	26 (2.2)	48 (2.8)	52 (2.0)
Naperville Sch. Dist. #203, IL	23 (1.9)	27 (2.1)	49 (2.6)	51 (2.7)
Project SMART Consortium, OH	24 (4.5)	26 (4.4)	49 (4.8)	51 (5.0)
Rochester City Sch. Dist., NY	22 (3.9)	29 (3.0)	48 (4.4)	52 (3.7)
SW Math/Sci. Collaborative, PA	22 (3.1)	29 (4.2)	47 (4.3)	54 (4.3)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

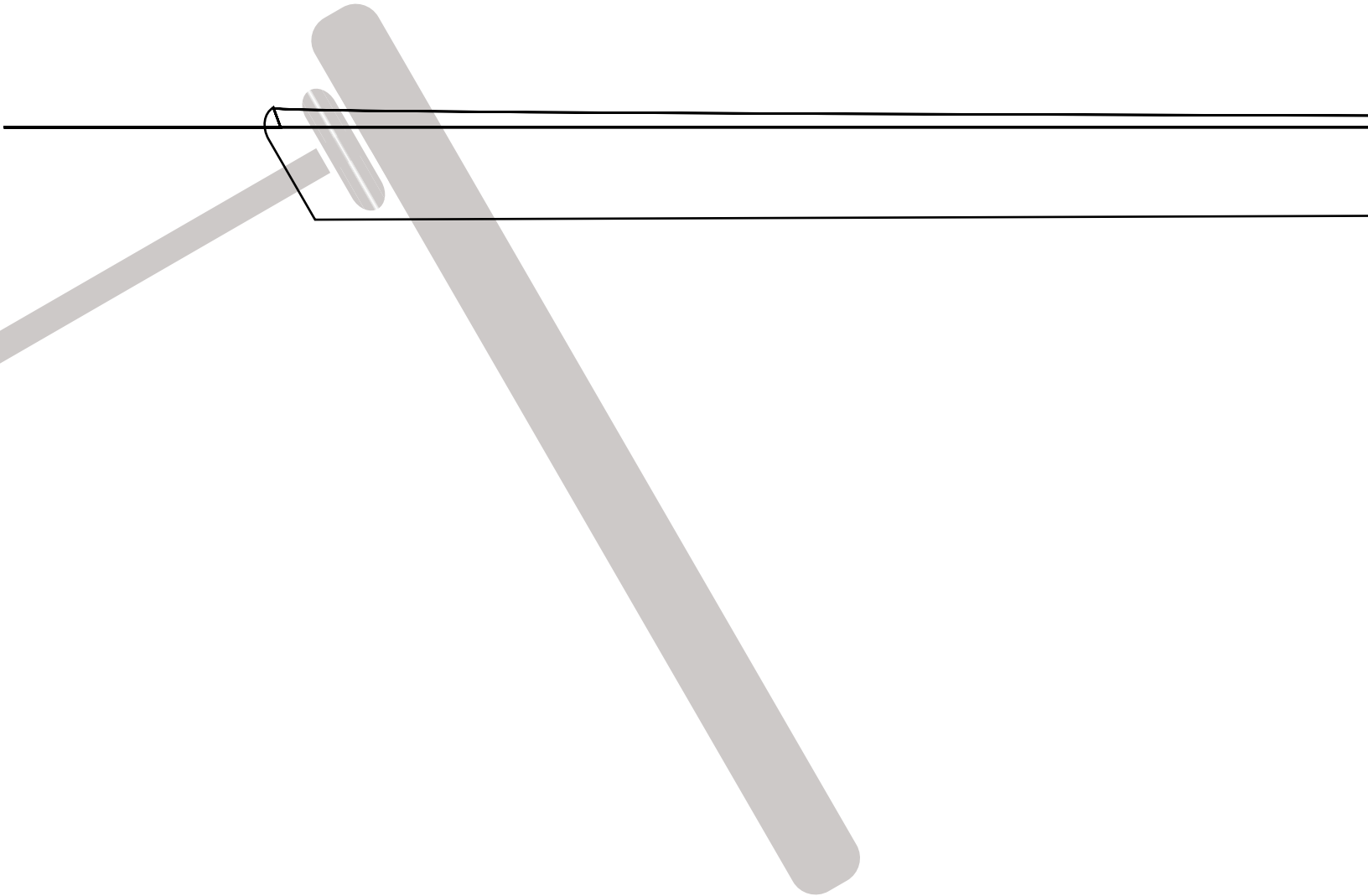
▲ Significantly greater percentage than other gender

Significance tests adjusted for multiple comparisons

chapter 2

Performance at International Benchmarks

The timss 1999 international benchmarks delineate performance of the top 10 percent, top quarter, top half, and lower quarter of students in the entities participating in the study. To help interpret the achievement results, Chapter 2 describes eighth-grade mathematics achievement at each of these benchmarks together with examples of the types of items typically answered correctly by students performing at the benchmark.



To provide an idea of the mathematics understandings and skills displayed by students performing at different levels on the timss mathematics achievement scale, timss described performance at four international benchmarks. The timss 1999 international benchmarks delineate performance of the top 10 percent, top quarter, top half, and lower quarter of students in the countries participating in the timss 1999 study. (The benchmarks were set at the 90th, 75th, 50th, and 25th percentiles, respectively.)

As states and school districts spend time and energy on improving students' mathematics achievement, it is important that educators, curriculum developers, and policy makers understand what students know and can do in mathematics, and what areas, concepts, and topics need more focus and effort. To help interpret the range of achievement results for the timss 1999 Benchmarking participants presented in Chapter 1, this chapter describes eighth-grade mathematics achievement at each of the timss 1999 international benchmarks, explaining the types of mathematics understandings and skills typically displayed by students performing at the benchmarks. The benchmark descriptions are presented together with examples of the types of mathematics test questions typically answered correctly by students reaching the benchmark. Appendix D contains the descriptions of the understandings and skills assessed by each item in the timss 1999 assessment at each benchmark.[1]

For each of the example test questions, the percentages of correct

students internationally. For example, top-performing Singapore had nearly half (46 percent) of its students reaching the Top 10% Benchmark and three-fourths (75 percent) reaching the Upper Quarter Benchmark – the point on the scale that typically only 25 percent of the students would be expected to reach if achievement were distributed equally from country to country. Most of the Singaporean students (93 percent) reached the Median Benchmark. Performance in the United States was closer to the distribution that might be expected if achievement were distributed the same from country to country: nine percent of the students reached the Top 10% Benchmark, 28 percent reached the Top Quarter Benchmark, and 61 percent reached the Median Benchmark.

The analysis of performance at these benchmarks in mathematics suggests

to identify the sets of items that students reaching each international benchmark were likely to answer correctly and those at the next lower benchmark were unlikely to answer correctly.[2] The sets of items thus produced represented the accomplishments of students reaching each benchmark and were used by a panel of subject-matter experts from the timss countries to develop the benchmark descriptions.[3] The work of the panel involved developing a short description for each item of the mathematical understandings demonstrated by students answering it correctly, summarizing students' knowledge and understandings across the set of items for each benchmark to provide more general statements of achievement, and selecting example items illustrating the descriptions.

How Should the Descriptions Be Interpreted?

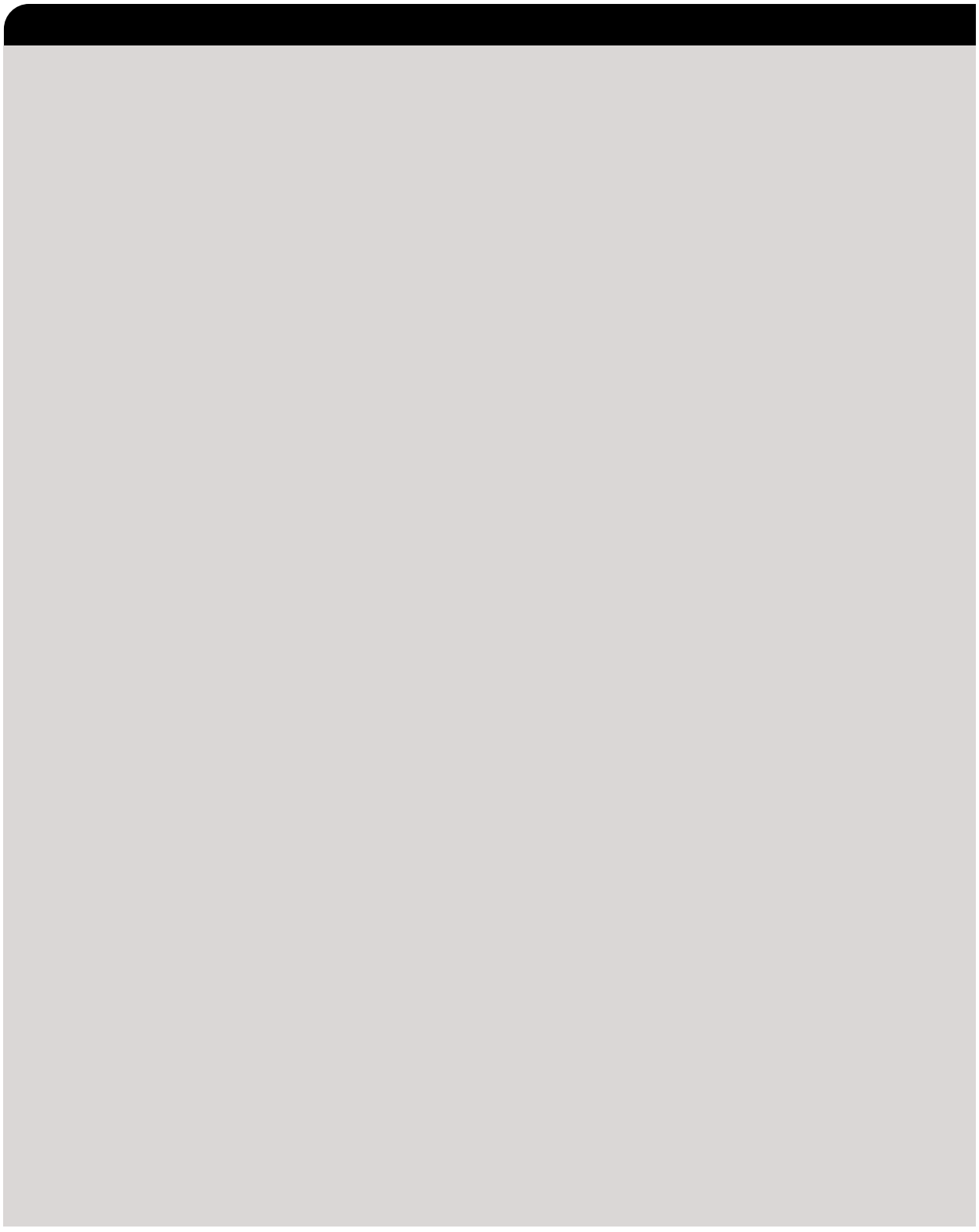
In general, the parts of the descriptions that relate to the understanding of mathematical concepts or familiarity with procedures are relatively straightforward. It needs to be acknowledged, however, that the cognitive behavior necessary to answer some items correctly may vary according to students' experience. An item may require only simple recall for a student familiar with the item's content and context, but necessitate problem-solving strategies from one unfamiliar with the material. Nevertheless, the descriptions are based on what the panel believed to be the way the great majority of eighth-grade students could be expected to perform.

It also needs to be emphasized that the descriptions of achievement characteristic of students at the international benchmarks are based solely on student performance on the timss 1999 items. Since those items were developed in particular to sample the mathematics domains prescribed for this study, neither the set of items nor the descriptions based on them purport to be comprehensive. There are undoubtedly other mathematics curriculum elements on which students at the various benchmarks would have been successful if they had been included in the assessment.

Please note that students reaching a particular benchmark demonstrated the knowledge and understandings characterizing that benchmark as well as those characterizing the lower benchmarks. The description of achievement at each benchmark is cumulative, building on the description of achievement demonstrated by students at the lower benchmarks.

2 For example, for the Top 10% Benchmark, an item was included if at least 65 percent of students scoring at the scale point corresponding to this benchmark answered the item correctly and less than 50 percent of students scoring at the Upper Quarter Benchmark answered it correctly. Similarly, for the Upper Quarter Benchmark, an item was included if at least 65 percent of students scoring at that point answered the item correctly and less than 50 percent of students at the Median Benchmark answered it correctly.

3 The participants in the scale anchoring process are listed in Appendix E.



subscriptions. With an international average of 24 percent correct (for full credit), this item was among the most difficult in timss 1999. Singapore, Korea, and Chinese Taipei were the only countries where the majority of the students answered correctly. The best performance by a Benchmarking entity was in Naperville, where 41 percent of the eighth graders answered correctly. Students in the First of World Consortium (36 percent) and Montgomery County (35f the

* The item was answered correctly by a majority of students reaching this benchmark.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.6).

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.3).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Content Area: Data Representation, Analysis and Probability

Description: Selects relevant information from two advertisements to solve a complex word problem involving decimals.

The answer shown illustrates the type of student response that was given full credit.

Singapore	57 (2.1)	▲
Korea, Rep. of	52 (1.5)	▲
Chinese Taipei	50 (1.8)	▲
Belgium (Flemish) †	42 (1.7)	▲
Naperville Sch. Dist. #203, IL	41 (2.6)	▲
Japan	39 (1.5)	▲
First in the World Consort., IL	36 (2.9)	▲
Montgomery County, MD [2]	35 (2.8)	▲
Hong Kong, SAR †	34 (1.8)	▲
Czech Republic	34 (2.5)	▲
Canada	32 (1.8)	▲
Connecticut	32 (2.7)	●
Texas	31 (4.0)	●
Russian Federation	30 (2.4)	●
Project SMART Consortium, OH	30 (3.5)	●
Indiana †	29 (3.5)	●
Massachusetts	29 (2.7)	●
Michigan Invitational Group, MI	29 (2.2)	●
Academy School Dist. #20, CO	27 (2.5)	●
Italy	27 (1.7)	●
Jersey City Public Schools, NJ	27 (4.4)	●
SW Math/Sci. Collaborative, PA	27 (3.2)	●
Guilford County, NC [2]	26 (2.4)	●
Pennsylvania		

* The item was answered fully correctly by a majority of students reaching this benchmark.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.6).

[2] National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.3).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Content Area: Geometry

Description: Uses properties of similar triangles to find the length of a corresponding side.

Korea, Rep. of	70 (1.9) ▲
Japan	68 (1.9) ▲

* The item was answered correctly by a majority of students reaching this benchmark.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.6).

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.3).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

* The item was answered fully correctly by a majority of students reaching this benchmark.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details

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

Achievement at the Upper Quarter Benchmark

Exhibit 2.6 describes performance at the Upper Quarter Benchmark. Eighth-grade students performing at this level applied their mathematical knowledge and understandings in a wide variety of relatively complex problem situations. For example, they demonstrated facility with fractions in various formats, as illustrated by Example Item 5 shown in Exhibit 2.7. This item required students to shade squares in a rectangular grid to represent a given fraction. Since the grid is divided

Students can apply their understanding and knowledge in a wide variety of relatively complex situations. They can order, relate and compute with fractions and decimals to solve word problems; solve multi-step word problems involving proportions with whole numbers; solve probability problems; use knowledge of geometric properties to solve problems; identify and evaluate algebraic expressions and solve equations with one variable.

Students demonstrate some facility with fractions and decimals through computation, ordering, rounding, and use in word problems. They can recognize equivalent fractions, add, subtract, multiply and divide fractions with unlike denominators, and correctly order operations. They can identify the smallest decimal from a set of decimals with differing number of places and provide a fraction that is less than a given fraction. They can solve word problems involving multiplication and division of whole numbers and fractions and use pictorial representations of fractions in solving problems. They can identify the fraction of an hour representing a given time interval and identify fractions representing the comparison of part to whole, given each of two parts in a word problem setting.

Students can select the correct rounding of a number involving four decimal places, identify the decimal that is between two decimals given in hundredths, and solve a word problem that involves multiplying a decimal in thousandths by a multiple of a hundred. They can produce an example of a number that would round to a given value. Given a length rounded to the nearest centimeter, they can identify an example of the actual length expressed to one decimal place. Students can

* The item was answered correctly by a majority of students reaching this benchmark.

States in *italics*

Content Area: Measurement

Description: Finds the area of a rectangle contained in a parallelogram of given dimensions.

Singapore	83 (1.5) ▲
Japan	80 (1.2) ▲
Hong Kong, SAR †	78 (1.6) ▲
Korea, Rep. of	78 (1.3) ▲
Chinese Taipei	75 (1.4) ▲
Naperville Sch. Dist. #203, IL	65 (2.8) ▲
Belgium (Flemish) †	65 (2.0) ▲
First in the World Consort., IL	62 (4.3) ▲
Canada	58 (1.6) ▲
Netherlands †	55 (4.7) ●
Academy School Dist. #20, CO	49 (3.4) ●
Russian Federation	49 (2.8) ●
Italy	48 (2.1) ●
England †	48 (2.3) ●
Czech Republic	46 (2.9) ●
Oregon	46 (4.0) ●
Michigan Invitational Group, MI	46 (3.9) ●
Montgomery County, MD 2	45 (3.9) ●

The answer shown illustrates the type of student response that was given credit.

* The item was answered correctly by a majority of students reaching this benchmark.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.6).

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.3).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Content Area: Algebra

Description: Solves a linear equation involving transposing.

Find th

7

$12x - 6x - 10 = 32$

$\Rightarrow 6x = 42$

$\Rightarrow \frac{6x}{6} = \frac{42}{6}$

$\Rightarrow x = 7.$

The answer shown illustrates the type of student response that was given credit.

	Overall Percent Correct
Japan	85 (1.4) ▲
Hong Kong, SAR †	80 (1.9) ▲
Korea, Rep. of	80 (1.5) ▲
Russian Federation	77 (3.1) ▲
Singapore	75 (2.8) ▲
Chinese Taipei	73 (2.0) ▲
Naperville Sch. Dist. #203, IL	72 (3.6) ▲
Czech Republic	66 (2.8) ▲
First in the World Consort., IL	61 (5.0) ▲
Belgium (Flemish) †	58 (1.9) ▲
Academy School Dist. #20, CO	57 (5.1) ●
Montgomery County, MD [2]	55 (4.1) ●
Italy	46 (2.8) ●
Indiana †	44 (5.7) ●
Michigan	40 (3.7) ●
Guilford County, NC [2]	40 (6.1) ●
Massachusetts	39 (3.7) ●
South Carolina	39 (3.9) ●
Texas	38 (5.3) ●
SW Math/Sci. Collaborative, PA	38 (3.8) ●
Oregon	37 (3.9) ●
Maryland	35 (3.7) ●
Idaho	34 (5.2) ●
United States	34 (1.8) ▼
Michigan Invitational Group, MI	33 (6.5) ●
Canada	33 (3.1) ▼
Project SMART Consortium, OH	32 (5.3) ●
Connecticut	32 (3.7) ▼
Illinois	32 (4.1) ▼
Pennsylvania	31 (2.6) ▼
North Carolina	27 (3.9) ▼
Rochester City Sch. Dist., NY	27 (5.2) ▼
Jersey City Public Schools, NJ	26 (5.0) ▼
England †	26 (2.7) ▼
Delaware Science Coalition, DE	25 (5.2) ▼
Missouri	24 (3.1) ▼
Fremont/Lincoln/WestSide PS, NE	22 (4.1) ▼
Netherlands †	19 (2.9) ▼
Miami-Dade County PS, FL	17 (4.8) ▼
Chicago Public Schools, IL	10 (2.3) ▼
International Avg. (All Countries)	44 (0.4)

▲ Participant average significantly higher than international average

● No statistically significant difference between participant average and international average

▼ Participant average significantly lower than international average

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Achievement at the Median Benchmark

Students at the Median Benchmark demonstrated the ability to apply basic mathematical knowledge in straightforward situations (see Exhibit 2.12). For example, as shown by Example Item 10 in Exhibit 2.13, students showed that they understand rounding and can use it to estimate the results of computations. Given the number of rows of cars in a parking lot and the number of cars in each row, students chose the number sentence that would give the best estimate of the total number of cars. While students at the Lower Quarter Benchmark rounded to the nearest hundred, students at the Median Benchmark successfully rounded numbers to get the best estimate for a product. Moreover, middle-performing students demonstrated greater competence with word problems than did those at the Lower Quarter Benchmark. The Benchmarking participants performed particularly well on this test

Students can apply basic mathematical knowledge in straightforward situations. They can add or subtract to solve one-step word problems involving whole numbers and decimals; identify representations of common fractions and relative sizes of fractions; solve for missing terms in proportions; recognize basic notions of percents and probability; use basic properties of geometric figures; read and interpret graphs, tables, and scales; and understand simple algebraic relationships.

Students can apply basic mathematical knowledge in straightforward situations. They are able to use addition and subtraction to solve one-step word problems involving whole numbers and decimals. They can round whole numbers to the nearest hundred and identify the number sentence that gives the best estimate for the product of two numbers after rounding. Students can arrange four given digits in descending and ascending order to form the largest and smallest possible numbers, and find the difference between those two numbers. Students can approximate the quantity remaining after an amount is reduced by a given percent.

Students demonstrate an understanding of place value in decimal numbers. They can estimate the location of a point representing a decimal number in tenths on a number line marked in whole numbers and identify an unlabeled midway point on a number line marked in tenths. They can set up and solve one-step problems involving addition and subtraction of numbers having up to three decimal places, including situations where the numbers have a different number of decimal places. Given an object of one length, to one decimal place, they can estimate the length of another object.

Students can select the smallest fraction from a list of fractions and can recognize models representing fractions as shaded regions. They can find the missing term in a proportion in word problems and number sentences. Students can solve a simple word problem involving the likelihood of a successful outcome.

Students are able to select the appropriate metric unit to measure the mass of an object. They recognize the inverse relationship between the length of a unit and the number of units required to cover a distance.

Students can locate and interpret data presented in bar graphs, pictographs, pie graphs, and line graphs. Given a table of values for two variables, they can select the graph that represents the given data.

Students can solve problems involving the properties

Content Area: Algebra

Description: Identifies the linear equation corresponding to a given verbal statement involving a variable.

Naperville Sch. Dist. #203, IL	94 (1.4)	▲
Hong Kong, SAR †	93 (0.9)	▲
First in the World Consort., IL	90 (1.4)	▲
Singapore	89 (1.7)	▲
Montgomery County, MD 2	87 (1.4)	▲
Japan	86 (0.8)	▲
Academy School Dist. #20, CO	85 (1.6)	▲
Korea, Rep. of	85 (0.7)	▲
Chinese Taipei	84 (1.1)	▲
Michigan	82 (1.6)	▲
Canada	82 (1.0)	▲
Russian Federation	82 (1.6)	▲
Project SMART Consortium, OH	82 (2.1)	▲
Pennsylvania	81 (1.8)	▲
Belgium (Flemish) †	81 (1.2)	▲
Massachusetts		

Achievement at the Lower Quarter Benchmark

As shown in Exhibit 2.16, the few items anchoring at the Lower Quarter Benchmark provided evidence that students performing at this level can add, subtract, and round with whole numbers. For example, students answering Example Item 13 correctly rounded 691 and 208 to estimate their sum as close to the sum of 700 and 200 (see Exhibit 2.17). The international average was 80 percent correct, and 27 countries had three-quarters or more of their students choosing the correct answer. In four countries – Singapore, Belgium (Flemish), Japan, and the Netherlands – 95 percent or more of the students gave the correct response. That level of performance was attained by students in twelve Benchmarking entities: Naperville, Indiana, the Michigan Invitational Group, the Southwest Pennsylvania Math and Science Collaborative, Montgomery County, the Project smart Consortium, Connecticut, Pennsylvania, Illinois, Missouri, Texas, and the First in the World

In addition, Example Item 16 in Exhibit 2.20 shows that students at this level could read a thermometer and locate the correct reading in a table. Internationally on average, 79 percent of students answered the item correctly. Students in the Benchmarking entities performed comparatively well on this question. Sixteen of the Benchmarking participants performed significantly above the international average and none below it. Essentially all of the students in Naperville (99 percent) responded correctly, and 90 percent or more did so in First in the World, the Academy School District, Illinois, Project smart, Indiana, the Southwest Pennsylvania Math and Science Collaborative, and Massachusetts.

• Lower Quarter Benchmark

Summary

Students can do basic computations with whole numbers.

The few items at this level provide some evidence that students can add, subtract, and round with whole numbers. When there are the same number of decimal places, they can subtract with multiple regrouping. Students can round whole numbers to the nearest hundred. They can read a thermometer and locate the reading in a table. Students recognize some basic notation.

25th Percentile: 396

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Content Area: Fractions and Number Sense

Description: Rounds to estimate the sum of two three-digit numbers.

Naperville Sch. Dist. #203, IL	99 (0.5) ▲
Indiana †	97 (0.7) ▲
Singapore	97 (0.5) ▲
Michigan Invitational Group, MI	97 (1.0) ▲
Belgium (Flemish) †	96 (0.7) ▲
SW Math/Sci. Collaborative, PA	96 (1.1) ▲
Montgomery County, MD 2	95 (0.9) ▲
Project SMART Consortium, OH	95 (1.0) ▲
Japan	95 (0.5) ▲
Connecticut	95 (1.1) ▲
Pennsylvania	95 (1.1) ▲
Illinois	95 (0.9) ▲
Missouri	95 (0.8) ▲

c{0R9}dle6 f05 1sa-460c6oe6l6_599i91906.5s gl8on8h76.51p2

* The item was answered correctly by a majority of students reaching this benchmark.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.6).

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.3).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Content Area: Fractions and Number Sense

Subtract:

$$\begin{array}{r} 7003 \\ -\ 4078 \\ \hline \end{array}$$

A. 2035

B. 2925

C. 3005

D. 3925

Singapore	92 (1.3)	▲
Chinese Taipei	90 (1.2)	▲
Texas	90 (1.9)	▲
Hong Kong, SAR †	90 (1.3)	▲
Korea, Rep. of	88 (1.2)	▲
Naperville Sch. Dist. #203, IL	88 (2.7)	▲
Japan	86 (1.4)	▲
Belgium (Flemish) †	85 (2.1)	▲
Academy School Dist. #20, CO	84 (2.8)	▲
Indiana †	84 (3.3)	●
Canada	83 (1.4)	▲
Massachusetts	82 (2.3)	▲
Montgomery County, MD ²	82 (4.3)	●
Illinois	82 (2.4)	●
Czech Republic	82 (2.4)	●
Jersey City Public Schools, NJ	81 (2.8)	●
Idaho	81 (2.8)	●
United States	81 (1.6)	▲
Oregon	80 (2.1)	●
Guilford County, NC ²	80 (4.5)	●
Chicago Public Schools, IL	80 (4.9)	●
Russian Federation	79 (2.2)	●
Nm5e2a1s0003 Tm[(374)GS2 ,50 M 0 978 474.3253 Tm()Tj0 0 0 1 k332s	79 (3.4)	●
SW Math/Sci. Collaborative, PA	79 (2.9)	●
Michigan Invitational Group, MI	78 (4.8)	●
Missouri	77 (3.3)	●
Pennsylvania	77 (2.4)	●
Connecticut	77 (3.8)	●
South Carolina	77 (2.6)	●

Project SMART Consortium, [.06 0 Td[(78)-468((4.8))]TJ0 0 0 0.2 k/GS2 gs/T1lM, MI

Naperville Sch. Dist. #203, IL	99 (1.0)	▲
Japan	96 (0.8)	▲
Singapore	95 (0.9)	▲
Belgium (Flemish) †	95 (1.5)	▲
First in the World Consort., IL	95 (2.7)	▲
Academy School Dist. #20, CO	92 (2.1)	▲
Korea, Rep. of	92 (0.9)	▲
England †	92 (2.2)	▲
Chinese Taipei	91 (1.2)	▲
Czech Republic	91 (1.9)	▲
Illinois	91 (1.8)	▲
Project SMART Consortium, OH	91 (3.7)	●
Indiana †	91 (1.9)	▲
SW Math/Sci. Collaborative, PA	91 (1.8)	▲
Hong Kong, SAR †	90 (1.5)	▲
Netherlands †	90 (2.6)	▲
Massachusetts	90 (2.0)	▲
Canada	89 (2.6)	▲
United States	89 (1.2)	▲
Fremont/Lincoln/WestSide PS, NE	89 (2.2)	▲
Montgomery County, MD 2	89 (3.2)	●
North Carolina	89 (2.2)	▲
Idaho	89 (2.6)	▲
Oregon	88 (1.9)	▲
Michigan Invitational Group, MI	88 (3.3)	●
Texas	88 (2.3)	▲
Guilford County, NC 2	88 (4.1)	●
Michigan	88 (2.7)	▲
Pennsylvania	87 (3.6)	●
Connecticut	87 (3.6)	●
Missouri	87 (1.9)	▲
Maryland	87 (1.8)	▲
Delaware Science Coalition, DE	87 (3.2)	●
South Carolina	87 (2.1)	▲
Chicago Public Schools, IL	86 (3.5)	●

chapter

Chapter 3 presents results by the major content areas in mathematics to provide information about the possible effects of curricular variation on average achievement. Average performance is provided for five content areas: fractions and number sense;

As delineated by the curriculum of the countries around the world and in the Benchmarking entities, mathematics contains a range of

How Does Achievement Differ Across Mathematics Content Areas?

Exhibit 3.1 presents average achievement in each of the five mathematics content areas for the Benchmarking states, districts, and consortia. The Benchmarking jurisdictions as well as selected reference countries are displayed in decreasing order of achievement for each content area, and symbols indicate whether performance is statistically significantly above or below the international average for all of the countries that participated in timss 1999. To allow comparison of the relative performance of each country in each content area, the international average for each content area was scaled to be 487, the same as the overa-2h..4871E369pTwsmJi5l3conKsrs.aiapTw.(Da)Tj2

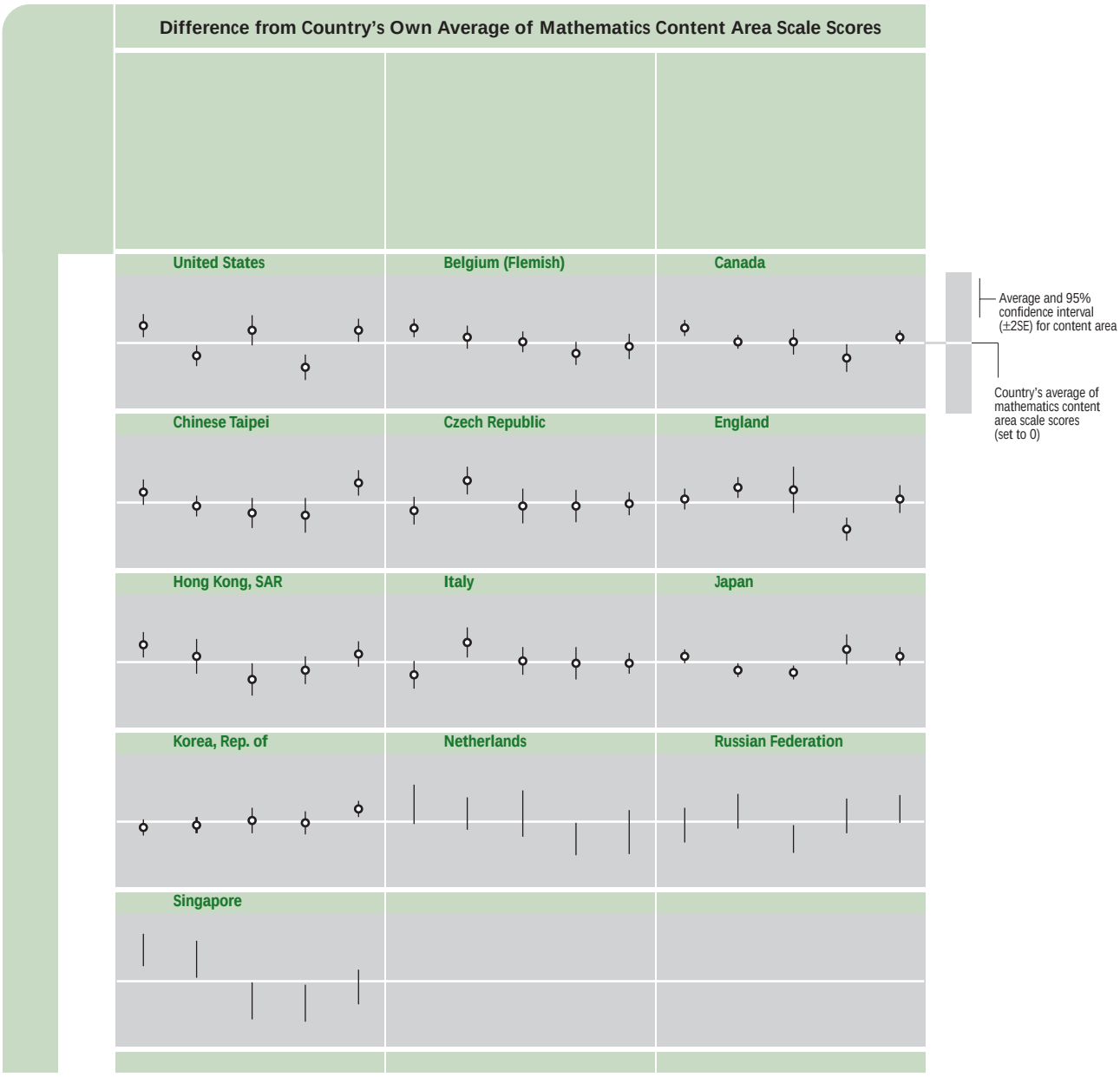
States in *italics*

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.6).

2 National Defined Population covers less than 90% of National Desired Population (see Exhibit A.3).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.



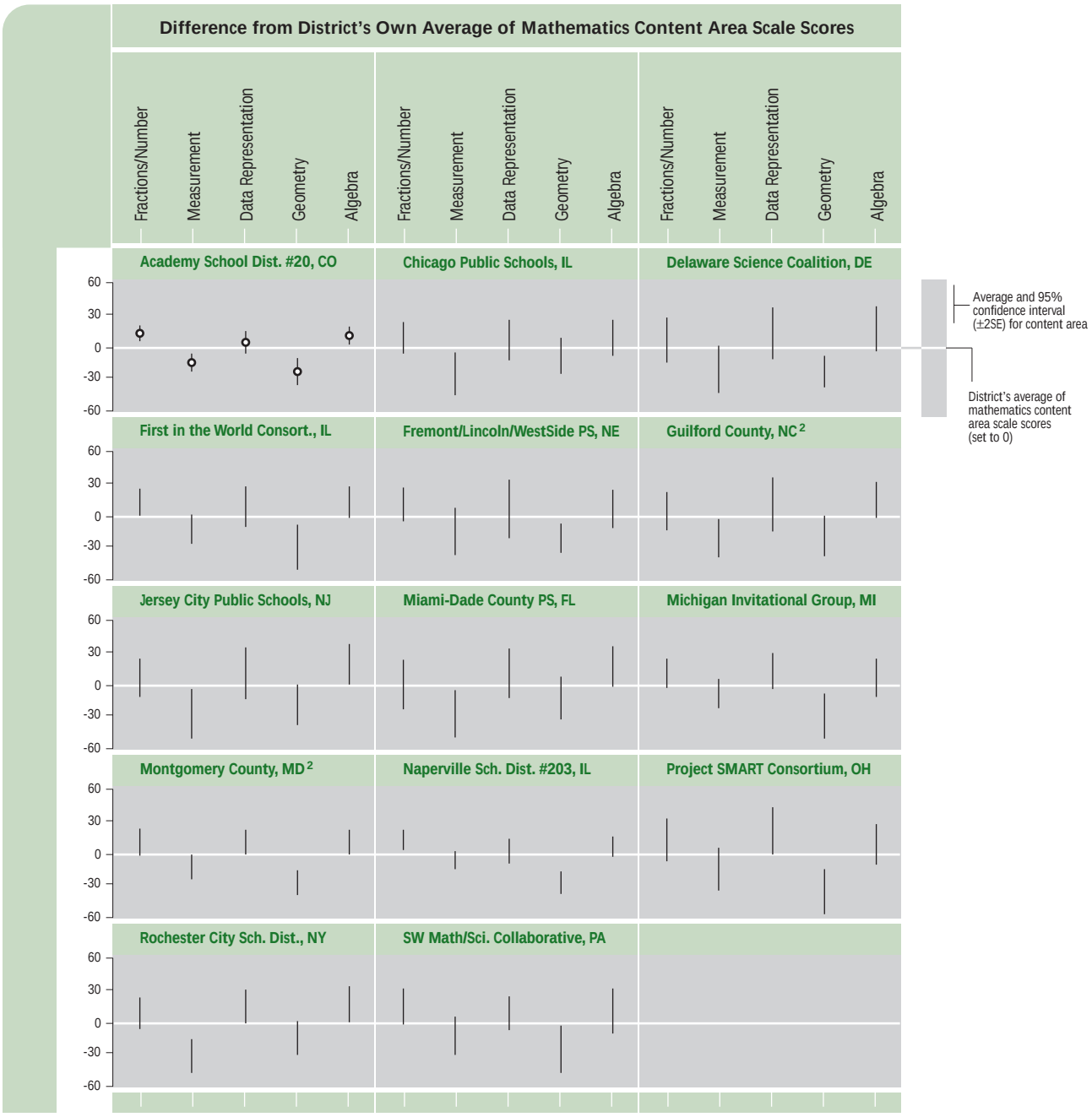
† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.6).

Difference from State's Own Average of Mathematics Content Area Scale Scores

Connecticut	**Idaho**	**Illinois**
Indiana	**Maryland**	**Massachusetts**
Michigan	**Missouri**	**North Carolina**
Oregon	***Pennsylvania***	**South Carolina**
Texas		

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.6).



2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.3).

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).
†

Countries				
United States	469 (5.5)	477 (5.1)		
Belgium (Flemish) †	538 (6.9)	531 (9.1)		
Canada	511 (6.5)	503 (4.9)		
Chinese Taipei	555 (7.1)	560 (6.8)		
Czech Republic	506 (7.6)	520 (4.9)		
England †	467 (4.8)	474 (6.7)		
Hong Kong, SAR †	558 (6.1)	554 (6.4)		
Italy	476 (8.6)	489 (5.1)		
Japan	572 (5.8)	578 (5.8)		
Korea, Rep. of	569 (7.3)	578 (4.8)		
Netherlands †	516 (7.0)	515 (5.2)		
Russian Federation	518 (7.2)	526 (7.4)		
Singapore	556 (9.2)	565 (6.5)		
States				
Connecticut	465 (10.5)	475 (8.8)		
Idaho	462 (9.3)	468 (7.1)		
Illinois	479 (8.5)	487 (9.5)		
Indiana †	471 (8.9)	481 (8.0)		
Maryland	462 (5.6)	471 (7.8)		
Massachusetts	475 (6.0)	478 (7.1)		
Michigan	480 (7.0)	493 (10.8)		
Missouri	464 (7.3)	468 (8.8)		
North Carolina	473 (8.3)	478 (7.3)		
Oregon	485 (8.9)	487 (6.9)		
Pennsylvania	466 (5.9)	479 (5.5)		
South Carolina	474 (9.8)	479 (9.1)		
Texas	484 (7.3)	489 (9.8)		
Districts and Consortia				
Academy School Dist. #20, CO	495 (6.5)	504 (5.5)		
Chicago Public Schools, IL	457 (5.8)	456 (9.4)		
Delaware Science Coalition, DE	456 (6.3)	458 (9.1)		
First in the World Consort., IL	519 (7.2)	518 (12.5)		
Fremont/Lincoln/WestSide PS, NE	461 (6.6)	473 (8.0)		
Guilford County, NC [2]	487 (8.2)	495 (9.1)		
Jersey City Public Schools, NJ	454 (10.3)	462 (7.2)		
Miami-Dade County PS, FL	420 (8.8)	425 (9.3)		
Michigan Invitational Group, MI	500 (8.9)	489 (10.2)		
Montgomery County, MD [2]	500 (8.0)			
Naperville Sch. Dist. #203, IL	522 (7.3)			
Project SMART Consortium, OH	470 (9.7)			
Rochester City Sch. Dist., NY	427 (10.7)			
SW Math/Sci. Collaborative, PA	476 (9.3)			
International Avg. (All Countries)	485 (1.2)			

chapter 4

Students' Backgrounds and Attitudes Towards Mathematics

There is abundant evidence that student achievement is related to home background factors, and to students' activities and attitudes. To help interpret the achievement results, Chapter 4 provides detailed information about students' home backgrounds, how they spend their time out of school, their self-concept in mathematics, and their attitudes towards mathematics.

To provide an educational context for interpreting the achievement results of the Benchmarking participants, timss collected detailed information from students about their home backgrounds, how they spend their time, and their attitudes towards mathematics. This chapter presents eighth-grade students' responses to a subset of these questions. One set addresses home resources and support for academic achievement. Another examines how much out-of-school time students spend on their schoolwork. A third addresses students' self-concept in mathematics and their feelings towards mathematics.

In an effort to summarize this information concisely and focus attention on educationally relevant support and practice, timss sometimes has combined information from individual questions to form an index that was more global and reliable than the component questions (e.g., home educational resources). According to their responses, students were placed in a "high," "medium," or "low" category. Cutoff points were established so that the high level of an index corresponds to conditions or activities generally associated with good educational practice and high academic achievement. For each index, the percentages of students in each category are presented in relation to their mathematics achievement. The data from the component questions and more detail about some areas are provided in the reference section of this report (see reference section R1).

What Educational Resources Do Students Have in Their Homes?

There is no shortage of evidence that students from homes with extensive educational resources have higher achievement in mathematics and other subjects than those from less advantaged backgrounds. timss in 1995 showed that this was true of students from homes with large numbers of books, with a range of educational study aids, or with parents with university-level education.[1] The timss 1999 international report presented combined student responses to these three variables in an index of home educational resources (her) that was clearly related to achievement in mathematics.[2]

Exhibit 4.1 summarizes the home educational resources index in a two-page display. The index is described on the first page. Students at the high level of this index reported coming from homes with more than 100 books, with all three study aids (a computer, a study desk or table for the student's own use, and a dictionary), and where at least one

text continued from page 111

used in this report. Despite the different educational approaches, structures, and organizations across the timss 1999 countries, it is clear that parents' education is positively related to students' mathematics achievement. The pattern across countries was that eighth-grade students whose parents had more education were also those who had higher achievement in mathematics. The same was true for nearly all Benchmarking jurisdictions.

As information technology and the Internet become more and more important as an educational resource, those who do not have access to this technology will be increasingly at a disadvantage. To provide information about this "digital divide," Exhibit 4.2 presents the percentage of students in each entity that reported having a computer at home, together with their average mathematics achievement. Compared with some of the reference countries as well as the international average (45 percent), students in the Benchmarking jurisdictions reported relatively high levels of computer ownership; more than 70 percent of students in each state reported having a computer at home. In the wealthier districts and consortia such as the Academy School District, the First in the World Consortium, Montgomery County, and the Naperville School District, more than 90 percent of students so reported. Even in the less advantaged public school districts, more than half the students reported having a computer at home. In almost every entity, students with a computer at home had higher average mathematics achievement than those without.

Students who speak a language (or languages) in the home that is different from the language spoken in school sometimes benefit from being multilingual. However, when they are still developing proficiency in the language of instruction they can be at a disadvantage in learning situations. Exhibit 4.3 contains students' reports of how frequently they speak the language of the timss test at home in relation to their average mathematics achievement. Students from homes where the language of the test is always or almost always spoken had higher average achievement than those who spoke it less frequently. In all of the Benchmarking states except Massachusetts and Texas, 90 percent or more of the students reported always or almost always speaking the language of the test at home. The percentage of students speaking the language of the test at home was lower in a number of school districts, however, particularly the public school systems in Chicago, Jersey City, and Miami-Dade.

Exhibit 4.4 presents students' reports of their race/ethnicity. Across the United States as a whole, 63 percent reported that they were white, 15 percent black, 12 percent Hispanic, five percent Asian or Pacific Islander, one percent American Indian or Alaskan Native, and four percent other.

There was a pronounced relationship between race/ethnicity and mathematics achievement, with Asian/Pacific Islander students having the highest average achievement, followed by white, Hispanic, and black students. This pattern was found for many of the Benchmarking participants. Because minority students are often concentrated in urban schools, the resource disparities between urban and non-urban schools summarized in the introduction to this report are particularly

Background data provided by students.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report achievement.

Countries						
United States	90 (1.0)	509 (3.8)	9 (1.0)	456 (8.2)	1 (0.1)	~ ~
Belgium (Flemish)	86 (1.3)	566 (3.2)	8 (0.7)	531 (8.0)	6 (0.9)	522 (13.5)

Background data provided by students.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report achievement.

An "r" indicates a 70-84% student response rate.

	White		Black		Hispanic	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
States						
Connecticut	74 (4.5)	533 (6.8)	10 (3.0)	432 (12.5)	9 (2.2)	451 (13.5)
Idaho	83 (2.0)	506 (6.5)	1 (0.3)	~ ~	10 (1.7)	432 (8.9)
Illinois	65 (3.4)	533 (5.3)	17 (2.9)	449 (7.8)	12 (2.3)	462 (10.3)
Indiana	83 (2.3)	525 (7.2)	10 (2.2)	438 (6.5)	3 (0.6)	493 (11.9)
Maryland	55 (4.2)	521 (4.7)	30 (3.9)	438 (7.0)	4 (0.6)	487 (12.8)
Massachusetts	74 (3.4)	524 (5.1)	7 (1.6)	464 (20.4)	8 (1.4)	464 (11.0)
Michigan	82 (3.4)	532 (5.9)	10 (3.4)	418 (9.5)	3 (0.6)	481 (15.6)
Missouri	78 (3.2)	505 (4.9)	15 (3.1)	426 (12.3)	2 (0.4)	~ ~
North Carolina	62 (3.5)	521 (6.7)	31 (3.2)	447 (7.9)	3 (0.5)	474 (14.1)
Oregon	80 (1.9)	523 (5.4)	1 (0.5)	~ ~	8 (1.1)	452 (13.6)
Pennsylvania	78 (4.5)	519 (5.6)	12 (3.7)	446 (16.8)	3 (1.3)	476 (7.1)
South Carolina	63 (4.0)	533 (6.0)	32 (4.0)	446 (7.0)	1 (0.4)	~ ~
Texas	47 (5.2)	562 (5.0)	13 (2.5)	464 (16.7)	32 (4.7)	476 (8.6)
Districts and Consortia						
Academy School Dist. #20, CO	82 (1.0)	535 (2.4)	3 (0.5)	484 (15.7)	7 (0.6)	496 (8.7)
Chicago Public Schools, IL	11 (3.2)	499 (12.5)	47 (10.6)	447 (8.4)	37 (8.9)	468 (10.0)
Delaware Science Coalition, DE	63 (2.3)	501 (9.3)	24 (2.0)	435 (6.2)	5 (0.7)	465 (12.4)
First in the World Consort., IL	74 (1.8)	564 (5.6)	1 (0.3)	~ ~	7 (0.8)	478 (5.0)
Fremont/Lincoln/WestSide PS, NE	83 (1.6)	498 (8.1)	3 (0.8)	437 (28.6)	4 (0.7)	404 (14.6)
Guilford County, NC	57 (2.1)	544 (6.8)	35 (2.3)	463 (8.6)	2 (0.5)	~ ~
Jersey City Public Schools, NJ	7 (0.9)	513 (14.7)	35 (1.7)	442 (7.7)	35 (1.1)	474 (6.4)
Miami-Dade County PS, FL	7 (2.5)	501 (24.8)	31 (5.6)	381 (11.5)	55 (6.8)	438 (8.5)
Michigan Invitational Group, MI	88 (1.2)	534 (6.0)	4 (1.0)	473 (14.5)	1 (0.5)	~ ~
Montgomery County, MD	50 (2.7)	564 (6.2)	16 (1.3)	482 (9.3)	12 (1.8)	480 (13.0)
Naperville Sch. Dist. #203, IL	82 (1.0)	569 (2.6)	1 (0.4)	~ ~	2 (0.5)	~ ~
Project SMART Consortium, OH	79 (1.9)	530 (8.4)	10 (1.5)	476 (5.5)	4 (0.7)	475 (12.5)
Rochester City Sch. Dist., NY	16 (2.2)	504 (12.0)	56 (2.6)	428 (6.1)	16 (1.7)	443 (6.5)
SW Math/Sci. Collaborative, PA	87 (2.9)	526 (6.9)	10 (2.6)	440 (11.9)	1 (0.3)	~ ~
United States	63 (2.4)	525 (4.6)	15 (1.9)	444 (5.5)	12 (1.6)	457 (6.4)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report achievement.

	Asian/ Pacific Islander		American Indian/ Alaskan Native		Other	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
States						
Connecticut	2 (0.4)	~ ~	0 (0.2)	~ ~	4 (0.6)	481 (13.8)
Idaho	2 (0.5)	~ ~	2 (0.5)	~ ~	2 (0.3)	~ ~
Illinois	4 (0.9)	544 (11.9)	0 (0.2)	~ ~	2 (0.4)	~ ~
Indiana	2 (0.4)	~ ~	1 (0.3)	~ ~	2 (0.4)	~ ~
Maryland	5 (0.6)	551 (7.0)	1 (0.2)	~ ~	5 (0.6)	511 (12.5)
Massachusetts	5 (0.8)	559 (19.8)	1 (0.2)	~ ~	5 (0.8)	490 (13.4)
Michigan	2 (0.3)	~ ~	1 (0.2)	~ ~	3 (0.3)	490 (14.1)
Missouri	1 (0.3)	~ ~	1 (0.4)	~ ~	3 (0.4)	450 (15.3)
North Carolina	1 (0.3)	~ ~	1 (0.4)	~ ~	2 (0.4)	~ ~
Oregon	4 (0.7)	531 (10.0)	3 (0.5)	482 (11.7)	4 (0.5)	517 (10.0)
Pennsylvania	3 (1.4)	526 (17.1)	1 (0.2)	~ ~	3 (0.5)	512 (12.1)
South Carolina	1 (0.2)	~ ~	1 (0.2)	~ ~	2 (0.3)	~ ~
Texas	4 (1.4)	569 (24.1)	1 (0.1)	~ ~	3 (0.4)	515 (16.7)
Districts and Consortia						
Academy School Dist. #20, CO	4 (0.6)	527 (10.7)	1 (0.3)	~ ~	4 (0.5)	511 (12.1)
Chicago Public Schools, IL	2 (1.0)	~ ~	1 (0.2)	~ ~	2 (0.5)	~ ~
Delaware Science Coalition, DE	2 (0.6)	~ ~	1 (0.2)	~ ~	5 (0.9)	475 (13.6)
First in the World Consort., IL	15 (1.7)	591 (11.4)	1 (0.4)	~ ~	2 (0.8)	~ ~
Fremont/Lincoln/WestSide PS, NE	3 (0.5)	476 (17.6)	2 (0.4)	~ ~	5 (0.9)	475 (19.3)
Guilford County, NC	4 (0.4)	529 (14.2)	1 (0.2)	~ ~	2 (0.5)	~ ~
Jersey City Public Schools, NJ	16 (1.7)	533 (16.2)	0 (0.2)	~ ~	7 (0.8)	504 (16.5)
Miami-Dade County PS, FL	2 (0.6)	~ ~	1 (0.1)	~ ~	5 (1.1)	426 (24.1)
Michigan Invitational Group, MI	3 (0.5)	580 (16.4)	0 (0.2)	~ ~	3 (0.3)	533 (19.2)
Montgomery County, MD	15 (1.4)	564 (6.7)	1 (0.2)	~ ~	6 (0.8)	535 (14.3)
Naperville Sch. Dist. #203, IL	12 (0.8)	599 (5.9)	0 (0.1)	~ ~	3 (0.5)	549 (8.6)
Project SMART Consortium, OH	3 (0.5)	550 (23.1)	1 (0.2)	~ ~	3 (0.7)	519 (15.8)
Rochester City Sch. Dist., NY	3 (0.5)	500 (22.4)	2 (0.5)	~ ~	7 (1.0)	465 (13.3)
SW Math/Sci. Collaborative, PA	1 (0.4)	~ ~	0 (0.1)	~ ~	2 (0.4)	~ ~
United States	5 (1.3)	539 (10.7)	1 (0.2)	~ ~	4 (0.3)	496 (9.5)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

* Response categories were defined by each country to conform to their own educational system and may not be strictly comparable across countries. See Reference Exhibit R1.4 for country definitions of educational levels.

1 In most countries, finish university is defined as completion of at least a 4-year degree program at a university or an equivalent institute of higher education. For the United States, includes community college, college, or university.

2 In some countries, may include higher post-secondary education levels.

3 In most countries, finish secondary school corresponds to completion of an upper-secondary track terminating after 11 to 13 years of schooling (ISCED level 3 vocational, apprenticeship or academic tracks).

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

How Much of Their Out-of-School Time Do Students Spend on Homework During the School Week?

One of the main ways for students to consolidate and extend classroom learning is to spend time out of school studying or doing homework. Well-chosen homework assignments can reinforce classroom learning, and by providing a challenge can encourage students to extend their understanding of the subject matter. Homework also allows students who are having trouble keeping up with their classmates to review material taught in class.

To summarize the amount of time typically devoted to homework in each country and Benchmarking jurisdiction, timss constructed an index of out-of-school study time (ost) that assigns students to a high, medium, or low level based on the amount of time they reported studying mathematics, science, and other subjects. Students at the high level reported spending more than three hours each day out of school studying all subjects combined. Students at the medium level reported spending more than one hour but not more than three, while those at the low level reported one hour or less per day.

Exhibit 4.6 shows the percentages of students at each level of this index, and their average mathematics achievement, for Benchmarking participants and comparison countries. On average across all the timss 1999 countries, 38 percent of eighth-grade students were at the high level of the out-of-school study time index, and a further 48 percent were at the medium level. Only 14 percent, on average, were at the low level, with just one hour of homework or less each day. The United States was one of the countries with relatively little emphasis on homework, with just 22 percent of students at the high level and 23 percent at the low level. Among Benchmarking participants, the jurisdictions that reported the greatest amount of out-of-school study time included the Jersey City and Chicago Public Schools, and the Academy School District, which each had more than one-third of their students at the high level of the index.

On average internationally, and in many of the Benchmarking entities, students at the low index level had lower average mathematics achievement than their classmates who reported more out-of-school study time. However, spending a lot of time studying was not necessarily associated with higher achievement. In many of the Benchmarking entities, students at the medium level of the study index had average achievement that was as high as or higher than that of students at the high

level. This pattern suggests that, compared with their higher-achieving counterparts, the lower-performing students may do less homework, either because they simply do not do it or because their teachers do not assign it, or more homework, perhaps in an effort to keep up academically.

More detailed information on the amount of time students reported

Exhibits 4.6-4.7

Background data provided by students.

1 Average hours based on: No time=0; less than 1 hour=.5; 1-2 hours=1.5; 3-5 hours=4; more than 5 hours=7.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

How Do Students Perceive Their Ability in Mathematics?

To investigate how students think of their abilities in mathematics, timss created an index of students' self-concept in mathematics (scm). It is based on student's responses to five statements about their mathematics ability:

- I would like mathematics much more if it were not so difficult
- Although I do my best, mathematics is more difficult for me than for many of my classmates
- Nobody can be good in every subject, and I am just not talented in mathematics
- Sometimes when I do not understand a new topic in mathematics initially, I know that I will never really understand it
- Mathematics is not one of my strengths.

Students who disagreed or strongly disagreed with all five statements were assigned to the high level of the index, while students who agreed or strongly agreed with all five were assigned to the low level. The medium level includes all other combinations of responses. (As an example of one of the components of the index, Exhibit R1.11 in the reference section shows the percentages of agreement for the statement "mathematics is not one of my strengths.")

The percentages of eighth-grade students at each index level, and their average mathematics achievement, are presented in Exhibit 4.8. Across participating countries, the United States was among those with the greatest percentages of students at the high level of the self-concept index: 31 percent compared with 18 percent on average across all countries. Several of the Benchmarking participants had even greater percentages at the high level, notably the Naperville School District and the First in the World Consortium, with 40 percent or more of students at this level.

Although there was a clear positive association between self-concept and mathematics achievement within every country and within every Benchmarking jurisdiction, the relationship across entitiess was more complex. Several countries with high average mathematics achievement, including Singapore, Hong Kong, Chinese Taipei, Korea, and Japan, had relatively low percentages of students (15 percent or less) in the high self-concept category. Since all of these are Asian Pacific countries, they may share cultural traditions that encourage a modest self-concept.

text continued on page 132

Index of Students' Self-Concept in Mathematics

Index based on students' responses to five statements about their mathematics ability: 1) I would like mathematics much more if it were not so difficult; 2) although I do my best, mathematics is more difficult for me than for many of my classmates; 3) nobody can be good in every subject, and I am just not talented in mathematics; 4) sometimes, when I do not understand a new topic in mathematics initially, I know that I will never really understand it; 5) mathematics is not one of my strengths. High level indicates student disagrees or strongly disagrees with all five statements. Low level indicates student agrees or strongly agrees with all five statements. Medium level includes all other possible combinations of responses.

	High SCM		Medium SCM		Low SCM	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Russian Federation	45 (1.5)	568 (4.7)	44 (1.1)	510 (6.5)	11 (0.8)	470 (10.9)
Naperville Sch. Dist. #203, IL	44 (1.4)	597 (3.9)	49 (1.7)	554 (3.1)	7 (0.8)	507 (7.6)
First in the World Consort., IL	40 (2.5)	590 (6.9)	55 (3.1)	545 (6.1)	5 (1.1)	481 (9.0)
SW Math/Sci. Collaborative, PA	36 (1.9)	553 (7.8)	56 (1.6)	504 (7.6)	8 (0.7)	447 (11.7)
Chicago Public Schools, IL	36 (2.8)	505 (6.7)	56 (2.7)	445 (6.0)	8 (1.2)	404 (9.1)
North Carolina	36 (1.7)	533 (7.5)	54 (1.4)	484 (6.7)	10 (0.8)	430 (8.7)
Michigan	36 (1.6)	554 (7.4)	53 (1.7)	508 (6.7)	11 (0.8)	452 (6.4)
Oregon	35 (1.6)	552 (5.8)	55 (1.3)	505 (5.6)	9 (0.9)	444 (7.5)
Illinois	35 (1.8)	549 (6.9)	56 (1.5)	495 (7.0)	9 (0.9)	448 (7.5)
Connecticut	35 (2.0)	547 (10.0)	56 (1.8)	502 (8.5)	9 (1.0)	448 (9.5)
Canada	35 (1.0)	573 (2.9)	56 (1.0)	517 (2.4)	9 (0.5)	459 (6.1)
Fremont/Lincoln/WestSide PS, NE	34 (2.1)	539 (9.7)	51 (1.7)	479 (9.1)	14 (1.5)	406 (8.6)
Project SMART Consortium, OH	34 (2.2)	562 (8.4)	56 (2.0)	509 (7.1)	10 (1.2)	448 (7.5)
Academy School Dist. #20, CO	34 (1.4)	560 (3.4)	58 (1.5)	521 (2.8)	8 (0.8)	460 (8.5)
Pennsylvania	34 (1.7)	543 (8.3)	56 (1.3)	499 (5.5)	10 (0.9)	443 (6.3)
Montgomery County, MD	33 (1.7)	572 (6.1)	58 (1.5)	529 (3.4)	9 (1.1)	473 (9.8)
Michigan Invitational Group, MI	33 (2.3)	568 (6.1)	55 (2.2)	527 (4.7)	12 (1.0)	465 (13.0)
Guilford County, NC	33 (2.7)	535 (7.7)	60 (2.7)	508 (8.0)	8 (1.1)	469 (13.5)
Massachusetts	33 (1.9)	553 (6.4)	58 (1.5)	503 (5.5)	10 (1.0)	446 (8.1)
Indiana	32 (1.9)	557 (6.9)	57 (1.5)	504 (6.5)	12 (1.1)	457 (9.6)
Rochester City Sch. Dist., NY	31 (1.6)	486 (6.6)	54 (1.6)	440 (8.0)	15 (1.2)	402 (8.1)
Maryland	31 (1.4)	535 (5.7)	58 (1.0)	487 (6.2)	11 (0.9)	432 (7.6)
Delaware Science Coalition, DE	31 (1.5)	528 (9.7)	57 (1.8)	472 (7.9)	12 (1.1)	418 (12.6)
United States	31 (1.0)	551 (4.6)	58 (0.8)	493 (3.9)	11 (0.6)	435 (5.6)
Idaho	31 (1.9)	534 (7.6)	58 (1.5)	488 (6.4)	11 (0.9)	429 (9.7)
Jersey City Public Schools, NJ	30 (2.8)	531 (8.9)	60 (2.4)	459 (6.8)	9 (1.2)	413 (9.3)
England	30 (1.3)	543 (5.0)	61 (1.2)	487 (3.9)	9 (0.6)	430 (6.5)
Texas	29 (1.5)	565 (9.0)	60 (1.3)	513 (9.1)	11 (1.1)	447 (10.6)
South Carolina	28 (1.8)	548 (6.9)	61 (1.4)	492 (7.7)	11 (0.9)	441 (8.0)
Missouri	27 (1.6)	527 (7.0)	60 (1.6)	484 (5.1)	12 (0.8)	441 (8.6)
Netherland	27 (2.0)	578 (7.0)	65 (1.8)	532 (7.7)	8 (0.9)	490 (9.8)
Belgium (Flemish)	25 (0.8)	600 (5.4)	62 (0.8)	554 (3.3)	13 (1.1)	506 (7.8)
Italy	24 (0.9)	539 (3.8)	63 (0.9)	474 (3.8)	13 (0.8)	412 (5.4)
Miami-Dade County PS, FL	23 (2.2)	478 (13.0)	60 (1.8)	420 (9.2)	17 (2.1)	364 (8.2)
Czech Republic	19 (1.2)	585 (5.7)	66 (1.0)	515 (4.0)	15 (1.0)	461 (5.5)
Singapore	15 (1.0)	656 (8.8)	74 (0.8)	603 (5.7)	11 (0.7)	547 (7.1)
Hong Kong, SAR	14 (0.7)	624 (4.6)	71 (0.8)	585 (3.8)	14 (0.8)	531 (6.3)
Chinese Taipei	11 (0.5)	660 (6.0)	75 (0.7)	591 (3.9)	14 (0.7)	506 (4.2)
Korea, Rep. of	10 (0.5)	646 (4.0)	85 (0.5)	585 (1.8)	5 (0.3)	515 (5.7)
Japan	6 (0.4)	634 (6.2)	82 (0.5)	581 (1.8)	12 (0.5)	536 (3.8)
International Avg. (All Countries)	18 (0.2)	547 (1.1)	67 (0.2)	486 (0.7)	15 (0.1)	436 (0.9)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Russian Federation
Naperville Sch. Dist. #203, IL
First in the World Consort., IL
SW Math/Sci. Collaborative, PA
Chicago Public Schools, IL
North Carolina
Michigan
Oregon
Illinois
Connecticut
Canada
Fremont/Lincoln/WestSide PS, NE
Project SMART Consortium, OH
Academy School Dist. #20, CO
Pennsylvania
Montgomery County, MD
Michigan Invitational Group, MI
Guilford County, NC
Massachusetts
Indiana
Rochester City Sch. Dist., NY
Maryland

Background data provided by students.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

What Are Students' Attitudes Towards Mathematics?

Generating positive attitudes towards mathematics among students is an important goal of mathematics education in many jurisdictions. To gain some understanding of eighth-graders' views about the utility of mathematics and their enjoyment of it as a school subject, timss created an index of positive attitudes towards mathematics (patm). Students were asked to state their agreement with the following five statements:

- I like mathematics
- I enjoy learning mathematics
- Mathematics is boring[5]
- Mathematics is important to everyone's life
- I would like a job that involved using mathematics.

For each statement, students responded on a four-point scale indicating whether their feelings about mathematics were strongly positive, positive, negative, or strongly negative. The responses were averaged, with students being placed in the high category if their average indicated a positive or strongly positive attitude. Students with a negative or strongly negative attitude on average were placed in the low category. The students between these extremes were placed in the medium category. The results are presented in Exhibit 4.10. (Additional information on students' liking mathematics, one of the components of the index, is provided in Exhibit R1.12 in the reference section.)

Internationally, eighth graders generally had positive attitudes towards mathematics, with 37 • M2 3r32.sitfrage ac1n.q6 sr3 06di7l information 2.9(, eighth graderir fe

Index based on students' responses to five statements about mathematics: 1) I like mathematics; 2) I enjoy learning mathematics; 3) mathematics is boring (reversed scale); 4) mathematics is important to everyone's life; 5) I would like a job that involved using mathematics. Average is computed across the five items based on a 4-point scale: 1 = strongly negative; 2 = negative; 3 = positive; 4 = strongly positive. High level indicates average is greater than 3. Medium level indicates average is greater than 2 and less than or equal to 3. Low level indicates average is less than or equal

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

An "r" indicates a 70-84% student response rate.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Jersey City Public Schools, NJ
Chicago Public Schools, IL
Singapore
North Carolina
England
Guilford County, NC
Rochester City Sch. Dist., NY
Illinois
Miami-Dade County PS, FL
South Carolina

Background data provided by students.

States in *italics*

chapter 5

The Mathematics Curriculum

The first part of Chapter 5 presents information about the curricular goals in the timss 1999 countries and Benchmarking states, districts, and consortia. The ways in which the curriculum is supported and monitored within each entity, and the relationship between the curriculum and system-wide testing, are examined. The second part of the chapter contains teachers' reports about the mathematics topics actually studied in their classrooms.

In comparing achievement across systems, it is important to consider differences in students' curricular experiences and how they may affect the mathematics they have studied. At the most fundamental level, students' opportunity to learn the content, skills, and processes tested in the timss 1999 assessment depends to a great extent on the curricular goals and intentions inherent in each system's policies for mathematics education. Just as important as what students are expected to learn, however, is what their teachers choose to teach them, which ultimately determines the mathematics students are taught.

Teachers' instructional programs are usually guided by an "official curriculum" that describes the mathematics education that should be provided. The official curriculum can be communicated by documents or statements of various sorts (often called guides, guidelines, standards, or frameworks) prepared by the education ministry or by national or regional education departments. These documents, together with supporting material such as instructional guides or mandated textbooks, are referred to as the *intended curriculum*.

To collect information about the intended mathematics curriculum at the eighth grade, the coordinators in each participating country and Benchmarking jurisdiction responsible for implementing the study completed questionnaires and participated in interviews. Information was gathered about factors related to supporting and monitoring the implementation of the official curriculum, including instructional materials, audits, and assessments aligned with the curriculum.

In many cases, teachers need to interpret and modify the intended curriculum according to their perceptions of the needs and abilities of their classes, and this evolves into the *implemented curriculum*. Research has shown that, even in highly regulated education systems, this is not identical to the intended curriculum. Furthermore, what is actually implemented is often inconsistent across an education system. Studies, including the Second International Mathematics Study, suggest that the implemented curriculum in the United States varies considerably from classroom to classroom – calling for more research into not only what is intended to be taught but what content is covered.

Does Decision Making About the Intended Curriculum Take Place at the National, State, or Local Level?

Depending on the education system, students' learning goals are set at

	National or Regional Curriculum	Year Curriculum Introduced	Status of Curriculum
United States			

Background data provided by National Research Coordinators.

A dash (–) indicates data are not available.

1 United States: The NCTM standards were developed in 1989 and revised for 2000. As of 1999, most states had developed content standards. Currently, many states are in the process of updating and revising their standards.

Background data provided by coordinators from participating jurisdictions.

1 Indicates year(s) in which curriculum frameworks/content standards were instituted.

	Level of Curriculum Development
Academy School Dist. #20, CO	Curriculum is developed at the school level. Curriculum is currently in revision to reflect state standards.
Chicago Public Schools, IL	Curriculum is developed at the school level. The district writes standards statements which are aligned with state standards; schools translate these into a curriculum. The district also offers an optional structured curriculum.
Delaware Science Coalition, DE	Curriculum is created at the district-level based on the state content standards.
First in the World Consort., IL	Most districts within the Consortium have district-wide objectives and/or a curriculum based on state standards.
Fremont/Lincoln/ WestSide PS, NE	Each district has locally-developed standards and a curriculum based on the state standards.
Guilford County, NC	The district uses state-developed curriculum, the North Carolina Standard Course of Study.
Jersey City Public Schools, NJ	The mathematics curriculum (pK-12) is developed by the district and is aligned with the New Jersey Core Curriculum Content Standards.
Miami-Dade County PS, FL	The district has developed a mathematics curriculum, Competency-Based Curriculum (CBC), which is correlated to the Florida Sunshine State Standards for Mathematics. Most recently, the state has developed Grade Level Expectations (GLEs) that further define what a student should know and be able to do at specific grade levels. The district is currently making revisions to the CBC to reflect the GLEs.
Michigan Invitational Group, MI	Most districts have district-wide curriculum guides aligned to the state standards.
Montgomery County, MD	The district develops curriculum based on state standards.
Naperville Sch. Dist. #203, IL	The district develops curriculum based on state standards. District level mathematics curriculum is being revised for 2000-01.
Project SMART Consortium, OH	Each district in the SMART Consortium has a separate curriculum. In 2001, SMART will be adopting a mathematics curriculum for project schools.
Rochester City Sch. Dist., NY	New York State has developed a core curriculum for all grade levels. The Rochester City School District has written aligned curricula for pre-K through grade 8. The curricula for grades 9-12 are currently under revision.
SW Math/Sci. Collaborative, PA	Each district in the consortium has a separate curriculum. District-level curriculum is not necessarily based on the state standards.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by coordinators from participating jurisdictions.

As shown in Exhibit 5.6, nine of the 13 Benchmarking states developed materials that included pedagogical guidance for instruction and implementation of the curriculum frameworks and standards. Twelve districts and consortia had at least state- or district-level guides to support curriculum implementation.

As shown in Exhibit 5.7, six of the participating states had accreditation systems, four of which included student performance on the state assessment in their accreditation review (Indiana, Michigan, Missouri, and Oregon). Two states without accreditation systems, Illinois and Texas, made periodic site visits to evaluate schools. Only one consortium, the Michigan Invitational Group, reported having an accreditation system at the state level. The Academy School District in Colorado reported that the state was in the process of implementing a system for 2001.

	Pre-Service Teacher Education	In-Service Teacher Education	Mandated or Recommended Textbook(s)	Instructional or Pedagogical Guide	Ministry Notes and Directives	System of School Inspection or Audit
United States [1]		+	+	+	+	+
Australia [2]	●	●		●	●	
Belgium (Flemish)	●	●		●	●	●
Bulgaria						

Background data provided by National Research Coordinators.

* Other than system-wide assessments and public examinations described in Exhibits 5.8 and 5.9, respectively.

1 United States: Methods are implemented by individual states and vary from state to state. As of 1998, 13 states have policies on textbook/materials selection; 8 states have policies recommending textbook/materials.

2 Australia: Results shown are for the majority of states/territories.

3 Canada: Results shown are for the majority of provinces.

States	
Connecticut	
Idaho	
Illinois	
Indiana	
Maryland	
Massachusetts	
Michigan	
Missouri	
North Carolina	
Oregon	
Pennsylvania	The state does not select textbooks.
South Carolina	The state selects a list of textbooks and materials from which districts can choose. The state funds the instructional materials that are selected from the state approved list.
Texas	

Background data provided by coordinators from participating jurisdictions.

Districts and Consortia	
Michigan Invitational Group, MI	STATE: The state does not select textbooks.

States	Pedagogical Guides
Connecticut	The "Guide to K-12 Program Development in Mathematics" (1999) provides a curriculum framework with content standards and performance standards as well as "illustrative lessons" for each content standard at each grade band. In addition, the state provides curriculum handbooks with objectives, sample lessons, sample test items, and teacher resources. Prototype assessments with high-quality student responses are also distributed.
Idaho	Pedagogical guides are not available at the state level.
Illinois	Performance descriptors have been completed in draft form. Classroom assessment tasks and student-work examplars will be available Summer 2001.
Indiana	The "Indiana Mathematics Proficiency Guide" (1997) contains grade specific standards with ideas for activities including examples that clarify the skills, and ways to incorporate communication, reasoning, problem solving, connections, and technology into the mathematics classroom. New Curriculum Frameworks are being written to support Indiana's new Academic Standards (2000).
Maryland	The guide "Better Mathematics: Building Effective Teaching Through Educational Research" focuses on appropriate teaching methods.
Massachusetts	The curriculum frameworks provide teaching activities for each learning standard.
Michigan	Toolkits are designed to support the implementation of the curriculum frameworks including kits on planning subject area instructional units, curriculum integration, designing classroom assessments, and connecting with the learner. The "Mathematics Teaching and Learning Sample Activities" was developed specifically to assist in teaching the mathematics frameworks.
Missouri	The Curriculum Frameworks provide appropriate teaching activities by discipline with examples of how "Show-Me Standards" may be taught and assessed.
North Carolina	The development of a curriculum enhancement guide is in process.
Oregon	"Teaching and Learning to Standards" supports the Oregon content standards and provides best practices, example lessons, teaching strategies, tools and on-line resources.
Pennsylvania	Pedagogical guides are not available at the state level.
South Carolina	The "South Carolina Standards Implementation Guide" includes information on standards-based education in the State, standards-based assessment practices, samples of standards-based instructional modules, tips and tools for educators (vignettes, content briefs, etc.), glossary of terms, and a list of websites.
Texas	The Educator's Guides include objectives for mathematics (grade 3 - high school algebra). The Supplement to the Educator's Guide includes additional information on teaching the objectives and sample problems. Study Guides are provided to students performing below the standard on state assessments. These Study Guides, for use by students, parents, and teachers, include sample problems and activities.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by coordinators from participating jurisdictions.

Districts and Consortia	
	There are not pedagogical guides at the state level. As soon as the state "Draft Content Mathematics Standards" are approved by the Ohio State Board of Education (early 2001) plans are underway to provide pedagogical guides to locals. Ohio is a local-control state, therefore, many locals have developed various types of mathematics guides.

	Use of Accreditation
Districts and Consortia	
	The state will be implementing an accreditation system beginning in Fall 2001 based primarily on the success and/or progress on
	No accreditation system.
	State-level accreditation is based in part on student performance on state assessments. The system is being revised to include successful achievement as well as continuous improvement.
	No accreditation system.
	No accreditation system.
	No accreditation system.
	No accreditation system.
	No accreditation system.

What TIMSS 1999 Countries Have Assessments And Exams in Mathematics?

Assessments and exams that are aligned with the intended curriculum provide a means for evaluating system- and student-level achievement. System-wide assessments are designed primarily to inform policy makers about matters such as national standards of achievement of the intended curriculum objectives, strengths and weaknesses in the curriculum or how it is being implemented, and whether educational achievement is improving or deteriorating. The primary purpose of national public examinations, while providing information of interest to national and regional policy makers, is to provide information for making decisions about individual students.

Exhibit 5.8 shows that about two-thirds of the participating countries had national assessments in mathematics, with half of those assessing all students and half sampling students. Most countries tested two or three grades, with Hong Kong (nine grades) and Korea (seven grades) testing the most grades. Generally, the purpose of system-wide assessments was to provide feedback to government policy makers and the public, although some countries provided feedback to individual schools. For example, in Singapore the 20 schools found to provide the greatest value-added measures received monetary rewards, as did teachers of the top 25 percent of classes in Chile.

Using public examinations as a way to select students for university or academic tracks in secondary school can be an important motivating factor for student achievement (see Exhibit 5.9

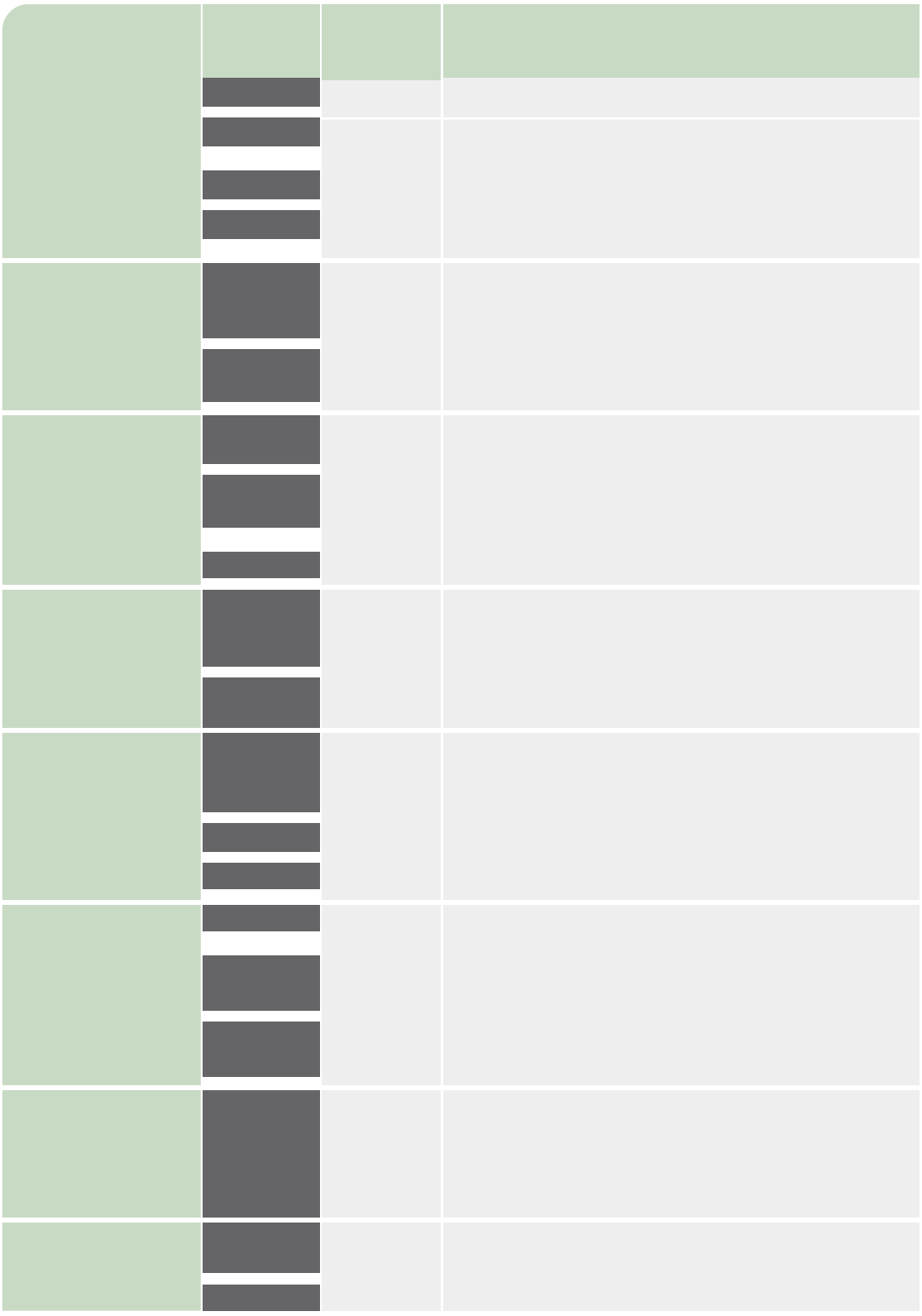
		Entire Grade Level	Sample from Grade Level	
United States	Yes		4, 8, 12	National and state-level feedback
Australia [2]	Yes			
Belgium (Flemish)	No			
Bulgaria	Yes		4, 8	System-level feedback, administered only in 1998
Canada [3]	Yes			
Chile	Yes			
Chinese Taipei	No			
Cyprus	No			
Czech Republic	No			
England	Yes	1, 5, 8		School-level feedback; course selection and placement for grade 9
Finland	Yes		4, 6, 9	System-level feedback
Hong Kong, SAR	Yes		1 - 9	System-level feedback
Hungary	Yes		4, 6, 8, 10, 12	System-level, school-level, and individual-level feedback
Indonesia	Yes		various grades	

Background data provided by National Research Coordinators.

1 Public examinations are also used for system-wide assessment purposes in these countries: Malaysia, Morocco, Netherlands, Philippines, Singapore, Tunisia, and Turkey.

2 Australia: System-wide assessments are administered in 3 of 8 states/territories.

3 Canada: System-wide assessments are administered in 5 of 10 provinces.



Background data provided by National Research Coordinators.

1 United States: As of 1997-1998, public examinations are administered in 47 of 50 states at grades 7-8 or 9-12.

2 Canada: Public examinations are administered in 5 of 10 provinces.

What Benchmarking Jurisdictions Have Assessments in Mathematics?

Across the United States, many states are conducting assessments based on their own content standards and are assessing whether students in their schools are meeting these standards for academic achievement. Forty-three states have some type of criterion-referenced mathematics assessment aligned to state standards.[5]

All 13 Benchmarking states had developed or were developing state-level mathematics assessments aligned with their state curriculum frameworks or content standards. As summarized in Exhibits 5.10 and 5.11, most of them reported recently revising or developing their criterion-referenced assessment to align with their current eighth-grade framework/standards. Assessments in Connecticut, Idaho, Indiana, Maryland, Massachusetts, North Carolina, and Texas were reported to be in revision, and those in Illinois, Michigan, and South Carolina to be in development. In addition to these criterion-referenced assessments, seven states (Idaho, Illinois, Indiana, Maryland, Missouri, North Carolina, and South Carolina) reported using norm-referenced mathematics tests to assess student mathematics achievement statewide.

All the Benchmarking states except Pennsylvania have participated in recent state mathematics assessments as part of the National Assessment of Educational Progress (naep). Ten of the 13 states participated in both 1996 and 2000, and Idaho and Oregon in one of the years.

As shown in Exhibit 5.12, six of the Benchmarking states use or plan to use performance on a mathematics assessment as a requirement for graduation from high school. In Indiana and Texas, the exit exam was based on the state mathematics standards. In Maryland, North Carolina, and South Carolina, they were basic skills competency tests not based on state standards, but these states were in the process of changing to standards-based exit exams. Massachusetts was planning to institute a standards-based exit exam beginning with the class of 2003.

Benchmarking states reported a range of other consequences of their mathematics assessments for students, apart from their use as a graduation requirement. For example, Connecticut, Oregon, and Pennsylvania reported that they affix a certificate or seal to students' diplomas to show that they have met the performance goal on the state high school mathematics assessment; Illinois, North Carolina, Oregon, and South Carolina reported a policy of using assessment results to assist in making promotion decisions; Texas was phasing in a promotion policy; and Connecticut

5 Orlofsky, G.F. and Olson, L. (2001), "The State of the States" in *Quality Counts 2001, A Better Balance: Standards, Tests, and the Tools to Succeed*, Education Week 20(17).

was encouraging its districts to reevaluate their social promotion

Connecticut	
Idaho	
Illinois	
Indiana	
Maryland	
Massachusetts	
Michigan	
Missouri	
North Carolina	
Oregon	

Background data provided by coordinators from participating jurisdictions.

	Assessment	Graduation Requirement	Other Consequences
Connecticut	Connecticut Mastery Test (CMT); Connecticut Academic Performance Test (CAPT)	No	STUDENT: Students meeting the state performance goal on the 10th grade CAPT assessment receive a certificate of mastery. This certificate is affixed to students' official transcripts. Students who do not meet the state goal may retake the test in grades 11 and 12. Results are reported publicly (e.g., newspapers) but there are no direct consequences. DISTRICT/SCHOOL: Based on test results, districts are encouraged to reevaluate their social promotion policy and curriculum. The State Board of Education developed a list of schools in need of improvement based on student performance and performance trends on the CMT. Targeted assistance for these schools is being discussed. Currently, districts with low-performance on the CMT receive additional funding to support remediation. Monetary awards are given to districts that increase the percent of students meeting the state goals on the CMT.
Idaho	Direct Mathematics Assessment	No	STUDENT: No consequences for students. DISTRICT/SCHOOL: Schools are expected to address student performance issues in their accreditation school improvement plans.
Illinois	Illinois Standards Achievement Tests (ISAT); Prairie State Achievement Examination (PSAE)	No	STUDENT: Test results may be used, in conjunction with other data, to make decisions about student's promotion/retention, summer school requirements, and remediation. DISTRICT/SCHOOL: Test results are considered at both the district and school levels as part of the state accountability system. Schools receive a measure of improvement based on the percentage of students in each performance level on the ISAT.
Indiana	Indiana Statewide Testing for Educational Progress-Plus (ISTEP+)	Students must pass the grade 10 test that is based on the 9th grade standards to graduate. As of 2000, students who fail parts of the exam but meet other criteria may still be allowed to graduate.	STUDENT: No additional consequences for the student. DISTRICT/SCHOOL: The state gives monetary rewards to schools that evidence improvement. Districts are required to provide remediation to low-performing students.
Maryland	Maryland School Performance Assessment Program (MSPAP); High School Assessment (HSA)	The HSA is being phased in and will be required for graduation with the class of 2007. Currently, the Maryland Functional Tests are required for graduation.	STUDENT: There are no student-level consequences based on the MSPAP since each student is given only a portion of the assessment. DISTRICT/SCHOOL: The MSPAP is a school accountability assessment. Part of schools' performance rating is based on MSPAP assessment scores. Schools that improve significantly over a two-year period receive monetary rewards. Schools are required to develop school improvement plans for areas in which standards were not met. The State Board of Education has the right to reconstitute schools based on low MSPAP test scores and lack of improvement. Thus far, three schools in Maryland have been reconstituted.
Massachusetts	Massachusetts Comprehensive Assessment System (MCAS)	Beginning with the class of 2003, students must pass the 10th grade assessments in English Language Arts and Mathematics to graduate.	STUDENT: No additional consequences for the student. DISTRICT/SCHOOL: Results are being used as a high-stakes accountability measure to evaluate performance and improvement for schools and districts. Schools will be rated based on performance and progress. Recognized schools may be eligible for an Exemplary Schools Program. Low performance and inadequate progress may result in the removal of principals and/or state-takeover of districts. Targeted resources and funding will be provided to low-performing schools and districts.
Michigan	Michigan Educational Assessment Program (MEAP)	No	STUDENT: Students meeting the standards on the 11th grade assessments qualify for college scholarship money. In the future, students that meet the standards on the 8th grade assessments will qualify for scholarship money, as well. DISTRICTS/SCHOOL: Low-performing schools receive additional teacher training and resources. Low-performance and inadequate progress may result in state-takeover of school districts.
Missouri	Missouri Assessment Program (MAP)	No	STUDENT: Students scoring at the lowest performance level must retake a shortened version of the exam the following year. Students performing at proficient or above on the 10th grade test receive state funds for college-level courses or Advanced Placement Exams. DISTRICT/SCHOOL: Test results will be a part of district-level accreditation.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by coordinators from participating jurisdictions.

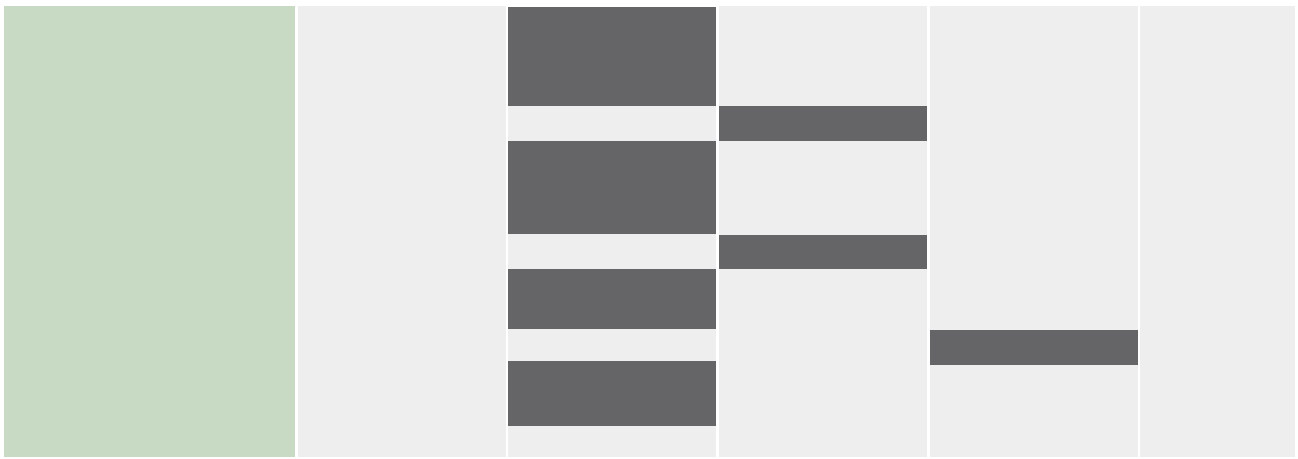
	Assessment	Graduation Requirement	Other Consequences
North Carolina	North Carolina Testing Program	Beginning with the class of 2003, students will have to pass a new 11th grade exit exam which will replace the current 8th and 10th grade competency tests. Currently, all students must pass the high school competency test to graduate.	STUDENT: North Carolina requires districts to consider student performance on the state assessments when making promotion decisions. Students are given several chances to perform to expectations on these exams. North Carolina is implementing a new promotion policy based on performance on the assessments. Beginning in 2000-01, 5th graders must perform at Level III for promotion. In 2001-02, 3rd and 8th graders must perform at Level III for promotion. Beginning in 2000-01, the Algebra I End-of-Course test will comprise 25 percent of each student's final grade for Algebra I. DISTRICT/SCHOOL: Schools are rated based on student performance and improvement. Monetary awards are given to schools that meet or exceed their goals. The state funds intervention at schools that have been low-performing. In addition, state-appointed assistant teams support low-performing schools in meeting the standards. North Carolina schools' accountability status is based on assessment results. Beginning in 2001, districts will not promote students not performing at grade level and intervention for these students will be required.
Oregon	Oregon State-wide Assessment System	No	STUDENT: Students who meet the performance standard on the state-level and local standards-based assessments receive Certificates of Initial Mastery in each area in which the standard is met. Students who do not meet the performance standard have an opportunity to take the test again. Low-performing students receive additional support and individual instruction to help them meet the standards. These students can change schools if instruction at one school is not meeting their needs. Districts may use the results of the tests to determine student promotion. DISTRICT/SCHOOL: Test results are part of the accountability system. Districts must meet set goals for the assessments to avoid possible sanctions.
Pennsylvania	Pennsylvania System of School Assessment (PSSA)	No	STUDENT: As of 2003, students who achieve a score of proficient or above on the 11th grade assessment will receive a seal on their diploma indicating their achievement. DISTRICT/SCHOOL: Beginning in 2001-02, Pennsylvania will require districts to provide extra academic assistance to students who are not meeting the 3rd and 5th grade mathematics standards. The recently passed Empowerment Act makes provisions for the state to take over districts in part due to low mathematics scores.
South Carolina	Palmetto Achievement Challenge Tests (PACT)	Beginning with the class of 2003, students will have to pass a standards-based exam to graduate. Currently, passing a basic skills exam is required.	STUDENT: The promotion policy considers students' performance on the state assessments. DISTRICT/SCHOOL: Schools are rated based on student performance and improvement. Accreditation of schools will take into account student performance on the state assessments. Districts are required to provide remediation to low-performing students.
Texas	Texas Assessment of Academic Skills (TAAS)	Students must pass the 10th-grade standards-based exit-level exam or the end-of-course exams.	STUDENT: Students may retake the high school exit-level exams, if necessary. A new promotion policy based on the assessments is being phased in for 5th and 8th grade students starting with students who enter kindergarten in 1999. DISTRICT/SCHOOL: School rating takes into account results on state assessments. Districts are required to offer remediation to low-performing students.

State	Local
Colorado Student Assessment Program (CSAP) includes a mathematics assessment at grade 5 starting in Spring 1999, at grade 8 in 2000, and at grade 10 in 2001. As of 2001, districts will be evaluated based on their achievement or progress on the state assessment. Intervention teams will be provided to those districts in need.	In addition to the CSAP, students take Terra Nova at grade 4; ITBS at grades 3, 5, and 7; and ITED at grade 10. District-developed performance assessment units are optional.
Starting in 2000, the Illinois Standard Achievement Test (ISAT), administered at grades 3, 5, and 8, replaced the Illinois Goal Assessment Program (IGAP) which was administered from 1988-1999 at 3, 6, 8, and 10. The ISAT is reported as a criterion-referenced and norm-referenced assessment. Beginning in 2001, the state will give new high school tests, the Prairie State Achievement Examination (PSAE), based on the 1997 Illinois Learning Standards for Mathematics. ISAT results may be used, in conjunction with other data, to make decisions about student's promotion/retention, summer school requirements, and remediation. Test results are considered at the district and school level as part of the state accountability system. Schools receive a measure of improvement based on the percentage of students in each performance level on the ISAT.	Chicago Academic Standards Exam was developed to assess the district framework and is being piloted in 1999-2000. Chicago also uses ITBS (3-8) and TAP (9-11). Students who have low scores on the ITBS in grades 3, 6, and 8 have to attend summer school prior to promotion. Chicago schools not meeting minimum school-wide levels on local assessments are put into a system of intervention, remediation, and/or probation. Schools with these designations receive additional supervision, support, and guidance. The state uses a similar process with the state assessments. For schools below level in both assessments, the state and district combine efforts.
The Delaware Student Testing Program (DSTP) is administered at grades 3, 5, 8, and 10. Accountability legislation has been passed for districts, schools, teachers, and students that is tied to assessment results. Following the 2001 administration, schools and districts will be evaluated based on improvement and sustained achievement on test scores. Policies to set acceptable improvement levels are under development. Following the 2002 administration, a portion of a teacher's annual appraisal will be tied to assessment results.	There are no district-wide assessments based on the standards. Legislation calls for standards-based testing at all grades beginning in 2001. These tests have not been identified/developed yet.
Starting in 2000, the Illinois Standard Achievement Test (ISAT), administered at grades 3, 5, and 8, replaced the Illinois Goal Assessment Program (IGAP) which was administered from 1988-1999 at 3, 6, 8, and 10. The ISAT is reported as a criterion-referenced and norm-referenced assessment. Beginning in 2001, the state will give new high school tests, the Prairie State Achievement Examination (PSAE), based on the 1997 Illinois Learning Standards for Mathematics. ISAT results may be used, in conjunction with other data, to make decisions about student's promotion/retention, summer school requirements, and remediation. Test results are considered at the district and school level as part of the state accountability system. Schools receive a measure of improvement based on the percentage of students in each performance level on the ISAT.	The consortium also participated in TIMSS in 1996 and is developing assessments for districts' use.
There are no assessments at the state level. Assessing students is local responsibility.	Fremont administers the ITBS (grades 3-9, 11), Lincoln administers the MAT (grades 2-9, 11), and Westside administers SAT-9 (grades 3, 5, 7), Explore (grade 8), and PLAN (grade 10).
The North Carolina Testing Program includes the end-of-grade tests (1994) administered at grades 3-8 and the end-of-course exams given in high school. These tests are currently in line with the 1989 Course of Study. The new test will be revised to assess the 1998 curriculum by 2000-01. The 8th and 10th grade competency test will be replaced by an 11th grade standards-based exit exam. State end-of-course exams are used to rate individual schools. State assistance teams may be sent to low-performing schools.	There are no additional district-wide assessments.
Starting in May 1999, the New Jersey Elementary School Proficiency Assessment (ESPA) was administered at grade 4. The ESPA contains a mathematics component. Similarly, beginning in March 1999, the NJ Grade Eight Proficiency Assessment (GEPA) was administered at grade 8. This test replaced the Early Warning Test which had been previously administered to the eighth graders. Both the ESPA and the GEPA are tests of excellence and measure student performance in relation to the NJ Core Content Curriculum Standards in Mathematics. The High School Proficiency Assessment (HSPA) is presently in development at the state level and will be used beginning in the spring 2001 for first time juniors (class of 2002) as the mandated test for graduation. Presently, the High School Proficiency Test (HSPT), which contains a mathematics component, has been administered statewide since the early 1990s as the mandated test for graduation.	In addition to the state assessments, at the elementary level, the district has developed district-wide mid-terms in mathematics in grades 3-8. These exams have been administered since 1999. The

Background data provided by coordinators from participating jurisdictions.

State	Local
Florida's Comprehensive Assessment Test (FCAT) is administered at grades 5, 8, and 10. The FCAT is a multiple-choice and performance-based assessment that includes both criterion-referenced and norm-referenced components. An extension of the FCAT will be in place in 2000 to assess grades 3, 4, 6, 7, and 9 using multiple-choice items. The 11th grade minimum skills graduation test that is not aligned with the standards is being phased out. Schools are graded on student performance on the FCAT in mathematics, reading and writing. Several levels of support are provided to the schools that are not performing well on the state assessment. Instructional supervisors, educational specialists, and other professionals assist with efforts to employ intervention strategies to support curriculum implementation of the Florida Sunshine State Standards.	The SAT-9 NRT Mathematics is administered to students in grade 2. The EXPLORE, which has mathematics and science assessments, is administered to all grade 8 students. District-developed standards-based assessments are used to monitor student progress in mathematics at grades 5, 8, and 10.
The Michigan Educational Assessment Program (MEAP) assesses students at grades 4, 7, and 11. The grade 4 and 7 tests are based upon the Michigan Essential Goals and Objectives for Mathematics Education (1998). These tests are in revision and will be administered at Grades 4 and 8 starting in 2001/02. The Grade 11 test, first administered in 1996 and revised in 1998, is based on the 1995 High School Proficiency Test Framework.	Districts administer norm-referenced tests.
The Maryland School Performance Assessment Program (MSPAP) assesses students at grades 3, 5, and 8. Currently, the MSPAP is based on the 1990 Learning Outcomes. By 2003, the MSPAP will be revised to assess the 2000 standards.	A criterion-referenced assessment has been developed to assess the curriculum for grades 3-8.
Starting in 2000, the Illinois Standard Achievement Test (ISAT), administered at grades 3, 5, and 8 replaced the Illinois Goal Assessment Program (IGAP) which was administered from 1988-1999 at 3, 6, 8, and 10. The	

Countries		Same Curriculum for All Students, and Teachers Adapt to Students' Needs	Same Curriculum with Different Levels for Different Groups	Different Curricula for Different Groups	Number of Curriculum Levels
United States [1]		**Yes**	No	No	1
Belgium (Flemish)		No	No	**Yes**	2
Canada	Yes	**Yes**	No	No	1
Chinese Taipei	Yes	**Yes**	No	No	1
Czech Republic	Yes	No	**Yes**	No	4
England [2]	Yes	No	**Yes**	No	9
Hong Kong, SAR	Yes		No	No	1
Italy	No				
Japan	No				
Korea, Rep. Of	Yes	**Yes**	No	No	1
Netherlands	Yes	No	No	**Yes**	4
Russian Federation	Yes	No	No	**Yes**	2



Background data provided by coordinators from participating jurisdictions.

1 United States: Most state standards are designed for all students.

2 England: While there is one "programme of study" for grades 6-8,the document identifies nine performance-levels describing the types and range of performance that pupils working at a particular level should demonstrate.

3 SW Math/Sci. Collaborative: Covering a workforce region of 118 autonomous districts, the Collaborative cannot provide a representative response for these questions.

A dash (–) indicates data are not available.

What Are the Major Characteristics of the Intended Curriculum?

Exhibit 5.15 indicates the relative emphasis given to various aspects of mathematics instruction in the intended curriculum. As might be anticipated for students at this point in their schooling, major emphasis in the comparison countries was most commonly placed on understanding mathematical concepts and mastering basic skills. Assessing student learning was also given major emphasis in most countries. "Real-life" applications of mathematics were stressed in the curriculum of most countries. In the Netherlands, for example, this approach was reported to be emphasized even more heavily than either understanding mathematics concepts or mastering basic skills. Communicating mathematically, an aspect of teaching and learning that has received increasing attention in recent years, was given major or moderate emphasis in the curriculum of most of the comparison countries. Adopting a multicultural approach, working on mathematics projects, solving non-routine problems, deriving formal proofs, and integrating mathematics with other school subjects all received less emphasis.

In general, curricular emphasis among the Benchmarking participants was very similar to that in the United States as a whole. A majority of the Benchmarking entities placed major emphasis in their curricula on mastering basic skills, understanding mathematics concepts, real-life applications of mathematics, communicating mathematically, and assessing student learning. With only one exception, all the other entities place moderate emphasis in each of these areas.

It is possible that in some entities some of the approaches and processes reported as being given minor or no emphasis in the intended curriculum may receive more emphasis in the implemented curriculum. Conversely, it is also possible that some of the approaches and processes reported as being given major or moderate emphasis in the intended curriculum may receive less emphasis in the implemented curriculum.

Countries											
United States											
Belgium (Flemish)											
Canada											
Chinese Taipei											
Czech Republic											
England											
Hong Kong, SAR											
Italy											
Japan											
Korea, Rep. Of											
Netherlands											
Russian Federation											
Singapore											
States											
Connecticut	●										
Idaho	●										
Illinois	●										
Indiana	●										
Maryland	●										
Massachusetts	●										
Michigan	●										
Missouri	●										
North Carolina	●										
Oregon	●										
Pennsylvania	●										
South Carolina	●										
Texas	●										
Districts and Consortia											
Academy School Dist. #20, CO	–	–	–	–	–	–	–	–	–	–	–
Chicago Public Schools, IL	●										
Delaware Science Coalition, DE	●										
First in the World Consort., IL	●										
Fremont/Lincoln/WestSide PS, NE											
Guilford County, NC											
Jersey City Public Schools, NJ											
Miami-Dade County PS, FL											
Michigan Invitational Group, MI											
Montgomery County, MD											
Naperville Sch. Dist. #203, IL											
Project SMART Consortium, OH											
Rochester City Sch. Dist., NY											
SW Math/Sci. Collaborative, PA [2]	–	–	–	–	–	–	–	–	–	–	–

Background data provided by coordinators from participating jurisdictions.

1 Canada: Results shown are for the majority of provinces.

2 SW Math/Sci. Collaborative: Covering a workforce region of 118 autonomous districts, the Collaborative cannot provide a representative response for these questions.

estimation, and “measurement – units” compared with their peers internationally who have completed these topics and received more focused instruction on integers, rational numbers, “exponents, roots

Background data provided by teachers.

States in *italics*

Are There Policies on Using Calculators?

Official policies on calculator use are summarized in Exhibit 5.17. In general, the curricula in the comparison countries included policies on using calculators, either without restriction (three countries) or with some restrictions (seven countries). Several countries commented that calculators were not permitted in the lower grades or that their use in these grades was limited. Across the United States as a whole, policy varied from state to state, and this was reflected among the Benchmarking states, with four states, Idaho, Indiana, Massachusetts, and North Carolina, reporting calculator use under restricted circumstances and the other nine reporting unrestricted use.

	Curriculum Contains Recommendations About Use of Calculators	Type of Policy	Comments
Countries			
United States	Yes	Varies from state to state	
Belgium (Flemish)	Yes	Restricted Use	Calculators are permitted on a limited basis so that students can master the basic skills of computation and mental calculation. Calculator usage increases and is compulsory after grade 9.
Canada	Yes	Unrestricted, 2 provinces, Restricted, 8 provinces	In general, calculator use is encouraged, except in lower grades in some provinces.
Chinese Taipei	Yes	Restricted Use	Calculators are not allowed on entrance exams so teachers limit their use in the classroom.
Czech Republic	Yes	Restricted Use	Computational skills are practiced without calculators.
England	Yes	Restricted Use	Calculator use increases as students progress through school. The emphasis is on pupils having a range of skills: calculator, pencil and paper, and mental computation. Graphic calculators are required at higher levels.
Hong Kong, SAR	Yes	Unrestricted Use	Calculators may be used for exploration only from grades 1 to 6. No restrictions are set on the use of calculators for students from grade 7 onwards.
Italy	No		
Japan	Yes	Unrestricted Use	Calculators are not permitted until grade 5.
Korea, Rep. of	Yes	Restricted Use	Currently, calculators are not used in class. However, the new curriculum, to be implemented in 2000/1, recommends the wide use of calculators.
Netherlands	Yes	Unrestricted Use	Calculators are compulsory at national exam level. In grades 11-12 the graphic calculator is compulsory for mathematics students.
Russian Federation	Yes	Restricted Use	There is some use of calculators in elementary school. Recommended use of calculators on a level with oral and written calculations in secondary school. Students are not allowed to use calculators on public exams in grades 9 and 11.
Singapore	Yes		
States			
Connecticut	Yes	Unrestricted Use	Calculator use is not permitted on the grade 4 test. It is permitted on two of the three testing sessions for the grade 6 and 8 tests and on all parts of the grade 10 test. It is recommended that students use the type of calculator with which they are most familiar.
Idaho	Yes	Restricted Use	Calculators should be used when appropriate with greater use after grade 4.
Illinois	Yes	Unrestricted Use	
Indiana	Yes	Restricted Use	
Maryland	Yes	Unrestricted Use	
Massachusetts	Yes	Restricted Use	Elementary students should learn basic arithmetic operations independent of calculator use; middle and secondary students may use graphing calculators to enhance, rather than replace, their understanding and skills. Calculators are allowed on specified portions of grades 8 and 10 assessments.
Michigan	Yes	Unrestricted Use	Calculators are used as a tool in mathematics. Local systems and teachers decide when they are appropriate to use. Unrestricted use of calculators is allowed on the state assessment.
Missouri	Yes	Unrestricted Use	Calculators are not allowed on grade 4 assessment but are allowed at later grades.
North Carolina	Yes		
Oregon	Yes	Unrestricted Use	Standards call for students to be proficient both with and without calculators. The state requires the selection and use of appropriate methods and tools for computing with numbers including mental calculations, paper and pencil, calculators, and computers. Restriction is left to the discretion of the district.
Pennsylvania	Yes		The standards document includes the use of technology in the classroom which specifically includes calculator usage. Restrictions are at the discretion of the districts and schools. The state test does include calculator usage. Some questions on the tests must be answered without the use of calculators in order to assess students' computational skills.
South Carolina	Yes	Unrestricted Use	Calculator usage is advocated by the standards at all levels. However, the testing program
Texas	Yes	Unrestricted Use	The standards documents indicate the use of calculators in 7th and 8th grade mathematics. The standards also require computation without the use of calculators. Calculators are not permitted on state assessments with the exception of the high school Algebra end-of-course test.

Background data provided by coordinators from participating jurisdictions.

* The use of calculators on TIMSS was not allowed in 1995 or in 1999.

1 Michigan Invitational Group: The consortium cannot provide a representative response for these questions.

2 SW Math/Sci. Collaborative: Covering a workforce region of 118 autonomous districts, the Collaborative cannot provide a representative response for these questions.

A dash (–) indicates data are not available.

	[redacted]		

What Mathematics Topics Are Included in the Intended Curriculum?

In the course of their meetings on planning and implementation of timss 1999, the National Research Coordinators developed a list of mathematics topics that they agreed covered most of the content in the intended mathematics curriculum in their respective countries. These topics, presented in Exhibit 5.18, built on the topics covered in the timss 1995 mathematics test and included in the teacher questionnaire. They represent all topics likely to have been included in the curricula of the 38 participating countries up to and including eighth grade. From the following choices, the coordinators from the participating entities indicated the percentages of students in their own countries or jurisdictions expected to have been taught each topic up to and including eighth grade:

- All or almost all students (at least 90 percent)
- About half of the students
- Only the more able students (top track – about 25 percent)
- Only the most advanced students (10 percent or less).

Exhibit 5.19 summarizes the data according to the percentage of topics intended to be taught to all or almost all students (at least 90 percent) in each entity, across the entire list of topics and for each content area. Information on specific topics in the intended curricula for each content area is presented in Exhibits R2.2 through R2.6 in the reference section of this report.

Internationally on average, curricular guidelines up to and including eighth grade called for nearly all students to have been taught three-fourths of the topics overall. The greatest percentage of topics intended to be taught to 90 percent or more of the students was in fractions and number sense (86 percent, on average across countries) and in measurement (88

in fractions and number sense, measurement, and data representation,

Background data provided by coordinators from participating jurisdictions according to the official curriculum. Coordinators indicated the percentage of students who should have been taught each of the topics listed in Exhibit 5.18. The response categories were: all or almost all of the students (at least 90%); about half of the students; only the more able students (top track - about 25%); only the most advanced students (10% or less); not included in curriculum through grade 8. (See Reference Exhibits R2.2-R2.6 for detail by topic.)

1 Academy School Dist. #20: As a district that has site-based curriculum development, the district cannot provide a representative response for these questions.

2 SW Math/Sci. Collaborative: Covering a workforce region of 118 autonomous districts, the Collaborative cannot provide a representative response for these questions.

A dash (–) indicates data are not available.

Have Students Been Taught the Topics Tested by TIMSS?

In interpreting the achievement results, it is important to consider how extensively the topics tested are taught in the participating entities. As shown in Exhibits 5.20 through 5.24, the five major mathematics content areas assessed in timss 1999 were represented by 34 topic areas. For each area, teachers indicated whether their students had been taught the topics before this year (i.e., the eighth grade), one to five periods this year, more than five periods this year; whether the topics had not yet been taught; or whether the teacher did not know. Exhibits 5.20 through 5.24 show the percentages of students in each entity reported to have been taught each topic before or during the year of testing.

According to their teachers, nearly all students in all the comparison countries had been taught the topics in fractions and number sense, as shown in Exhibit 5.20. The international average for each topic exceeded 90 percent of students, with the exception of "square roots (of perfect squares less than 144), small integer exponents" and "concepts of ratio and proportions; ratio and proportion problems," with averages of 83 and 87 percent, respectively. Teachers in the United States overall as well as in the Benchmarking jurisdictions reported similar percentages, with 90 percent or more of the students in each jurisdiction being taught each topic with the exception of the two topics relating to square roots and ratio/proportion.

However, Exhibit R2.7 in the reference section indicates that internationally many students had instruction in these topics before the eighth grade, while students in several Benchmarking jurisdictions were taught them during that grade. For example, high-performing Chinese Taipei reported that 90 percent of its students were taught more than 80 percent of the fractions and number sense topics before the eighth grade and not again during the eighth grade. Only eight percent of U.S. students were taught more than 80 percent of these topics before the eighth grade only. Similarly, all but one of the Benchmarking jurisdictions had less than one-fifth of their students taught more than 80 percent of fraction and number sense topics before the eighth grade only. In the U.S. overall and across the Benchmarking jurisdictions, a larger proportion of students were taught, or were continued to be taught, fractions and number sense topics at the eighth grade than were students internationally. This echoes the findings of the timss 1995

43 percent. Coverage of this topic varied widely, from just three or four percent in Japan and Chinese Taipei to 99 percent in Korea. The Benchmarking jurisdictions generally resembled the United States overall, where 79 percent were taught this topic.

For students in most countries, the data representation, analysis, and probability topics received moderate attention in the eighth grade, with few students having been taught them only in earlier grades, and one-third having not yet been taught half or more of the topics by the end of the eighth grade (see Exhibit R2.9). In comparison, however, relatively greater percentages of students in the United States and in the Benchmarking entities were reported to have been taught these topics during the eighth grade. In the U.S. overall, 79 percent of students were taught more than half the topics during the eighth grade. All Benchmarking jurisdictions had a much greater percentage of students than internationally (39 percent, on average) who were taught more than half the topics during the eighth grade, ranging from 60 percent in Rochester to 99 percent in Chicago.

Teachers reported a range of instructional coverage across topics in geometry, presented in Exhibit 5.23. “Simple two dimensional geometry – angles on a straight line, parallel lines, triangles and quadrilaterals” was reported to have been taught internationally on average to 95 percent of the students, and “visualization of three-dimensional shapes” to only 57 percent. The topics showing the greatest variation across countries were “symmetry and transformations” and “visualization of three-dimensional shapes.” For example, the percentage of students taught “symmetry and transformations” ranged from less than 30 percent in Chinese Taipei to 98 percent in Japan. The other four geometry topics were taught to more than 90 percent of the students in high-performing Japan, Korea, and Singapore. The United States was similar to the international averages in coverage of the geometry topics, as were most of the Benchmarking participants, although they did show variation, particularly the districts and consortia. For example, in Jersey City, Montgomery County, and Naperville, 90 percent of more of the students were taught each of the geometry topics. However, in the Academy School District, Miami-Dade, and Rochester, less than 50 percent of the students were taught “symmetry and transformations” and “visualization of three-dimensional shapes,” the two topics that had the lowest coverage both internationally and in the U.S.

As shown in Exhibit R2.10 in the reference section, only small percentages of students had completed instruction in the geometry topics before the eighth grade, and relatively large percentages had not yet been introduced to many geometry topics by the end of the eighth grade. According to the teachers in the United States, 25 percent of the students had not been taught half or more of the geometry topics by the end of eighth grade, close to the international average of 22 percent. This was exceeded only by Chinese Taipei (33 percent) among the comparison countries. In the Czech Republic, Italy, Japan, Korea, and Singapore, less than only 10 percent of the students had not yet been taught half or more of these topics. One-quarter or more of the students in six Benchmarking states and four districts and consortia had not been taught half or more of the geometry topics by the end of the eighth grade, with the greatest percentage in the Academy School District (49 percent).

Teachers across countries reported that most students had been taught y t756 0 e d272J/F4 1 Tf16l2 Tc0 TwTD2727(pe7e)]TJ*tudent in Exhibit R

Exhibits 5.20-5.24

Countries							
United States	100 (0.2)	100 (0.0)	100 (0.0)	98 (0.8)	98 (0.8)	98 (0.8)	99 (0.7)
Belgium (Flemish)	95 (3.1)	99 (1.2)	97 (2.4)	88 (2.9)	83 (2.2)	89 (4.1)	90 (3.5)
Canada	r 99 (0.6)	r 100 (0.3)	r 100 (0.3)	r 99 (0.5)	r 98 (0.8)	r 99 (0.4)	r 100 (0.3)
Chinese Taipei	100 (0.0)	100 (0.3)	100 (0.3)	100 (0.3)	99 (0.7)	100 (0.3)	98 (1.1)
Czech Republic	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
England	s 100 (0.1)	s 99 (0.5)	s 93 (2.0)	s 97 (0.9)	s 95 (1.1)	s 94 (1.1)	s 97 (0.9)
Hong Kong, SAR	98 (1.1)	99 (0.8)	99 (0.8)	99 (0.8)	100 (0.0)	99 (0.8)	100 (0.4)
Italy	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.5)	100 (0.0)	100 (0.0)	100 (0.4)
Japan	99 (1.0)	98 (1.4)	100 (0.0)	98 (1.4)	100 (0.0)	99 (1.0)	92 (2.7)
Korea, Rep. of	92 (2.1)	96 (1.5)	96 (1.6)	97 (1.4)	96 (1.6)	96 (1.7)	94 (2.0)
Netherlands	r 74 (5.8)	100 (0.3)	100 (0.3)	r 96 (3.2)	r 96 (3.3)	r 96 (3.3)	100 (0.0)
Russian Federation	– –	– –	– –	– –	– –	– –	– –
Singapore	100 (0.0)	100 (0.0)	100 (0.0)	99 (0.9)	100 (0.0)	100 (0.0)	100 (0.0)
States							
Connecticut	r 99 (0.9)	r 100 (0.0)	r 100 (0.0)	r 100 (0.0)	r 99 (0.9)	r 100 (0.0)	r 100 (0.0)
Idaho	r 100 (0.3)	r 100 (0.0)	r 100 (0.0)	r 97 (2.1)	r 97 (2.2)	r 98 (1.5)	r 100 (0.3)
Illinois	100 (0.0)	100 (0.0)	100 (0.0)	99 (1.1)	97 (2.2)	99 (1.1)	99 (1.1)
Indiana	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	99 (1.4)	98 (1.5)	100 (0.0)
Maryland	r 100 (0.0)	r 100 (0.0)	r 100 (0.0)	r 98 (1.8)	r 98 (1.8)	r 98 (1.7)	r 98 (1.7)
Massachusetts	r 100 (0.0)	100 (0.0)	100 (0.0)	r 99 (1.1)	r 98 (1.5)	r 99 (1.2)	r 99 (1.1)
Michigan	100 (0.0)	100 (0.0)	100 (0.0)	99 (1.0)	99 (1.0)	100 (0.3)	100 (0.3)
Missouri	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	99 (0.9)	100 (0.2)	100 (0.0)
North Carolina	100 (0.0)	100 (0.0)	100 (0.0)	99 (1.1)	98 (1.5)	99 (1.1)	100 (0.0)
Oregon	100 (0.0)	100 (0.0)	100 (0.0)	98 (1.3)	98 (1.4)	100 (0.2)	100 (0.2)
Pennsylvania	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.4)	99 (1.0)	r 100 (0.1)	95 (4.8)
South Carolina	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	99 (0.9)	99 (0.9)	100 (0.0)
Texas	100 (0.0)	100 (0.0)	100 (0.0)	98 (1.3)	98 (1.3)	99 (1.3)	99 (1.2)
Districts and Consortia							
Academy School Dist. #20, CO	100 (0.0)	100 (0.0)	100 (0.0)	98 (0.2)	98 (0.2)	100 (0.0)	100 (0.0)
Chicago Public Schools, IL	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
Delaware Science Coalition, DE	r 100 (0.0)	r 100 (0.4)	r 100 (0.4)	r 99 (0.5)	r 99 (0.5)	r 99 (0.5)	r 100 (0.4)
First in the World Consort., IL	r 100 (0.0)	r 100 (0.0)	r 100 (0.0)	r 100 (0.0)	r 100 (0.0)	r 100 (0.0)	r 100 (0.0)
Fremont/Lincoln/WestSide PS, NE	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
Guilford County, NC	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	98 (2.0)	100 (0.0)	100 (0.0)
Jersey City Public Schools, NJ	r 100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
Miami-Dade County PS, FL	s 100 (0.0)	s 99 (0.5)	s 99 (0.6)	s 97 (2.5)	s 97 (2.5)	s 96 (2.7)	s 97 (2.2)
Michigan Invitational Group, MI	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
Montgomery County, MD	s 100 (0.0)	s 100 (0.0)	s 100 (0.0)	s 100 (0.0)	s 100 (0.0)	s 100 (0.0)	s 100 (0.0)
Naperville Sch. Dist. #203, IL	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
Project SMART Consortium, OH	100 (0.0)	100 (0.2)	100 (0.2)	100 (0.2)	100 (0.2)	100 (0.2)	100 (0.0)
Rochester City Sch. Dist., NY	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
SW Math/Sci. Collaborative, PA	100 (0.0)	100 (0.0)	98 (0.4)	98 (1.9)	97 (2.0)	99 (0.6)	100 (0.0)
International Avg. (All Countries)	98 (0.3)	99 (0.2)	98 (0.2)	98 (0.2)	98 (0.2)	98 (0.2)	95 (0.3)

Background data provided by teachers.

* Taught before or during this school year.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Countries						
United States	100 (0.2)	99 (0.5)	96 (1.4)	97 (1.1)	82 (3.7)	93 (1.8)
Belgium (Flemish)	r 94 (2.0)	96 (2.5)	93 (2.1)	89 (2.6)	80 (2.2)	70 (2.8)

Countries																
United States		96	(1.0)	r	92	(1.7)	r	91	(1.2)		95	(1.4)		90	(1.6)		83	(2.0)	r	84	(2.5)
Belgium (Flemish)		95	(1.8)	r	83	(3.8)	r	85	(4.1)		98	(1.2)	r	85	(3.9)		89	(3.5)		88	(2.2)
Canada	r	99	(0.5)	r	97	(1.2)	r	97	(1.0)	r	97	(0.9)	r	96	(1.3)	r	68	(2.7)	r	92	(2.1)
Chinese Taipei		96	(1.7)		95	(2.0)		90	(2.7)		100	(0.3)		92	(2.3)		99	(0.7)		74	(3.8)
Czech Republic		100	(0.2)	r	99	(0.6)		97	(1.2)		100	(0.0)		90	(3.2)		100	(0.0)		98	(1.2)
England	s	98	(0.9)	s	96	(1.3)	s	86	(2.8)	s	98	(1.0)	s	96	(1.1)	s	93	(1.4)	s	76	(2.6)
Hong Kong, SAR		98	(1.2)		96	(1.9)		92	(2.5)		100	(0.0)		99	(0.8)		98	(1.5)		91	(2.7)
Italy		100	(0.0)		96	(1.6)		90	(2.3)		99	(0.8)		96	(1.3)		95	(1.4)		91	(2.2)
Japan		90	(2.5)	r	84	(3.3)	r	66	(4.2)		99	(0.7)		78	(3.3)		98	(1.4)		84	(3.1)
Korea, Rep. of		85	(2.7)		84	(2.7)		93	(2.1)		98	(1.2)		95	(1.8)		98	(1.0)		73	(3.4)
Netherlands	r	93	(4.7)	s	54	(8.4)	r	78	(6.3)		98	(1.2)		84	(4.9)		89	(4.9)		88	(5.3)
Russian Federation		–	–		–	–		–	–		–	–		–	–		–	–		–	–
Singapore		100	(0.0)	r	98	(1.2)		98	(1.3)		100	(0.0)		100	(0.0)		100	(0.0)		96	(1.6)
States																					
Connecticut	r	95	(2.6)	s	95	(2.5)	s	91	(3.6)	r	95	(2.3)	r	90	(3.5)	r	81	(4.3)	s	88	(4.0)
Idaho	r	91	(4.5)	s	93	(4.4)	s	90	(4.4)	r	93	(2.3)	r	79	(5.1)	r	73	(6.3)	r	79	(5.7)
Illinois		98	(1.6)		99	(0.5)	r	98	(1.7)		98	(2.0)		93	(2.9)		91	(3.3)		90	(3.5)
Indiana		99	(1.1)		98	(1.2)		92	(3.9)		95	(2.3)		85	(4.9)		83	(4.6)		82	(5.0)
Maryland	r	97	(1.8)	r	93	(3.2)	r	97	(1.8)	r	97	(2.0)	r	94	(2.8)	r	83	(4.9)	r	91	(3.6)
Massachusetr																					

Background data provided by teachers.

* Taught before or during this school year.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Background data provided by teachers.

* Taught before or during this school year.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Background data provided by teachers.

* Taught before or during this school year.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

What Can Be Learned About the Mathematics Curriculum?

In contrast to the United States, most countries around the world have well-established, centrally-mandated national curricula. Recently, however, states and districts in the U.S. have been making great strides in establishing content standards and curriculum frameworks to guide curriculum implementation in schools. Furthermore, many education systems in the U.S. have begun to assess whether the intended curriculum in mathematics is being attained or learned by their students.

Although effort has been made to develop rigorous curriculum standards, the intended mathematics curriculum in the United States overall and in many Benchmarking jurisdictions does not seem as advanced or focused as that in other countries. Students in the U.S. are generally taught more topics with less depth, with each often spread over the course of more grades, than are their peers in other nations.[10] This lack of focus has been cited as a potential explanation for the relatively poor academic performance of U.S. students compared with those in other nations.[11] Thoroughly examining the Benchmarking jurisdictions' results in an international context can provide insights into what students are expected to learn in mathematics, what is taught in classrooms, and what policies and practices provide the best match between the intended and the implemented curriculum to improve student achievement.

10 Schmidt, W.H., McKnight, C.C., and Raizen, S.A. (1997), *A Splintered Vision: An Investigation of U.S. Science and Mathematics Education*, Dordrecht, the Netherlands: Kluwer Academic Publishers.

11 Mayer, D.P., Mullens, J.E., and Moore, M.T. (2000), *Monitoring School Quality: An Indicators Report*, NCES 2001-030, Washington, DC: National Center for Education Statistics.

chapter 6

Teachers and Instruction

Chapter 6 presents information about mathematics teachers and instruction. Teachers' reports are given on their educational background, teaching preparation, and instructional practices. Information is also provided about how teachers spend their time related to teaching tasks, the materials used in instruction, the activities students do in class, the use of calculators and computers in mathematics lessons, the role of homework, and the reliance on different types of assessment.

Exhibit 6.2 presents teachers' reports about their major areas of study during their post-secondary teacher preparation programs. Teachers' undergraduate and graduate studies give some indication of their preparation to teach mathematics. Also, research shows that higher achievement in mathematics is associated with teachers having a bachelor's and/or master's degree in mathematics.[1] According to their teachers, however, U.S. eighth-grade students were less likely than those in other countries to be taught mathematics by teachers with a major area of study in mathematics.

On average internationally, 71 percent of students were taught by teachers who had mathematics as a major area of study. (Note that teachers can have dual majors, or different majors at the undergraduate and graduate level.) This compares with 41 percent for the United States, a figure not too different from that for many Benchmarking participants, although there was a range of 16 percent in Jersey City to 73 percent in First in the World and Naperville. Suffice it to say that in the United States and most Benchmarking entities, a smaller percentage of students than the international average was taught by mathematics teachers with a major in mathematics. Canada and Italy were the only nations that reported lower percentages than the United States.

Internationally on average, 31 percent of the students were taught by teachers with mathematics education as a major area of study. In comparison, more than half of the students were taught by teachers with this major in the states of Illinois, Michigan, and Pennsylvania, as well as in the districts and consortia of Chicago, First in the World, the Fremont/Lincoln/Westside Public Schools, Guilford County, Project smart, Rochester, and the Southwest Pennsylvania Math and Science Collaborative.

Internationally on average, 32 percent of the students were taught by teachers with education as a major area of study. Significantly more students in the United States (54 percent) had mathematics teachers with an education major than did students internationally. In general across the Benchmarking participants, about twice as many teachers reported an education major as did internationally. It is clear that teachers in the United States have less "in field" mathematics preparation than their counterparts around the world.

To gauge teachers' confidence in their ability to teach mathematics topics, timss constructed an index of teachers' confidence in their preparation to teach mathematics (cptm), presented in Exhibit 6.3. Teachers were asked how well prepared they felt to teach each of 12 mathematics topics (e.g., properties of geometric figures, solving linear equations and

[1] Goldhaber, D.D. and Brewer, D.J. (1997), "Evaluating the Effect of Teacher Degree Level on Educational Performance" in W. Fowler (ed.), *Developments in School Finance*, 1996, NCES 97-535, Washington DC: National Center for Education Statistics; Darling-Hammond, L. (2000), *Teacher Quality and Student Achievement: A Review of State Policy Evidence*, Education Policy Analysis Archives, 8(1).

inequalities). There were three possible responses: very well prepared was assigned a value of three, somewhat prepared two, and not well prepared one. Students were assigned to the high level of the index if their teachers reported feeling very well prepared, on average, across the 12 topics (2.75 or higher). The medium level indicates that teachers reported being somewhat to well prepared (averages from 2.25 to 2.75), and the low level that they felt only somewhat prepared or less (averages less than 2.25).

The results show that average mathematics achievement is related to how well prepared teachers felt they were to teach mathematics, with higher achievement related to higher levels of teachers' confidence. On average internationally, teachers reported relatively high degrees of confidence, with 63 percent of students taught by teachers who believed they were very well prepared. Interestingly, for the United States as a whole and most Benchmarking entities, more students were taught mathematics by teachers confident about their preparation than in almost all the comparison countries. Interpreting these results should take several factors into account. For example, cultural issues may dictate that teachers in the high-scoring Asian countries are more reserved about reporting their strengths and abilities. Also, when the mathematics curriculum is more challenging, teachers may feel less confident in their academic and pedagogical preparation. Nevertheless, it appears that in relation to both high- and low-performing countries around the world, teachers in many Benchmarking entities and in the United States overall may be overconfident about their preparation to teach eighth-grade mathematics.

Exhibit R3.1 in the reference section provides the detail for the 12 topics comprising the confidence in preparation index. On average across countries, the topics having the most students (from 79 to 82 percent) taught by teachers who felt very well prepared were "fractions, decimals, and percentages;" "ratios and proportions;" "perimeter, area, and volume;" "evaluate and perform operations on algebraic expressions;" and "solving linear equations and inequalities." Teachers

by teachers who reported being very well prepared to teach the three algebra topics: "algebraic representation;" "evaluate and perform operations on algebraic expressions;" and "solving linear equations and inequalities." Similar results were obtained for the topics "representation and interpretation of data in graphs, charts, and tables;" and "simple probabilities – understanding and calculations," even though teachers in Idaho, Massachusetts, and North Carolina were less confident about this latter topic. Teachers also appeared confident in their preparation to teach "measurement – units, instruments, and accuracy,"except in North Carolina, the Fremont/Lincoln/Westside Public Schools, Guilford County, and Rochester, where less than 80 percent of the students were taught by teachers who felt very well prepared to teach this topic. The pattern of less confidence in teaching this measurement topic was found internationally and for the United States.

Teachers in the Benchmarking entities expressed the least confidence in their preparation to teach geometry. Less than 80 percent of the students in Idaho, Oregon, the Delaware Science Coalition, and the Fremont/Lincoln/Westside Public Schools had teachers confident about their preparation in any of the three geometry topics. Across nearly all the participating states as well as in a number of the districts and consortia, teachers expressed less than full confidence in their preparation to teach "geometric figures – symmetry, motions and transformations, congruence and similarity." Interestingly, this pattern was also noted internationally and for the United States, even though these topics are included in the curriculum and taught to substantial percentages of eighth-grade students in the U.S. and abroad. Beyond those already mentioned, Benchmarking entities where less than 80 percent of students had teachers confident about their preparation to teach "coordinate geometry" were Illinois, Indiana, Missouri, the Jersey City Public Schools, and the Miami-Dade County Public Schools.

Exhibit R3.2 shows principals' opinions about the degree to which shortages of qualified mathematics teachers affect the capacity to provide instruction. On average internationally, principals reported that such

Teachers' beliefs about mathematics learning and instruction are to some degree related to their preparation. Exhibits R3.3 and R3.4 in the reference section show the percentages of eighth-grade students whose mathematics teachers reported certain beliefs about mathematics, the way mathematics should be taught, and the importance of various cognitive skills in achieving success in the discipline. In general, more students in the Benchmarking entities than internationally were taught by teachers agreeing that mathematics is primarily a formal way of representing the real world. Conversely, more students internationally than in the Benchmarking entities had teachers who agreed that some students have a natural talent for mathematics, and that an effective teaching approach is to give students having difficulty more practice by themselves during class. There was nearly complete agreement by teachers throughout the Benchmarking jurisdictions and around the world that more than one representation should be used in teaching a mathematics topic. Views varied substantially, for both the countries and the Benchmarking entities, regarding the importance of being able to remember formulas and procedures. Less than one-quarter of the students in the Delaware Science Coalition (similar to Chinese Taipei and Korea) were taught by teachers who believed remembering formulas and procedures was very important for students' success in mathematics. In contrast, more than half the students in Idaho, South Carolina, Guilford County, Jersey City, and Rochester (similar to the Russian Federation) had teachers who believed this to be the case.

How teachers spend their time in school is determined mainly by school and district policies and practices, but the perspectives they gain during their teacher preparation can also have an effect. Across countries, students' mathematics teachers spent only about 60 percent of their formally scheduled school time teaching mathematics (see Exhibit R3.5 in the reference section). Additionally, about 10 percent was spent teaching subjects other than mathematics, about 10 percent on curriculum planning, and about 20 percent on various administrative and other duties. The results for the United States as a whole and for most of the Benchmarking entities were very similar to the international profile.

	Percentage of Students by Age of Teachers				Percentage of Students by Gender of Teachers	
	29 Years or Under	30-39 Years	40-49 Years	50 Years or Older	Female	Male
Countries						
United States	11 (2.0)					
Belgium (Flemish)	20 (2.7)					
Canada	17 (2.4)					
Chinese Taipei	10 (2.6)					
Czech Republic	7 (2.5)					
England	s 20 (2.9)				s	
Hong Kong, SAR	32 (4.2)					
Italy	0 (0.0)					
Japan						
Korea, Rep. of						
Netherlands	r					
Russian Federation						
Singapore						
States						
Connecticut	r				r	
Idaho	r				r	
Illinois						
Indiana						
Maryland	r				r	
Massachusetts						
Michigan						
Missouri						
North Carolina						
Oregon						
Pennsylvania						
South Carolina						
Texas						
Districts and Consortia						
Academy School Dist. #20, CO						
Chicago Public Schools, IL						
Delaware Science Coalition, DE	r				r	
First in the World Consort., IL						
Fremont/Lincoln/WestSide PS, NE						
Guilford County, NC						
Jersey City Public Schools, NJ						
Miami-Dade County PS, FL	s				s	
Michigan Invitational Group, MI						
Montgomery County, MD	s				s	
Naperville Sch. Dist. #203, IL						
Project SMART Consortium, OH						
Rochester City Sch. Dist., NY						
SW Math/Sci. Collaborative, PA						
International Avg. (All Countries)						

Background data provided by teachers.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Jersey City Public Schools, NJ	97 (2.7)	479 (9.0)	3 (2.7)	351 (4.6)	0 (0.0)	~ ~
Naperville Sch. Dist. #203, IL	95 (1.9)	570 (3.0)	5 (1.9)	529 (8.9)	0 (0.0)	~ ~
Michigan Invitational Group, MI	94 (2.1)	530 (5.0)	6 (2.1)	519 (27.2)	0 (0.0)	~ ~
SW Math/Sci. Collaborative, PA	94 (3.4)	519 (8.1)	5 (3.4)	508 (20.0)	1 (0.0)	~ ~
Rochester City Sch. Dist., NY	93 (2.0)	444 (7.3)	7 (2.0)	406 (16.9)	0 (0.0)	~ ~
First in the World Consort., IL	93 (5.5)	564 (6.4)	7 (5.5)	491 (11.8)	0 (0.0)	~ ~
Academy School Dist. #20, CO						

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.


Percentage of Students at High Level of Index of Teachers' Confidence in Preparation to Teach Mathematics (CPTM)
Jersey City Public Schools, NJ
Naperville Sch. Dist. #203, IL
Michigan Invitational Group, MI
SW Math/Sci. Collaborative, PA
Rochester City Sch. Dist., NY
First in the World Consort., IL
Academy School Dist. #20, CO
Maryland
Missouri
South Carolina
Pennsylvania
Michigan
Project SMART Consortium, OH
North Carolina
United States
Connecticut
Illinois
Massachusetts
Texas
Chicago Public Schools, IL
Indiana
Miami-Dade County PS, FL
Guilford County, NC
Montgomery County, MD
Czech Republic
Delaware Science Coalition, DE
Fremont/Lincoln/WestSide PS, NE
Netherlands
Oregon
Idaho
Chinese Taipei
Canada
Singapore
Belgium (Flemish)
Hong Kong, SAR
Italy
Korea, Rep. of
Japan
England
Russian Federation
0
20
40
60
80
100

How Much School Time Is Devoted to Mathematics Instruction?

Exhibit 6.4 presents information about the amount of mathematics instruction given to eighth-grade students in the timss 1999 Benchmarking jurisdictions and the comparison countries. Since different systems have school years of different lengths (see Exhibit R3.6) and different arrangements of daily and weekly instruction, the information is given in terms of the average number of hours of mathematics instruction over the school year as reported by mathematics teachers. Canada provides 150 hours per year, on average, and the United States 144 hours, compared with the international average of 129 hours. Benchmarking entities with teachers reporting more than 150 hours of mathematics instruction per year were the Jersey City Public Schools, South Carolina, North Carolina, the Delaware Science Coalition, and the Fremont/Lincoln/Westside Public Schools. Interestingly, the teachers in the Naperville School District and the First in the World Consortium reported the least amount of mathematics instructional time (114 hours) per year. Among the reference countries, the percentage of instructional time at the eighth grade that was devoted to mathematics ranged from 17 percent in the Russian Federation to nine percent in Chinese Taipei and the Netherlands. Among the Benchmarking jurisdictions, the percentage ranged from 18 percent in North Carolina to 11 percent in Indiana, Pennsylvania, and First in the World.

As shown in Exhibit 6.5, teachers of about half the students, on average internationally, reported that mathematics classes meet for at least two hours per week but fewer than three and a half. For another one-third of students, classes meet for at least three and a half hours but fewer than five. On average, eighth graders in the United States spend more time in mathematics class per week (typically three and a half to five hours) than do their counterparts internationally. This pattern of more classroom time held for nearly all of the Benchmarking entities, with the exception of the Chicago Public Schools and Naperville (primarily two to three and a half hours), and North Carolina and the Jersey City Public Schools (primarily five hours or more).

The data, however, reveal no clear pattern between the number of in-class instructional hours and mathematics achievement either across or within participating entities. Common sense and research both support the idea that time on task is an important contributor to achievement, yet this time can be spent more or less efficiently. Time alone is not enough; it needs to be spent on high-quality mathematics instruction. Devoting extensive class time to remedial activities can deprive students of this. Also, instructional time can be spent out of school in various tutoring programs; low-performing students may be receiving additional instruction.

Videotapes of mathematics classes in the United States and Japan in timss 1995 revealed that outside interruptions like those for announcements or to conduct administrative tasks can affect the flow of the lesson and detract from instructional time.[2] As shown in Exhibit 6

Jersey City Public Schools, NJ	238	(9.8)
South Carolina	189	(10.6)
North Carolina	182	(8.9)

Mathematics instructional time provided by teachers, and total instructional time provided by schools.

1 Computed as the ratio of mathematics instructional time to total instructional time averaged across students.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates school and/or teacher response data available for 70-84% of students. An "s" indicates school and/or teacher response data available for 50-69% of students. An "x" indicates school and/or teacher response data available for <50% of students.

Countries								
United States	16 (2.2)	490 (9.2)	56 (3.4)	501 (4.9)	17 (2.6)	528 (11.6)	11 (2.3)	491 (14.5)
Belgium (Flemish)	4 (1.0)	590 (11.7)	40 (2.8)	595 (4.1)	43 (3.8)	544 (7.7)	13 (3.4)	502 (18.9)
Canada r								

Background data provided by teachers.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Background data provided by students.

What Activities Do Students Do in Their Mathematics Lessons?

Because it can affect pedagogical strategies, class size is shown in Exhibit 6.7. Teachers' reports on the size of their eighth-grade mathematics class reveal that across countries the average was 31 students, but there was considerable variation even among the higher-performing countries – from 42 students in Korea to 19 in Belgium (Flemish). Average class size was relatively uniform across all of the Benchmarking entities, ranging from 22 to 30 students. The relationship between class size and achievement is difficult to disentangle, given the variety of policies and practices and the fact that smaller classes can be used for both advanced and remedial learning. It makes sense, however, that teachers may have an easier time managing and conducting more student-centered instructional activities with smaller classes.

Extensive research about class size in relation to achievement indicates that the existence of such a relationship is dependent on the situation.

As might be anticipated, students reported that use of the board was an extremely common presentational mode in mathematics class (see Exhibit 6.10). On average internationally, 92 percent of students reported that teachers used the board at least pretty often, and 60 percent reported that students did so. Using the board seems to be less common in the United States, especially for students (37 percent). In the United States, use of an overhead projector is a popular presentational mode, especially for teachers – 59 percent compared with 19 percent internationally. This mode was used frequently for more than 80 percent of the students in Maryland, North Carolina, Oregon, the Academy School District, the Fremont/Lincoln/Westside Public Schools, Guilford County, Montgomery County, and Naperville.

Educators, parents, employers, and most of the public support the goal of improving students' capacity for mathematics problem-solving. To examine the emphasis placed on that goal, timss created an index of teachers' emphasis on mathematics reasoning and problem-solving (emrps). As shown in Exhibit 6.11, the index is based on teachers' responses about how often they asked students to explain the reasoning behind an idea, represent and analyze relationships using tables, charts, or graphs, work on problems for which there was no immediate solution, and write equations to represent relationships. Students were placed in the high category if, on average, they were asked to do these activities in most of their lessons. The medium level represents students asked to do these activities in some to most lessons, and students in the low category did them only in some lessons or rarely.

Nearly half the Japanese students were at the high index level, compared with the international average of

internationally on average nearly three-fourths of the students (73 percent) were asked to practice their computational skills in most or every mathematics lesson. Nearly as many (70 percent) were asked to explain the reasoning behind an idea this frequently. The other three problem-solving activities occurred much less often. Forty-three percent of students, on average across countries, wrote equations representing rela-

Background data provided by students.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

9 (0.7)	37 (1.9)	16 (1.0)
2 (0.5)	42 (1.8)	2 (0.8)
5 (0.5)	25 (1.2)	7 (0.8)
2 (0.2)	48 (1.6)	2 (0.3)
2 (0.4)	91 (1.7)	4 (0.5)
6 (0.8)	13 (1.0)	3 (0.6)
3 (0.4)	46 (1.7)	3 (0.4)
5 (0.6)	84 (1.1)	7 (0.6)
1 (0.4)	50 (2.5)	1 (0.3)
7 (0.9)	38 (1.7)	3 (0.3)
2 (0.3)	9 (1.2)	2 (0.3)
1 (0.2)	92 (0.6)	4 (0.5)
11 (1.2)	52 (2.0)	21 (1.1)
8 (1.4)	43 (3.4)	18 (2.7)
9 (1.5)	30 (2.7)	12 (1.2)
8 (1.3)	37 (4.8)	16 (1.9)
8 (1.1)	42 (3.7)	16 (1.7)
10 (1.0)	44 (3.8)	32 (1.9)
7 (1.3)	46 (3.4)	17 (2.3)
7 (1.1)	30 (2.2)	18 (2.1)
8 (0.9)	39 (3.0)	15 (2.0)
10 (1.2)	51 (3.0)	33 (2.6)
9 (0.9)	22 (1.8)	28 (2.5)
5 (0.6)	65 (2.9)	16 (2.6)
10 (1.4)	32 (3.0)	16 (1.7)
9 (1.5)	32 (3.4)	22 (1.9)
6 (0.7)	30 (1.0)	23 (1.1)
10 (1.9)	50 (4.5)	18 (4.5)
10 (1.1)	38 (2.8)	27 (2.7)
5 (1.3)	43 (6.2)	
15 (1.4)	23 (2.7)	
6 (0.9)	35 (2.5)	
17 (1.9)	50 (3.2)	
16 (1.9)	46 (6.4)	
7 (0.9)	35 (2.2)	
9 (0.9)	32 (2.7)	
5 (0.7)	43 (1.9)	
11 (1.5)	45 (3.2)	
r 16 (2.1)	r 35 (3.0)	r
5 (0.7)	57 (4.2)	
5 (0.1)	60 (0.2)	

Background data provided by students.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates a 70-84% student response rate.

Exhibit 6.11

Japan		49 (4.1)	584 (2.6)	45 (4.1)	574 (2.5)	7 (2.1)	562 (6.2)
Jersey City Public Schools, NJ	r	46 (6.4)	481 (11.1)	50 (6.0)	482 (15.3)	4 (2.5)	372 (7.2)
First in the World Consort., IL		42 (8.8)	536 (8.1)	54 (8.8)	581 (10.4)	4 (3.0)	492 (12.6)
Michigan Invitational Group, MI		41 (9.6)	521 (5.0)	52 (10.2)	549 (9.4)	7 (3.5)	484 (17.2)
Italy							

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

How Are Calculators and Computers Used?

Exhibit 6.12 shows data on students' access to calculators for use in mathematics class and on policies on their use for those with access. When all 38 timss 1999 countries were considered, teachers in 14 countries reported that nearly all students (more than 90 percent) had access to calculators in class. In addition to the United States, the countries with this high degree of access were Australia, Belgium (Flemish),

Exhibit R3.9

Netherlands						

* The use of calculators on TIMSS was not allowed in 1995 or in 1999.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher and/or student response data available for 70-84% of students. An "s" indicates teacher and/or student response data available for 50-69% of students.

	Percentage of Students at High Level of Index of Emphasis on Calculators in Mathematics Class (ECMC)
Netherlands	
Jersey City Public Schools, NJ	
Naperville Sch. Dist. #203, IL	
Montgomery County, MD	
Academy School Dist. #20, CO	
Michigan Invitational Group, MI	
Oregon	
First in the World Consort., IL	
Singapore	
Fremont/Lincoln/WestSide PS, NE	
England	
North Carolina	
Canada	
Michigan	
Missouri	
Connecticut	
Hong Kong, SAR	
Guilford County, NC	
Illinois	
SW Math/Sci. Collaborative, PA	
Maryland	
United States	
Massachusetts	
Pennsylvania	
Idaho	
Delaware Science Coalition, DE	
Indiana	
Italy	
Project SMART Consortium, OH	
Miami-Dade County PS, FL	
South Carolina	
Belgium (Flemish)	
Texas	
Czech Republic	
Chicago Public Schools, IL	
Russian Federation	
Rochester City Sch. Dist., NY	
Chinese Taipei	
Korea, Rep. of	
Japan	

	Almost Always or Pretty Often		Once in a While		Never	
					Percent of Students	Average Achievement
Countries						
United States						
Belgium (Flemish)						
Canada						
Chinese Taipei						
Czech Republic						
England						
Hong Kong, SAR						
Italy						
Japan						
Korea, Rep. of						
Netherlands						
Russian Federation						
Singapore						
States						
Connecticut						
Idaho						
Illinois						
Indiana						
Maryland						
Massachusetts						
Michigan						
Missouri						
North Carolina						
Oregon						
Pennsylvania						
South Carolina						
Texas						
Districts and Consortia						
Academy School Dist. #20, CO						
Chicago Public Schools, IL						
Delaware Science Coalition, DE						
First in the World Consort., IL						
Fremont/Lincoln/WestSide PS, NE						
Guilford County, NC						
Jersey City Public Schools, NJ						
Miami-Dade County PS, FL						
Michigan Invitational Group, MI						
Montgomery County, MD						
Naperville Sch. Dist. #203, IL						
Project SMART Consortium, OH						
Rochester City Sch. Dist., NY r						
SW Math/Sci. Collaborative, PA						
International Avg. (All Countries)						

Background data provided by students.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report achievement.

An "r" indicates a 70-84% student response rate.

	Percentage of Students				
Countries					
United States					
Belgium (Flemish)					
Canada					
Chinese Taipei					
Czech Republic					
England					
Hong Kong, SAR					
Italy					
Japan	r		s		
Korea, Rep. of					
Netherlands					
Russian Federation					
Singapore					
States					
Connecticut					
Idaho					
Illinois					
Indiana					
Maryland					
Massachusetts					
Michigan					
Missouri					
North Carolina					
Oregon					
Pennsylvania					
South Carolina					
Texas					
Districts and Consortia					
Academy School Dist. #20, CO					
Chicago Public Schools, IL					
Delaware Science Coalition, DE					
First in the World Consort., IL					
Fremont/Lincoln/WestSide PS, NE					
Guilford County, NC					
Jersey City Public Schools, NJ					
Miami-Dade County PS, FL					
Michigan Invitational Group, MI					
Montgomery County, MD					
Naperville Sch. Dist. #203, IL					
Project SMART Consortium, OH					
Rochester City Sch. Dist., NY					
SW Math/Sci. Collaborative, PA					
International Avg. (All Countries)					

Background data provided by students.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates a 70-84% student response rate. An "s" indicates a 50-69% student response rate.

What Are the Roles of Homework and Assessment?

The amount of time students spend on homework assignments is an important consideration in examining their opportunity to learn mathematics. Exhibit 6.16 presents the index of teachers' emphasis on mathematics homework (emh). Students in the high category had teachers who reported giving relatively long homework assignments (more than 30 minutes) on a relatively frequent basis (at least once or twice a week). Those in the low category had teachers who gave short assignments (less than 30 minutes) relatively infrequently (less than once a week or never). The medium level includes all other combinations of responses. Details from teachers' reports about the length and frequency of their homework assignments are found in the reference section in Exhibit R3.11.

The results show substantial variation across countries and Benchmarking entities in the emphasis placed on homework. Together with Italy, Singapore, and the Russian Federation among the comparison countries, the Academy School District had more than half its students in the high category. For the remaining Benchmarking participants, the majority of students were in the medium category. Very few students were in the low category. One notable exception is Japan (34 percent in the low category), where students were more likely to spend extra time in tutoring and special schools than doing homework.[4] There was little relationship between the amount of homework assigned and students' performance. Again, lower-performing students may need more homework assignments for remedial reasons.

Since problem-solving activities will potentially be more beneficial if they can be extended to out-of-class-situations and stretched over a longer time, timss asked teachers how often they assigned homework based on projects and investigations. The data in Exhibit R3.12 in the reference section show that most students (82 percent on average internationally) had teachers that never or rarely gave such homework. Even though teachers in some of the Benchmarking entities reported giving project-based homework more frequently than did teachers internationally, such assignments did not appear to be made very often. The Benchmarking entities where approximately one-third or more of the students were given projects to do as homework at least sometimes were Connecticut, Massachusetts, Oregon, South Carolina, the Jersey City Public Schools, the Miami-Dade County Public Schools, Montgomery County, and the Project smart Consortium.

4 Robitaille, D.F., (1997), *National Contexts for Mathematics and Science Education: An Encyclopedia of the Education Systems Participating in TIMSS*, Vancouver, BC: Pacific Educational Press.

States in *italics*

Italy
Academy School Dist. #20, CO
Singapore
Russian Federation
Chinese Taipei
Hong Kong, SAR
Jersey City Public Schools, NJ

In What Types of Professional Development Activities Do U.S. Mathematics Teachers Participate?

As a timss 1999 national option, the United States asked mathematics teachers to describe their professional development during the 1998-99 school year, defined as June 1998 to May 1999. Since no other countries asked these questions, cross-country comparisons are not possible. Comparisons, however, can be made to the United States as a whole and among the Benchmarking jurisdictions. Teachers were asked both how often they observed and were observed by other teachers (see Exhibit 6.18). In the U.S. overall, these observations of and by teachers were reported by the mathematics teachers of 25 and 35 percent of the students, respectively. Among the Benchmarking states, the results for classroom observation as a professional development approach resembled the national results. Among districts and consortia, observations were used most extensively in the First in the World Consortium and Montgomery County with more than half the students having teachers who reported both observing and being observed by other teachers.

The professional development activities teachers were asked about include the following school- and district-based activities: immersion or internship activities; receiving mentoring, coaching, lead teaching, or observation; teacher resource centers; committees or task forces; and teacher study groups. As shown in Exhibit 6.19, participation on committees or task forces was the most frequently used of these activities. It was reported nationally by the mathematics teachers of more than half the eighth graders (55 percent), and was similarly popular among the Benchmarking participants.

Mathematics teachers were asked about their participation in several types of workshops, conferences, and networks, including within-district workshops and institutes; out-of-district workshops and institutes; teacher collaborative or networks; out-of-district conferences; and other forms of organized professional development (see Exhibit 6.20). They were also asked about individual activities, including taking courses for college credit; individual research projects; individual learning; and other individual professional development activities (see Exhibit 6.21). Of all of the professional development activities, within-district workshops or institutes (79 percent of the students) and individual learning (84 percent) were generally the most frequent activities in which mathematics teachers of U.S. eighth-grade students participated during the 1998-99 school year. Even though there was considerable variation, these activities were also widely reported by teachers in the Benchmarking jurisdictions.

Background data provided by teachers.

1 Based on complete class periods teachers observed other teachers in their school teach mathematics from the beginning of the 1998-99 school year until the time of testing.

2 Based on complete class periods teachers were observed while teaching mathematics by other teachers in their school from the beginning of the 1998-99 school year until the time of testing.

3 Teachers who did not participate in the professional development activity were not included in the average.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report average number of class periods.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Background data provided by teachers.

* Based on participation in professional development activities from June 1998 until the time

States										
Connecticut	r 82 (5.8)	14 (1.7)	r 33 (7.2)	15 (2.0)	r 30 (6.9)	12 (3.3)	r 41 (7.5)	12 (2.2)	r 11 (5.1)	6 (1.7)
Idaho	r 64 (5.7)	12 (1.4)	r 34 (4.9)	25 (5.0)	r 14 (4.2)	7 (1.0)	r 37 (7.5)	15 (2.4)	r 12 (3.7)	6 (1.8)

Background data provided by teachers.

* Based on participation in professional development activities from June 1998 until the time of testing.

1 Teachers who did not participate in the professional development activity were not included in the average.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report average hours.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Connecticut	r 15 (4.4)	27 (7.2)	r 35 (6.3)	23 (4.5)	r 84 (5.6)	25 (2.7)	s 31 (6.4)	18 (5.3)
Idaho	r 54 (8.2)	27 (2.9)	r 22 (4.1)	23 (5.4)	r 68 (5.6)	27 (3.9)	r 29 (7.1)	31 (8.8)
Illinois	36 (7.0)	24 (5.7)	33 (7.3)	23 (6.4)	88 (4.0)	23 (3.9)	19 (5.3)	21 (9.2)
Indiana	21 (4.5)	40 (9.1)	21 (4.7)	13 (2.8)	84 (5.5)	19 (1.7)	20 (4.8)	19 (5.5)
Maryland	r 31 (4.5)	40 (6.9)	r 25 (5.2)	26 (5.9)	r 79 (6.1)	23 (2.2)	r 26 (6.0)	24 (4.6)
Massachusetts	27 (5.5)	43 (4.2)	36 (6.3)	19 (3.6)	84 (4.0)	26 (3.4)	r 37 (7.4)	21 (5.0)
Michigan	17 (4.7)	22 (5.9)	37 (6.1)	15 (4.2)	85 (4.2)	18 (2.9)	r 39 (6.3)	16 (4.7)
Missouri	23 (4.3)	19 (6.5)	20 (4.6)	43 (11.6)	83 (4.7)	20 (2.4)	15 (4.7)	17 (4.4)
North Carolina	17 (4.8)	30 (7.6)	39 (5.6)	18 (3.7)	80 (3.5)	16 (2.1)	r 20 (4.8)	19 (4.5)
Oregon	28 (4.2)	28 (5.6)	36 (4.6)	18 (4.2)	86 (3.6)	24 (2.6)	34 (5.5)	28 (8.1)
Pennsylvania								

Background data provided by teachers.

* Based on participation in professional development activities from June 1998 until the time of testing.

1 The response range had a maximum of 90 hours spent in courses for college credit.

2 Teachers who did not participate in the professional development activity were not included in the average.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students. An "x" indicates teacher response data available for <50% of students.

Background data provided by teachers.

1 Based on participation in professional development activities from June 1998 until the time of testing. Does not include students whose teachers reported that they do not teach the topic.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

	Percentage of Students Whose Teachers Reported That the Content Area is Focused On in Their Professional Development[1]				
Connecticut	r 32 (7.6)	r 29 (7.2)	r 42 (6.5)	r 32 (7.4)	r 44 (7.1)
Idaho	r 40 (6.9)	r 34 (6.5)	r 33 (5.4)	r 24 (5.8)	r 37 (5.5)
Illinois	46 (5.7)	39 (6.5)	49 (6.8)	39 (5.6)	46 (5.4)
Indiana	40 (6.2)	32 (6.2)	37 (6.8)	26 (6.0)	41 (6.0)
Maryland	r 46 (6.5)	r 41 (7.3)	r 65 (5.7)	r 40 (6.0)	r 58 (6.8)
Massachusetts	52 (5.6)	52 (6.4)	52 (5.0)	43 (5.7)	53 (5.5)
Michigan	39 (5.6)	29 (5.3)	44 (7.0)	38 (6.8)	48 (6.6)
Missouri	47 (6.4)	51 (6.3)	54 (6.1)	47 (5.2)	52 (4.7)
North Carolina	53 (6.6)	53 (6.7)	53 (5.9)	53 (7.1)	56 (5.9)
Oregon	42 (7.0)	41 (5.8)	46 (5.1)	38 (5.6)	45 (5.5)
Pennsylvania	r 37 (5.6)	r 35 (5.6)	r 41 (6.6)	r 24 (4.4)	r 37 (6.2)
South Carolina	52 (6.8)	45 (5.5)	56 (7.2)	42 (6.0)	58 (6.4)
Texas	r 59 (7.0)	r 47 (7.0)	r 56 (6.8)	r 45 (7.1)	r 64 (7.0)
Districts and Consortia					
Academy School Dist. #20, CO	42 (0.4)	28 (0.4)	30 (0.4)	17 (0.4)	37 (0.4)
Chicago Public Schools, IL	r 41 (11.0)	r 37 (9.5)	r 41 (12.2)	r 34 (9.0)	r 40 (11.0)
Delaware Science Coalition, DE	r 61 (6.5)	r 63 (7.1)	r 59 (6.1)	r 52 (6.3)	r 64 (6.7)
First in the World Consort., IL	46 (6.4)	52 (9.0)	37 (6.5)	77 (6.7)	66 (9.7)
Fremont/Lincoln/WestSide PS, NE	52 (8.6)	33 (5.4)	55 (8.0)	39 (1.4)	52 (8.6)
Guilford County, NC	45 (6.3)	36 (6.4)	34 (6.3)	40 (6.2)	51 (5.7)
Jersey City Public Schools, NJ	53 (5.2)	58 (5.2)	46 (3.9)	50 (4.3)	54 (5.7)
Miami-Dade County PS, FL	s 57 (8.5)	s 66 (7.6)	s 68 (7.7)	s 60 (8.4)	s 59 (7.1)
Michigan Invitational Group, MI	39 (4.8)	34 (4.7)	45 (4.6)	35 (8.0)	48 (4.1)
Montgomery County, MD	s 34 (6.3)	s 18 (3.6)	s 72 (9.1)	s 48 (7.3)	s 64 (9.1)
Naperville Sch. Dist. #203, IL	26 (2.8)	17 (2.8)	47 (5.2)	22 (0.7)	40 (4.5)
Project SMART Consortium, OH	36 (5.9)	41 (4.6)	47 (5.7)	34 (4.4)	46 (6.6)
Rochester City Sch. Dist., NY	s 76 (5.5)	s 86 (6.9)	s 84 (6.3)	s 76 (6.2)	s 81 (6.8)
SW Math/Sci. Collaborative, PA	30 (4.8)	34 (5.7)	38 (7.0)	36 (5.6)	36 (7.9)
United States	54 (3.3)	45 (3.3)	r 50 (3.0)	r 45 (2.4)	r 56 (3.1)

Background data provided by teachers.

1 Content areas are focused on in professional development if 80% or more of the TIMSS topics in the content area are reported by teachers to have been focused on in their professional development from June 1998 until the time of testing.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Background data provided by teachers.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students. An "x" indicates teacher response data available for <50% of students.

What Is the Economic Composition of the Student Body?

There is considerable evidence that student achievement is greater in schools with higher proportions of students from advantaged socio-economic backgrounds.[1] To provide information on the composition of the student body, schools' reports on the percentage of their students that are eligible to receive free or reduced-price lunch are summarized in Exhibit 7.1 for each of the Benchmarking participants.[2] The Benchmarking participants span almost the complete range on this factor, from the Naperville School District and the Academy School District, with just a few percent of low-income students, to the Jersey City Public Schools, where almost all students (89 percent) were eligible to receive free or reduced-price lunch. Although mathematics achievement was not perfectly correlated with the percentage of students eligible for free or reduced-price lunch, it is noticeable that several high-performing jurisdictions had low percentages of eligible students, and that three of the four lowest-performing[3] – the Chicago Public Schools, the Rochester City School District, and the Jersey City Public Schools – had the highest percentages of such students.

1 Data on this issue from TIMSS 1995 are presented in Martin, M.O., Mullis, I.V.S., Gregory, K.D., Hoyle, C.D., and Shen, C. (2000), *Effective Schools in Science and Mathematics: IEA's Third International Mathematics and Science Study*, Chestnut Hill, MA: Boston College.

2 These data were collected only in the United States and in the Benchmarking jurisdictions.

3 The response rate from schools in the Miami-Dade County Public Schools was insufficient for reliable reporting.

Background data provided by schools.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates school response data available for 70-84% of students. An "s" indicates school response data available for 50-69% of students. An "x" indicates school response data available for <50% of students.

What School Resources Are Available to Support Mathematics Learning?

Some school resources are specific to mathematics, but many are general resources that improve learning opportunities across the curriculum. All the available resources can work together to support mathematics learning and instruction. timss collected data on a range of school resources, including those of a general nature such as buildings and infrastructure, as well as equipment and materials specifically related to mathematics learning.

To measure the extent of school resources in each participating entity, timss created an index of availability of school resources for mathematics instruction (asrmi). As described in Exhibit 7.2, the index is based on schools' average response to five questions about shortages that affect their general capacity to provide instruction and five questions about shortages that affect mathematics instruction in particular. Students were placed in the high category if principals reported that shortages, both general and for mathematics in particular, had no or little effect on instructional capacity. The medium level indicates that one type of shortage affects instruction some or a lot, and the low level that both shortages affect it some or a lot.

Schools in the United States appear to be fairly well-resourced in comparison with the timss 1999 countries. Across the United States as a whole, 37 percent of students were in schools reporting that resource shortages had little effect on instruction, compared with 19 percent on average internationally. Of the reference countries, only Belgium (Flemish), Singapore, the Czech Republic, and the Netherlands reported higher percentages in this category. Across the Benchmarking participants, reports varied widely. In the Academy School District, the First in the World Consortium, and Naperville, more than 75 percent of students were in well-resourced schools, whereas in North Carolina and Oregon 17 percent or less were in such schools.

In many of the Benchmarking jurisdictions and timss 1999 countries, students in schools in the high category had higher average mathematics achievement than those in the low category. For example, in the United States 37 percent of the students were in the high category with an average mathematics achievement of 516, compared with four percent in the low category with an average of 480. However, the relationship between a country's average mathematics achievement and availability of instructional resources is complex. For example, in some countries that performed

in schools with high availability of resources for mathematics instruction. In contrast, in other high-performing countries such as Belgium (Flemish) and the Netherlands, no students were in schools with low availability of resources.

Exhibit R4.1 in the reference section shows the results for each of the types of facilities and materials summarized in the general capacity part of the index. There was substantial variation across countries, but internationally on average, nearly half the students were in schools where mathematics instruction was negatively affected by shortages or inadequacies in instructional materials, the budget for supplies, school buildings, and instructional space. Generally, the Benchmarking participants reported fewer students in schools where mathematics instruction was negatively affected by resource shortages, but again the situation varied widely across jurisdictions. Shortage of instructional space was a problem in Oregon, the Fremont/Lincoln/Westside Public Schools, Jersey City, Miami-Dade, and Montgomery County, where more than half of the eighth-grade students were affected. Inadequate school buildings or grounds were also a problem in Miami-Dade, and Oregon

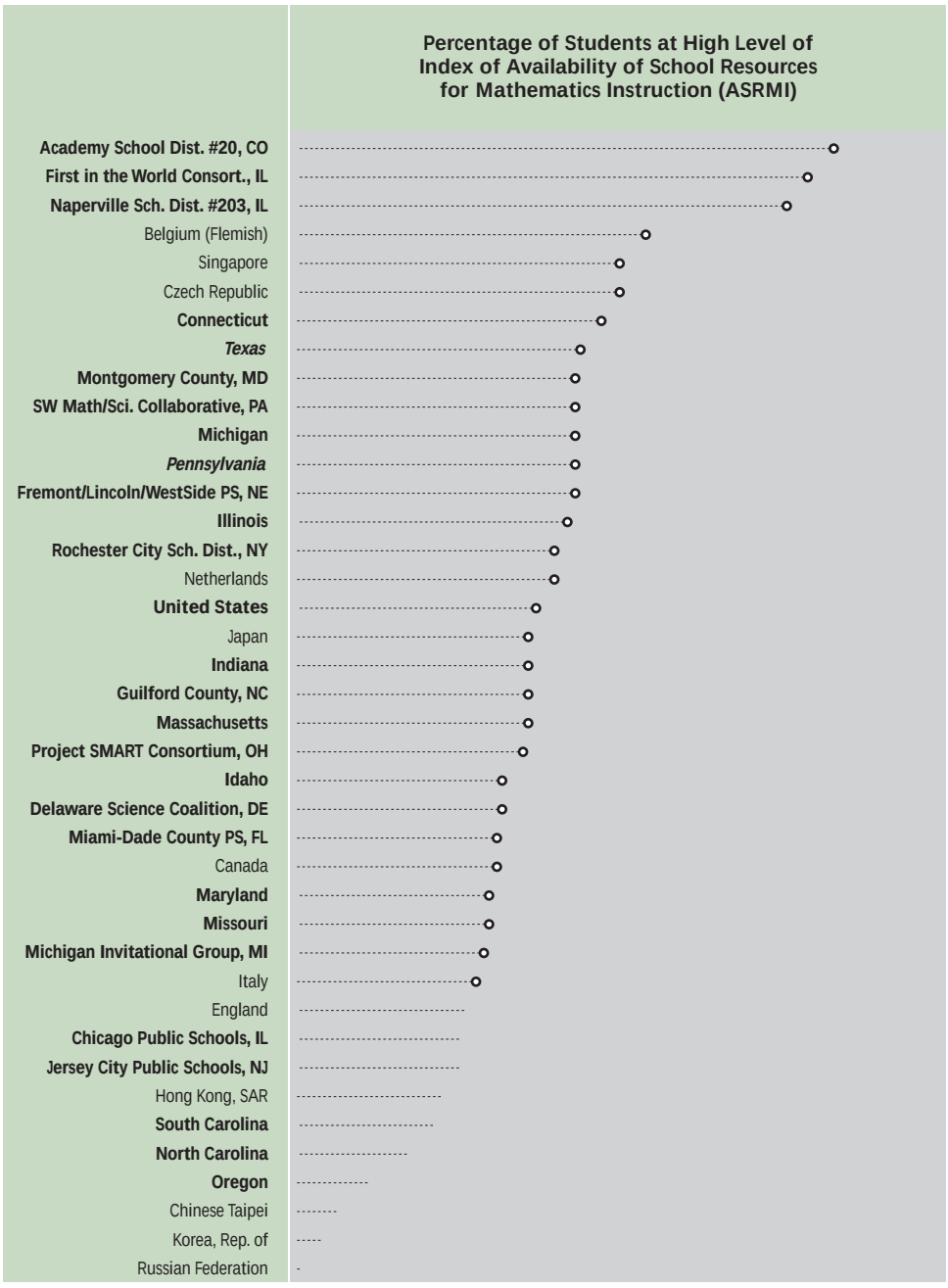
Academy School Dist. #20, CO		83 (0.4)	529 (1.8)	17 (0.4)	524 (4.9)	0 (0.0)	~ ~
First in the World Consort., IL	r	79 (1.0)	564 (7.8)	21 (1.0)	531 (15.9)	0 (0.0)	~ ~
Naperville Sch. Dist. #203, IL		76 (1.5)	569 (3.5)	24 (1.5)	569 (5.0)	0 (0.0)	~ ~
Belgium (Flemish)		54 (4.6)	556 (7.2)	46 (4.6)	558 (10.0)	0 (0.0)	~ ~
Singapore		50 (4.0)	603 (8.4)	46 (4.1)	608 (8.8)	4 (1.4)	589 (16.2)
Czech Republic		50 (3.6)	525 (6.7)	49 (3.9)	516 (5.8)	2 (1.5)	~ ~
Connecticut	s	47 (9.4)	528 (17.6)	50 (9.5)	523 (8.2)	3 (0.3)	479 (10.1)
Texas	r	44 (5.0)	523 (17.8)	52 (5.9)	517 (12.6)	4 (3.9)	500 (4.7)
Montgomery County, MD	s	43 (13.6)	540 (7.7)	57 (13.6)	535 (6.9)	0 (0.0)	~ ~
SW Math/Sci. Collaborative, PA		43 (9.1)	518 (11.8)	52 (9.6)	519 (11.0)	5 (3.4)	498 (4.3)
Michigan		43 (7.6)	540 (11.1)	52 (8.0)	517 (7.4)	5 (3.2)	505 (11.4)
Pennsylvania		43 (6.2)	522 (10.6)	54 (6.5)	504 (7.6)	3 (1.9)	520 (22.2)
Fremont/Lincoln/WestSide PS, NE	r	43 (1.7)	491 (15.3)	46 (1.5)	472 (9.8)	11 (1.3)	568 (58.7)
Illinois		42 (5.4)	526 (8.3)	57 (5.4)	508 (8.4)	1 (0.9)	~ ~
Rochester City Sch. Dist., NY	r	40 (1.6)	467 (12.2)	44 (1.6)	423 (9.7)	16 (0.5)	436 (18.0)
Netherlands	r	40 (6.2)	539 (10.5)	60 (6.2)	552 (10.5)	0 (0.0)	~ ~
United States	r	37 (3.8)	516 (6.9)	59 (3.6)	493 (5.2)	4 (1.5)	480 (14.2)
Japan		36 (4.3)	582 (3.9)	61 (4.2)	578 (2.6)	3 (1.5)	562 (5.5)
Indiana		36 (7.8)	515 (12.3)	62 (7.7)	514 (8.2)	2 (1.8)	~ ~
Guilford County, NC	s	36 (1.3)	496 (13.0)	64 (1.3)	523 (14.9)	0 (0.0)	~ ~
Massachusetts	s	36 (7.4)	522 (13.3)	64 (7.4)	516 (7.8)	0 (0.0)	~ ~
Project SMART Consortium, OH		35 (1.6)	536 (15.2)	61 (1.5)	507 (8.0)	4 (0.5)	516 (43.0)
Idaho	r	32 (7.9)	481 (12.9)	63 (8.7)	505 (9.2)	4 (3.5)	472 (17.6)
Delaware Science Coalition, DE	r	32 (1.5)	447 (15.7)	59 (1.9)	484 (14.0)	9 (1.8)	496 (48.0)
Miami-Dade County PS, FL	s	31 (12.2)	458 (10.1)	57 (13.5)	426 (16.2)	11 (7.8)	399 (4.4)

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report achievement.

An "r" indicates school response data available for 70-84% of students. An "s" indicates school response data available for 50-69% of students.


Percentage of Students at High Level of Index of Availability of School Resources for Mathematics Instruction (ASRMI)
Academy School Dist. #20, CO
First in the World Consort., IL
Naperville Sch. Dist. #203, IL
Belgium (Flemish)
Singapore
Czech Republic
Connecticut
Texas
Montgomery County, MD
SW Math/Sci. Collaborative, PA
Michigan
Pennsylvania
Fremont/Lincoln/WestSide PS, NE
Illinois
Rochester City Sch. Dist., NY
Netherlands
United States
Japan
Indiana
Guilford County, NC
Massachusetts
Project SMART Consortium, OH
Idaho
Delaware Science Coalition, DE
Miami-Dade County PS, FL
Canada
Maryland
Missouri
Michigan Invitational Group, MI
Italy
England
Chicago Public Schools, IL
Jersey City Public Schools, NJ
Hong Kong, SAR
South Carolina
North Carolina
Oregon
Chinese Taipei
Korea, Rep. of
Russian Federation

What Is the Role of the School Principal?

	Average Total Hours Per Month Spent on Activities[1]			
	Instructional Leadership Activities[2]	Communicating with Students, Parents, and Education Officials[3]	Administrative Duties[4]	Teaching (including preparation)
Countries				
United States	r	r	r	r
Belgium (Flemish)				
Canada				
Chinese Taipei				
Czech Republic				
England				
Hong Kong, SAR	r	r	r	r
Italy				
Japan				
Korea, Rep. of				
Netherlands	r	r	r	r
Russian Federation	r	r	r	r
Singapore				
States				
Connecticut	s	s	s	s
Idaho	r	r	r	r
Illinois	r	r	r	r
Indiana				
Maryland	r	r	r	r
Massachusetts	s	s	s	s
Michigan				
Missouri				
North Carolina	r	r	r	r
Oregon				
Pennsylvania	r	r	r	r
South Carolina	r	r	r	r
Texas	s	s	s	s
Districts and Consortia				
Academy School Dist. #20, CO				
Chicago Public Schools, IL	s	s	s	s
Delaware Science Coalition, DE	s	s	s	s
First in the World Consort., IL	r	r	r	r
Fremont/Lincoln/WestSide PS, NE	s	s	s	s
Guilford County, NC	r	r	r	r
Jersey City Public Schools, NJ	r	r	r	r
Miami-Dade County PS, FL				
Michigan Invitational Group, MI				
Montgomery County, MD	s	s	s	s
Naperville Sch. Dist. #203, IL				
Project SMART Consortium, OH	r	r	r	r
Rochester City Sch. Dist., NY	r	r	r	r
SW Math/Sci. Collaborative, PA				
International Avg. (All Countries)				

What Are the Schools' Expectations of Parents?

Schools' expectations for parental involvement are shown in Exhibit 7.4. Clearly schools expect help from parents. On average across all the timss 1999 countries, 85 percent of the students attended schools expecting parents to ensure that their children complete their homework, and 79 percent attended schools expecting parents to volunteer for school projects or field trips. About half the students were in schools expecting parents to help raise funds and to serve on committees. Only 28 percent were in schools expecting parents to help as aides in the classroom.

In the United States, almost all students were in schools that expected parents to ensure that their children completed their homework and to volunteer for school projects, programs, or field trips. Parents generally were not often expected to serve as teacher aides (with the notable exception of the Chicago Public Schools, where 34 percent of students were in such schools), but were more often expected to serve on committees and to raise funds for the school. Schools in the Benchmarking jurisdictions generally resembled those in the United States overall, with few major differences.

How Serious Are School Attendance Problems?

Index of Good School and Class Attendance

Index based on schools' responses to three questions about the seriousness of attendance problems in school: arriving late at school; absenteeism; skipping class (see exhibit 7.6). High level indicates that all three behaviors are reported to be not a problem. Low level indicates that two or more behaviors are reported to be a serious problem, or two behaviors are reported to be minor problems and the third a serious problem. Medium level includes all other possible combinations of responses.

		High SCA		Medium SCA		Low SCA	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Naperville Sch. Dist. #203, IL		55 (1.5)	564 (4.0)	45 (1.5)	576 (3.6)	0 (0.0)	~ ~
Belgium (Flemish)		52 (4.4)	579 (7.1)	45 (4.5)	536 (7.4)	3 (1.0)	535 (9.3)
Academy School Dist. #20, CO		42 (0.4)	524 (3.3)	58 (0.4)	531 (1.8)	0 (0.0)	~ ~
Czech Republic		36 (5.8)	526 (9.9)	56 (6.0)	516 (4.4)	8 (2.3)	539 (20.2)
Michigan Invitational Group, MI		34 (1.4)	533 (11.0)	66 (1.4)	532 (7.0)	0 (0.0)	~ ~
Italy		33 (3.3)	497 (5.8)	58 (3.6)	481 (5.1)	9 (2.4)	424 (12.4)
Singapore		32 (4.1)	630 (11.9)	64 (4.0)	592 (7.0)	3 (1.6)	597 (19.3)
Korea, Rep. of		31 (3.7)	585 (3.7)	61 (4.0)	588 (2.4)	9 (2.4)	595 (5.4)
Netherlands	r	30 (7.3)	524 (14.5)	46 (7.3)	555 (6.6)	24 (7.5)	519 (27.9)
First in the World Consort., IL	r	28 (1.4)	568 (18.2)	72 (1.4)	549 (8.6)	0 (0.0)	~ ~
Chinese Taipei		28 (3.7)	616 (7.6)	61 (3.6)	570 (4.0)	11 (2.7)	591 (10.1)
Michigan	r	28 (6.7)	529 (6.3)	69 (6.2)	526 (10.1)	3 (2.5)	496 (57.7)
Chicago Public Schools, IL	s	27 (13.5)	486 (15.6)	65 (13.2)	456 (9.5)	8 (1.2)	442 (20.9)
Indiana		27 (7.8)	544 (9.2)	66 (8.4)	506 (9.3)	7 (3.7)	503 (6.0)
Hong Kong, SAR		25 (3.9)	603 (7.4)	68 (4.3)	582 (6.8)	7 (2.5)	540 (13.3)
Project SMART Consortium, OH	s	25 (1.2)	537 (23.8)	71 (1.2)	507 (9.8)	4 (0.2)	477 (16.0)
Illinois		22 (6.5)	519 (12.6)	73 (6.7)	510 (6.5)	5 (0.4)	540 (10.4)
Connecticut	s	22 (6.6)	551 (28.7)	78 (6.6)	512 (10.9)	0 (0.0)	~ ~
United States	r	19 (3.0)	534 (11.5)	68 (3.4)	498 (5.2)	13 (2.5)	470 (9.3)
Fremont/Lincoln/WestSide PS, NE	s	18 (0.6)	507 (19.1)	69 (1.5)	470 (12.2)	13 (1.5)	568 (58.7)
Canada		18 (2.2)	530 (7.1)	73 (3.0)	530 (3.0)	9 (2.0)	535 (7.9)
Texas	s	15 (7.0)	544 (17.6)	81 (7.3)	516 (12.0)	4 (2.8)	454 (13.8)
Montgomery County, MD	s	15 (11.0)	566 (9.6)	85 (11.0)	531 (4.2)	0 (0.0)	~ ~
Massachusetts	s	14 (5.1)	537 (14.2)	74 (6.2)	515 (7.1)	11 (5.4)	513 (8.1)
Idaho	r	14 (6.7)	498 (14.7)	78 (7.6)	499 (8.6)	8 (3.6)	469 (24.9)
SW Math/Sci. Collaborative, PA		13 (3.6)	545 (10.2)	78 (6.2)	522 (8.9)	9 (4.6)	448 (18.3)
Guilford County, NC	r	13 (0.6)	545 (18.7)	79 (1.0)	515 (12.0)	8 (0.9)	448 (19.6)
South Carolina	r	11 (4.0)	484 (29.5)	75 (5.4)	507 (7.8)	13 (4.0)	485 (27.2)
Maryland	r	11 (4.5)	514 (9.2)	80 (6.1)	490 (6.4)	10 (5.1)	452 (23.1)
Russian Federation		10 (1.7)	535 (12.0)	70 (3.8)	532 (6.4)	20 (3.4)	500 (8.2)
Missouri		10 (5.0)	511 (13.2)	80 (7.0)	491 (6.5)	10 (5.1)	424 (24.7)
North Carolina	r	10 (4.2)	483 (16.5)	84 (5.7)	502 (6.1)	6 (4.0)	452 (8.6)
Pennsylvania		9 (5.1)	525 (12.0)	83 (6.6)	514 (7.0)	8 (4.1)	471 (18.0)
Japan		7 (2.4)	590 (12.2)	47 (4.1)	579 (2.6)	46 (3.9)	576 (2.4)
Jersey City Public Schools, NJ	r	7 (0.3)	517 (9.1)	90 (0.4)	472 (10.8)	3 (0.1)	442 (16.4)
Oregon		4 (3.0)	487 (2.3)	84 (5.9)	515 (7.5)	12 (4.8)	504 (13.9)
Delaware Science Coalition, DE	r	0 (0.0)	~ ~	88 (2.0)	462 (10.9)	12 (2.0)	534 (38.5)
Rochester City Sch. Dist., NY	s	0 (0.0)	~ ~	50 (1.5)	448 (11.8)	50 (1.5)	433 (10.8)
Miami-Dade County PS, FL		x x	x x	x x	x x	x x	x x
England		– –	– –	– –	– –	– –	– –
International Avg. (All Countries)		20 (0.6)	497 (2.8)	60 (0.7)	488 (1.0)	19 (0.5)	474 (2.0)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

An "r" indicates school response data available for 70-84% of students. An "s" indicates school response data available for 50-69% of students. An "x" indicates school response data available for <50% of students.

	Percentage of Students Whose Schools Reported the Behavior					
	Arriving Late		Absenteeism		Skipping Class	
	Occurs at Least Weekly	Is a Serious Problem	Occurs at Least Weekly	Is a Serious Problem	Occurs at Least Weekly	Is a Serious Problem
Countries						
United States	r 71 (3.7)	r 12 (2.3)	r 60 (4.2)	r 12 (2.7)	r 29 (3.6)	r 4 (1.8)
Belgium (Flemish)	44 (4.7)	3 (1.4)	11 (2.4)	4 (1.8)	4 (1.3)	2 (1.0)
Canada	58 (2.7)	7 (1.7)	45 (3.1)	7 (1.6)	22 (2.3)	3 (1.0)
Chinese Taipei	43 (4.1)	2 (1.1)	32 (4.0)	10 (2.7)	30 (3.8)	11 (2.8)
Czech Republic	21 (3.8)	0 (0.3)	9 (2.8)	8 (2.5)	5 (2.2)	8 (2.4)
England	– –	– –	– –	– –	– –	– –
Hong Kong, SAR	r 61 (4.8)	9 (2.8)	r 34 (4.5)	3 (1.6)	r 10 (2.8)	r 1 (0.9)
Italy	32 (3.6)	4 (1.6)	11 (2.2)	9 (2.3)	8 (2.2)	7 (2.0)
Japan	55 (4.1)	20 (3.4)	63 (4.1)	76 (3.9)	14 (3.2)	27 (3.8)
Korea, Rep. of	32 (4.0)	1 (1.0)	31 (4.1)	12 (2.9)	21 (3.6)	5 (1.8)
Netherlands	r 76 (4.9)	r 18 (6.8)	r 35 (5.9)	r 12 (6.4)	r 44 (6.5)	r 15 (7.1)
Russian Federation	41 (3.8)	14 (3.5)	22 (2.9)	12 (2.2)	32 (4.2)	10 (2.2)
Singapore	51 (4.8)	3 (1.6)	40 (4.4)	3 (1.5)	23 (4.0)	0 (0.0)
States						
Connecticut	s 67 (9.4)	s 0 (0.0)	s 48 (9.5)	s 4 (0.5)	s 20 (6.7)	s 0 (0.0)
Idaho	r 72 (8.9)	r 5 (2.7)	r 67 (8.5)	r 8 (3.6)	r 31 (7.3)	r 1 (0.1)
Illinois	57 (8.4)	5 (3.0)	42 (7.4)	7 (1.2)	r 9 (4.0)	0 (0.0)
Indiana	64 (7.9)	7 (3.5)	55 (7.9)	9 (4.2)	20 (4.5)	0 (0.0)
Maryland	r 63 (7.1)	r 10 (5.1)	r 51 (6.9)	r 10 (5.1)	r 21 (6.0)	r 0 (0.0)
Massachusetts	s 59 (8.9)	s 16 (7.5)	s 62 (7.6)	s 14 (6.1)	s 17 (6.6)	s 0 (0.0)
Michigan	48 (7.1)	r 1 (1.0)	37 (7.3)	r 5 (3.4)	11 (4.5)	r 0 (0.0)
Missouri	76 (6.0)	2 (1.7)	69 (6.7)	13 (5.6)	33 (6.5)	r 9 (5.0)
North Carolina	r 54 (8.3)	r 3 (0.2)	r 52 (9.0)	r 11 (5.0)	r 16 (6.2)	r 0 (0.0)
Oregon	81 (6.5)	r 8 (3.0)	75 (7.6)	19 (5.3)	43 (8.1)	5 (1.8)
Pennsylvania	73 (7.2)	8 (4.1)	50 (6.7)	8 (4.1)	17 (5.0)	1 (0.0)
South Carolina	r 73 (6.5)	r 10 (4.9)	r 67 (7.8)	r 20 (5.1)	16 (4.4)	r 0 (0.0)
Texas	r 81 (7.3)	s 4 (2.8)	r 68 (7.6)	s 1 (1.4)	r 39 (6.1)	s 0 (0.0)
Districts and Consortia						
Academy School Dist. #20, CO	54 (0.4)	0 (0.0)	29 (0.4)	0 (0.0)	46 (0.4)	0 (0.0)
Chicago Public Schools, IL	s 66 (8.3)	s 8 (1.2)	s 49 (11.4)	s 10 (7.8)	s 14 (6.1)	r 0 (0.0)
Delaware Science Coalition, DE	r 84 (2.0)	r 0 (0.0)	r 90 (0.6)	r 12 (2.0)	s 54 (1.7)	r 0 (0.0)
First in the World Consort., IL	r 62 (1.4)	r 0 (0.0)	r 15 (0.4)	r 0 (0.0)	r 0 (0.0)	r 0 (0.0)
Fremont/Lincoln/WestSide PS, NE	r 68 (1.1)	s 0 (0.0)	r 58 (1.4)	s 13 (1.5)	r 48 (1.7)	s 0 (0.0)
Guilford County, NC	r 77 (0.9)	r 0 (0.0)	r 88 (0.6)	r 8 (0.9)	r 36 (1.1)	r 0 (0.0)
Jersey City Public Schools, NJ	66 (1.0)	r 12 (0.8)	50 (1.4)	r 0 (0.0)	0 (0.0)	r 0 (0.0)
Miami-Dade County PS, FL	x x	x x	x x	x x	x x	x x
Michigan Invitational Group, MI	48 (1.5)	9 (0.8)	40 (1.6)	0 (0.0)	31 (1.5)	0 (0.0)
Montgomery County, MD	s 83 (9.6)	s 0 (0.0)	s 61 (12.2)	s 0 (0.0)	s 12 (7.2)	s 0 (0.0)
Naperville Sch. Dist. #203, IL	39 (1.9)	0 (0.0)	15 (2.1)	0 (0.0)	0 (0.0)	0 (0.0)
Project SMART Consortium, OH	r 73 (1.1)	s 4 (0.2)	r 47 (1.6)	s 4 (0.2)	r 33 (1.6)	s 0 (0.0)
Rochester City Sch. Dist., NY	r 100 (0.0)	s 19 (0.6)	r 100 (0.0)	s 19 (0.6)	r 84 (0.5)	s 30 (1.5)
SW Math/Sci. Collaborative, PA	68 (7.7)	9 (4.6)	62 (6.2)	7 (4.3)	26 (8.7)	3 (2.9)
International Avg. (All Countries)	49 (0.6)	11 (0.4)	38 (0.6)	17 (0.5)	27 (0.6)	13 (0.5)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by schools.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available.

An "r" indicates school response data available for 70-84% of students. An "s" indicates school response data available for 50-69% of students. An "x" indicates school response data available for <50% of students.

How Safe and Orderly Are Schools?

Discipline that maintains an orderly atmosphere conducive to learning is very important to school quality, and research indicates that urban schools have conditions less conducive to learning than non-urban schools.[5] For example, urban schools report more crime against students and teachers at school and that physical conflict among students is a serious or moderate problem. Among the Benchmarking participants there was considerable variation in principals' reports about the seriousness of a variety of potential discipline problems.

The frequency and seriousness of student behavior threatening an orderly school environment are presented in Exhibit 7.7. The three types of behavior are violating the dress code, creating a classroom disturbance, and cheating. Violation of dress code is likely to reflect, at least partially, whether there is a uniform requirement. For many countries, violating the dress code was not reported to be a serious problem; on average internationally only six percent of the students were in schools where it was a serious problem. Dress code violations were more frequently reported in the United States, where 42 percent of students were in schools where this occurs at least weekly, compared with 24 percent internationally. This was also a frequent problem in Texas and in Rochester, with 79 and 59 percent of students, respectively, in such schools.

Classroom disturbance was a more frequent problem in schools in the United States, as well as a more serious one. More than two-thirds of U.S. eighth-grade students were in schools where disturbances occur at least weekly, and 11 percent where these are a serious problem. Benchmarking jurisdictions where classroom disturbances were both more frequent and more serious than in the United States generally included Maryland, Missouri, North Carolina, Pennsylvania, the Delaware Science Coalition, Guilford County, the Michigan Invitational Group, Montgomery County, and Rochester.

The frequency and seriousness of student behavior threatening a safe school environment are shown in Exhibit 7.8. The five types of behavior are vandalism, theft, physical injury to other students, intimidation or verbal abuse of other students, and intimidation or verbal abuse of teachers or staff. As in other reports of student behavior, cross-national comparisons are difficult because of differing perceptions of what constitutes a serious problem. However, with only a few exceptions, the overwhelming majority of students attend schools judged to have few serious problems. The incidence of such student behavior was

5 Mayer, D.P., Mullens, J.E., and Moore, M.T. (2000),

Countries						
United States						
Belgium (Flemish)						
Canada						
Chinese Taipei						
Czech Republic						
England						
Hong Kong, SAR						
Italy						
Japan						
Korea, Rep. of						
Netherlands						
Russian Federation						
Singapore						
States						

Background data provided by schools.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available.

An "r" indicates school response data available for 70-84% of students. An "s" indicates school response data available for 50-69% of students. An "x" indicates school response data available for <50% of students.

Background data provided by schools.

States in *italics*

	Percentage of Students Whose Schools Reported the Behavior			
	Intimidation or Verbal Abuse of Other Students		Intimidation or Verbal Abuse of Teachers or Staff	
	Occurs at Least Weekly	Is a Serious Problem	Occurs at Least Weekly	Is a Serious Problem
Countries				
United States	r 46 (4.3)	r 16 (3.6)	r 7 (2.0)	r 3 (1.5)
Belgium (Flemish)	23 (3.4)	15 (3.7)	5 (1.5)	3 (1.2)
Canada	42 (3.0)	22 (2.5)	4 (1.2)	3 (1.1)
Chinese Taipei	11 (2.7)	18 (3.1)	1 (1.0)	17 (3.0)
Czech Republic	5 (1.5)	17 (3.6)	0 (0.0)	9 (2.6)
England	– –	– –	– –	– –
Hong Kong, SAR	r 8 (2.7)	r 4 (1.8)	r 3 (1.5)	r 2 (1.3)
Italy	14 (2.3)	23 (3.0)	4 (1.7)	13 (2.7)
Japan	3 (1.5)	25 (3.8)	2 (1.2)	23 (3.7)
Korea, Rep. of	12 (2.9)	12 (2.8)	8 (2.3)	9 (2.5)
Netherlands	r 49 (7.3)	r 23 (6.9)	r 17 (6.6)	r 16 (6.4)
Russian Federation	3 (1.3)	7 (2.1)	1 (0.5)	1 (0.6)
Singapore	7 (2.3)	2 (1.2)	1 (0.7)	1 (0.9)
States				
Connecticut	s 53 (11.3)	s 14 (6.2)	s 5 (3.9)	s 6 (4.5)
Idaho	r 62 (9.7)	r 29 (7.3)	r 13 (3.5)	r 2 (0.1)
Illinois	42 (7.2)	11 (4.6)	6 (3.3)	3 (2.6)
Indiana	35 (7.1)	7 (2.0)	2 (0.1)	0 (0.0)
Maryland	r 66 (7.1)	r 25 (7.3)	r 36 (6.5)	r 16 (6.1)
Massachusetts	s 52 (9.2)	s 15 (7.2)	s 9 (4.4)	s 4 (2.7)
Michigan	46 (5.1)	r 16 (5.4)	0 (0.0)	r 2 (0.1)
Missouri	49 (7.7)	r 13 (3.9)	21 (5.9)	r 5 (3.4)
North Carolina	r 49 (6.8)	r 18 (5.8)	r 12 (5.1)	r 0 (0.1)
Oregon	67 (7.8)	23 (7.9)	4 (2.7)	2 (2.3)
Pennsylvania	53 (8.2)	21 (7.3)	13 (4.0)	9 (4.9)
South Carolina	47 (8.9)	r 9 (4.3)	8 (4.6)	r 3 (2.5)
Texas	r 43 (5.1)	s 12 (6.3)	r 2 (2.5)	s 0 (0.0)
Districts and Consortia				
Academy School Dist. #20, CO	25 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)
Chicago Public Schools, IL	s 30 (12.5)	s 0 (0.0)	s 0 (0.0)	s 0 (0.0)
Delaware Science Coalition, DE	r 83 (0.9)	r 13 (0.7)	r 16 (1.9)	r 10 (0.6)
First in the World Consort., IL	r 37 (1.0)	r 0 (0.1)	r 0 (0.1)	r 0 (0.1)
Fremont/Lincoln/WestSide PS, NE	r 51 (1.6)	s 24 (1.1)	r 43 (1.8)	s 0 (0.0)
Guilford County, NC	r 46 (1.2)	s 6 (0.5)	r 9 (0.4)	s 10 (0.5)
Jersey City Public Schools, NJ	36 (1.3)	r 19 (1.0)	35 (1.3)	r 9 (0.8)
Miami-Dade County PS, FL	x x	x x	x x	x x
Michigan Invitational Group, MI	50 (1.5)	14 (0.7)	12 (0.8)	0 (0.0)
Montgomery County, MD	s 48 (8.8)	s 23 (11.1)	s 28 (14.9)	x x
Naperville Sch. Dist. #203, IL	21 (1.0)	0 (0.0)	0 (0.0)	0 (0.0)
Project SMART Consortium, OH	r 61 (1.6)	s 26 (1.0)	r 16 (0.8)	s 18 (0.9)
Rochester City Sch. Dist., NY	r 100 (0.0)	s 36 (1.7)	r 50 (1.7)	s 0 (0.0)
SW Math/Sci. Collaborative, PA	52 (9.4)	14 (6.3)	22 (7.7)	4 (3.3)
International Avg. (All Countries)	16 (0.5)	14 (0.5)	4 (0.3)	9 (0.4)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

reference 1

Students' Backgrounds and Attitudes Towards Mathematics

Background data provided by students.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

	Three or More Bookcases (More Than 200 Books)		About Two Bookcases (101-200 Books)		About One Bookcase (26-100 Books)		About One Shelf (11-25 Books)		None or Very Few (0-10 Books)	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Countries										
United States	28 (1.2)	537 (5.5)								
Belgium (Flemish)	14 (0.8)	580 (5.1)								
Canada	31 (0.9)	543 (3.5)								
Chinese Taipei	16 (0.8)	637 (5.8)								
Czech Republic	28 (1.4)	539 (5.0)								
England	26 (1.2)	537 (6.1)								
Hong Kong, SAR	8 (0.5)	588 (8.8)								
Italy	20 (0.9)	505 (5.6)								
Japan	18 (0.7)	605 (4.6)								
Korea, Rep. of	20 (0.8)	625 (2.9)								
Netherlands	24 (1.8)	564 (8.5)								
Russian Federation	23 (1.5)	556 (6.3)								
Singapore	12 (0.6)	618 (8.3)								
States										
Connecticut	35 (2.7)	544 (8.4)								
Idaho	32 (1.6)	518 (8.0)								
Illinois	29 (2.5)	542 (7.6)								
Indiana	30 (2.2)	542 (7.8)								
Maryland	31 (1.8)	531 (6.1)								
Massachusetts	32 (1.9)	543 (6.2)								
Michigan	36 (1.9)	544 (7.4)								
Missouri	26 (1.6)	511 (6.9)								
North Carolina	23 (1.8)	525 (8.3)								
Oregon	33 (2.1)	546 (6.9)								
Pennsylvania	28 (2.2)	537 (8.6)								
South Carolina	23 (1.3)	540 (10.4)								
Texas	20 (2.1)	575 (7.0)								
Districts and Consortia										
Academy School Dist. #20, CO	46 (1.2)	544 (2.2)								
Chicago Public Schools, IL	17 (2.6)	474 (9.2)								
Delaware Science Coalition, DE	28 (2.1)	518 (9.2)								
First in the World Consort., IL	41 (2.2)	570 (8.5)								
Fremont/Lincoln/WestSide PS, NE	32 (1.7)	504 (9.6)								
Guilford County, NC	29 (2.3)	555 (8.0)								
Jersey City Public Schools, NJ	12 (1.4)	488 (17.4)								
Miami-Dade County PS, FL	14 (2.6)	470 (19.3)								
Michigan Invitational Group, MI	37 (2.7)	545 (7.1)								
Montgomery County, MD	41 (2.3)	563 (5.0)								
Naperville Sch. Dist. #203, IL	49 (1.4)	579 (4.5)								
Project SMART Consortium, OH	26 (2.3)	544 (11.4)								
Rochester City Sch. Dist., NY	17 (2.1)	478 (13.9)								
SW Math/Sci. Collaborative, PA	28 (2.5)	548 (7.6)								
International Avg. (All Countries)	18 (0.2)									

Background data provided by students.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report achievement.

Countries										
United States	35 (1.7)	535 (4.9)	46 (1.3)	496 (3.2)	5 (0.4)	456 (5.4)	1 (0.2)	~ ~	13 (0.7)	468 (5.6)
Belgium (Flemish)	16 (1.0)	595 (6.9)	45 (0.9)	568 (3.8)	10 (0.7)	540 (6.3)	0 (0.1)	~ ~	29 (1.0)	534 (4.2)
Canada	45 (1.3)	543 (3.5)	34 (1.0)	530 (2.8)	6 (0.5)	509 (8.1)	0 (0.1)	~ ~	15 (0.7)	506 (4.0)
Chinese Taipei	15 (1.0)	635 (6.5)	64 (0.8)	590 (3.8)	14 (0.7)	550 (4.8)	1 (0.1)	~ ~	7 (0.4)	527 (7.5)
Czech Republic	22 (1.2)	555 (6.2)	46 (1.3)	527 (4.5)	21 (1.2)	503 (5.5)	0 (0.0)	~ ~	11 (0.9)	480 (7.1)
England	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –
Hong Kong, SAR	7 (0.7)	607 (8.5)	38 (1.0)	591 (4.3)	32 (0.9)	583 (4.2)	9 (0.7)	558 (7.6)	13 (0.6)	568 (5.7)
Italy	10 (0.8)	513 (6.4)	45 (1.3)	499 (3.6)	40 (1.5)	455 (4.5)	2 (0.3)	~ ~	3 (0.4)	453 (12.0)
Japan	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –
Korea, Rep. of	25 (1.0)	620 (2.5)	48 (0.8)	587 (2.7)	14 (0.5)	566 (3.2)	5 (0.4)	559 (6.1)	8 (0.4)	545 (4.3)
Netherlands	12 (1.1)	572 (9.8)	53 (2.4)	553 (6.8)	7 (1.0)	518 (12.6)	1 (0.5)	~ ~	27 (2.1)	516 (9.1)
Russian Federation	33 (1.4)	551 (6.4)	47 (1.2)	522 (6.4)	5 (0.5)	488 (10.2)	1 (0.2)	~ ~	14 (0.9)	504 (6.1)
Singapore	11 (1.0)	652 (8.4)	51 (1.0)	608 (5.8)	23 (1.0)	589 (6.9)	4 (0.3)	579 (9.2)	12 (0.6)	588 (7.0)
States										
Connecticut	41 (2.8)	540 (10.8)	42 (2.1)	498 (7.3)	4 (0.7)	458 (12.7)	0 (0.2)	~ ~	13 (0.9)	492 (10.5)
Idaho	31 (2.1)	517 (7.3)	46 (1.9)	500 (6.0)	6 (1.0)	446 (11.2)	1 (0.2)	~ ~	16 (0.7)	469 (11.6)

	Finished University	Finished Upper Secondary School But Not University	
		Post-Secondary Level	Upper-Secondary Level[1]
Internationally Defined Level	Finished University	Some Vocational-Technical Education After Secondary School or Some University	Finished Secondary School
United States (P) ‡			
United States (S) §			
Australia §			
Belgium (Flemish) §		Post-Secondary Tertiary Higher Education Outside University or Some Years of University	Finish Higher Secondary School
Canada	Finish University or College		
Chile			
Cyprus §			
Czech Republic (P) §‡			
Czech Republic (S)			
Finland			
Hungary §			
Indonesia			
Italy §			
Japan (S) [3]			
Korea, Rep. of §			
Latvia (LSS) §			
Lithuania §			
Netherlands			
New Zealand (P) ‡			
New Zealand (S) §			
Philippines §			
Romania §			
Singapore §			
Slovenia (S) §‡			
South Africa §			
Thailand §			
Tunisia			

National educational level is the same as the internationally-defined level

Lower-Secondary Level	Primary Level[2]		Internationally Defined Level
Finished Some Secondary School	Finished Primary School	Some Primary School or Did Not Go to School	
			New Zealand (P)
			New Zealand (S)
Some High School	Finish Elementary School	Some Elementary School or Did Not Go to School	Philippines
Did Not Complete Senior Secondary	Finish Junior Secondary (Gymnasium - grade 8)	Did Not Finish Grade 8 or Did Not Go to School	Romania
			Singapore
			Slovenia (S)
			South Africa
Finish Lower Secondary School	Finish Upper Primary School	Finish Lower Primary School or Did Not Go to School	Thailand
			Tunisia

National educational level is the same as the internationally-defined level

Countries					
United States					
Belgium (Flemish)					
Canada					
Chinese Taipei					
Czech Republic					
England					
Hong Kong, SAR					
Italy					
Japan					
Korea, Rep. of					
Netherlands					
Russian Federation					
Singapore					
States					
Connecticut					
Idaho					
Illinois					
Indiana					
Maryland					
Massachusetts					
Michigan					
Missouri					
North Carolina					
Oregon					
Pennsylvania					
South Carolina					
Texas					
Districts and Consortia					
Academy School Dist. #20, CO					
Chicago Public Schools, IL					
Delaware Science Coalition, DE					
First in the World Consort., IL					
Fremont/Lincoln/WestSide PS, NE					
Guilford County, NC					
Jersey City Public Schools, NJ					
Miami-Dade County PS, FL					
Michigan Invitational Group, MI					
Montgomery County, MD					
Naperville Sch. Dist. #203, IL					
Project SMART Consortium, OH					
Rochester City Sch. Dist., NY					

Background data provided by students.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Exhibit R1.7 Students' Perception of Their Friends' View of the Importance of Various Activities

	Percentage of Students Agreeing That Their Friends Think It Is Important To Do Each Activity				
	Do Well in Mathematics	Do Well in Science	Do Well in Language	Have Time to Have Fun	Be Good at Sports
Countries					
United States	79 (0.8)	72 (0.8)	76 (1.0)	98 (0.2)	86 (0.5)
Belgium (Flemish)	81 (1.1)	66 (1.2)	77 (1.4)	98 (0.5)	76 (1.1)
Canada	84 (0.6)	72 (0.9)	82 (0.7)	99 (0.1)	84 (0.9)
Chinese Taipei	84 (0.7)	82 (0.7)	84 (0.6)	98 (0.2)	94 (0.4)
Czech Republic	84 (0.9)	68 (1.0)	83 (0.8)	97 (0.4)	83 (0.9)
England	90 (0.8)	84 (1.0)	90 (0.7)	99 (0.2)	80 (1.0)
Hong Kong, SAR	84 (0.7)	66 (1.0)	87 (0.8)	96 (0.3)	83 (0.8)
Italy	80 (0.9)	66 (1.3)	84 (0.7)	98 (0.3)	94 (0.5)
Japan	85 (0.6)	78 (0.8)	85 (0.8)	99 (0.2)	80 (0.7)
Korea, Rep. of	77 (0.7)	72 (0.8)	73 (0.8)	93 (0.3)	80 (0.8)
Netherlands	88 (1.0)	79 (1.2)	90 (0.9)	98 (0.4)	70 (1.9)
Russian Federation	89 (0.6)	83 (0.7)	89 (0.6)	97 (0.4)	87 (0.8)
Singapore	96 (0.3)	94 (0.6)	97 (0.3)	93 (0.6)	88 (0.6)
States					
Connecticut	78 (1.5)	71 (2.1)	76 (1.7)	98 (0.4)	84 (1.1)
Idaho	77 (1.8)	71 (2.2)	74 (1.5)	98 (0.4)	87 (1.1)
Illinois	80 (1.7)	70 (2.1)	75 (2.0)	98 (0.3)	86 (1.1)
Indiana	79 (1.3)	73 (1.5)	76 (1.3)	99 (0.3)	86 (0.9)
Maryland	76 (1.1)	69 (1.3)	75 (1.2)	98 (0.3)	85 (0.9)
Massachusetts	74 (1.5)	69 (1.8)	72 (1.4)	99 (0.2)	85 (0.9)
Michigan	79 (1.0)	75 (1.3)	75 (1.4)	98 (0.3)	87 (1.0)
Missouri	76 (1.3)	71 (1.4)	73 (1.3)	98 (0.4)	85 (1.2)
North Carolina	85 (1.3)	78 (1.5)	84 (1.3)	99 (0.2)	89 (1.0)
Oregon	76 (1.6)	70 (1.9)	74 (1.7)	98 (0.3)	87 (1.1)
Pennsylvania	77 (1.2)	70 (1.2)	74 (1.2)	99 (0.3)	87 (0.8)
South Carolina	83 (1.0)	74 (1.3)	82 (0.8)	98 (0.4)	87 (0.8)
Texas	77 (1.3)	70 (1.7)	74 (1.5)	98 (0.6)	87 (1.0)
Districts and Consortia					
Academy School Dist. #20, CO	77 (1.1)	74 (1.2)	75 (1.2)	99 (0.3)	86 (0.9)
Chicago Public Schools, IL	88 (1.3)	65 (2.4)	78 (2.2)	96 (0.9)	85 (1.2)
Delaware Science Coalition, DE	73 (1.6)	67 (1.8)	74 (1.3)	98 (0.6)	87 (1.1)
First in the World Consort., IL	77 (1.8)	71 (1.4)	74 (1.7)	99 (0.5)	82 (1.3)
Fremont/Lincoln/WestSide PS, NE	75 (1.4)	69 (1.1)	70 (1.1)	97 (1.1)	83 (1.6)
Guilford County, NC	88 (1.3)	82 (1.5)	87 (1.3)	99 (0.3)	87 (1.2)
Jersey City Public Schools, NJ	89 (1.3)	76 (1.6)	88 (1.2)	97 (0.7)	88 (1.0)
Miami-Dade County PS, FL	80 (1.4)	73 (1.4)	80 (1.0)	97 (0.5)	84 (1.1)
Michigan Invitational Group, MI	76 (1.6)	72 (1.8)	73 (1.4)	98 (0.8)	83 (1.8)
Montgomery County, MD	78 (1.6)	69 (1.8)	75 (1.6)	99 (0.4)	85 (1.1)
Naperville Sch. Dist. #203, IL	84 (1.1)	79 (1.2)	82 (1.1)	99 (0.3)	83 (1.0)
Project SMART Consortium, OH	76 (1.2)	73 (1.3)	74 (1.5)	99 (0.3)	85 (1.1)
Rochester City Sch. Dist., NY	82 (1.5)	79 (1.5)	79 (1.6)	97 (0.8)	85 (1.6)
SW Math/Sci. Collaborative, PA	79 (1.2)	72 (1.4)	75 (1.0)	99 (0.2)	86 (1.6)
International Avg. (All Countries)	86 (0.1)	77 (0.2)	86 (0.1)	92 (0.1)	85 (0.1)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries									
United States	41 (0.8)	40 (0.7)	18 (0.6)	34 (0.8)	47 (0.7)	19 (0.6)	58 (1.2)	36 (1.0)	6 (0.3)
Belgium (Flemish)	18 (1.2)	40 (1.4)	42 (1.1)	15 (0.6)	52 (1.2)	33 (1.1)	24 (0.8)	46 (1.3)	30 (1.2)
Canada	43 (1.1)	40 (0.9)	17 (0.6)	25 (0.5)	46 (0.6)	30 (0.6)	57 (0.8)	36 (0.6)	7 (0.5)
Chinese Taipei	27 (0.7)	50 (0.8)	23 (0.9)	29 (0.8)	50 (0.6)	20 (0.7)	42 (0.9)	46 (0.7)	11 (0.5)
Czech Republic	32 (1.2)	48 (1.2)	20 (1.0)	22 (1.1)	56 (1.0)	22 (1.0)	46 (1.3)	39 (1.0)	15 (0.9)
England	36 (1.2)	41 (1.0)	23 (1.0)	21 (1.0)	41 (0.9)	38 (1.0)	43 (1.3)	42 (1.1)	15 (0.9)
Hong Kong, SAR	28 (0.8)	53 (0.8)	19 (0.6)	26 (0.7)	55 (0.7)	19 (0.7)	29 (0.8)	49 (0.8)	22 (0.8)
Italy	30 (0.7)	45 (1.0)	24 (0.8)	27 (1.0)	51 (1.0)	22 (0.9)	33 (0.7)	46 (1.0)	20 (0.9)
Japan	12 (0.5)	39 (0.7)	49 (1.0)	6 (0.4)	25 (0.7)	69 (0.8)	34 (0.8)	54 (0.7)	11 (0.7)
Korea, Rep. of	10 (0.5)	34 (0.6)	56 (0.7)	12 (0.5)	50 (0.7)	38 (0.7)	31 (0.7)	54 (0.7)	15 (0.5)
Netherlands	18 (1.2)	37 (0.9)	45 (1.3)	7 (0.8)	36 (1.2)	57 (1.3)	20 (1.2)	45 (1.1)	35 (1.6)
Russian Federation	42 (1.1)	42 (1.0)	16 (0.8)	20 (0.7)	40 (1.0)	39 (1.3)	40 (1.0)	48 (1.0)	12 (0.6)
Singapore	40 (1.0)	46 (0.8)	13 (0.6)	26 (0.8)	46 (0.6)	28 (0.8)	54 (1.1)	41 (1.0)	5 (0.4)
States									
Connecticut	36 (1.4)	43 (1.1)	21 (1.3)	32 (1.5)	47 (1.4)	20 (0.9)	54 (1.8)	41 (1.9)	6 (0.6)
Idaho	42 (1.4)	42 (1.2)	16 (0.9)	36 (1.0)	48 (1.1)	17 (0.8)	57 (1.5)	37 (1.3)	6 (0.8)
Illinois	40 (1.1)	42 (0.9)	18 (0.6)	29 (1.2)	49 (1.4)	22 (0.9)	58 (1.3)	37 (1.2)	5 (0.8)
Indiana	45 (2.2)	41 (2.3)	15 (0.8)	34 (1.6)	49 (1.4)	17 (0.9)	59 (2.3)	36 (2.0)	5 (0.5)
Maryland	43 (0.9)	40 (0.8)	16 (0.7)	36 (1.1)	46 (1.0)	18 (1.0)	59 (1.2)	35 (1.1)	6 (0.6)
Massachusetts	33 (1.1)	42 (1.2)	25 (1.4)	31 (0.8)	47 (1.1)	22 (1.1)	50 (1.2)	43 (1.1)	7 (0.5)
Michigan	38 (1.1)	44 (1.0)	18 (1.1)	30 (1.1)	49 (1.1)	20 (1.2)	55 (1.4)	40 (1.3)	5 (0.5)
Missouri	39 (1.5)	44 (1.3)	17 (1.2)	37 (1.1)	45 (1.3)	19 (1.1)	53 (1.2)	38 (1.2)	9 (0.6)
North Carolina	49 (1.2)	37 (1.2)	14 (0.8)	42 (1.5)	43 (1.1)	15 (1.1)	67 (1.5)	29 (1.4)	4 (0.3)
Oregon	39 (1.7)	43 (1.5)	18 (0.9)	32 (1.4)	52 (2.0)	17 (1.1)	52 (1.6)	41 (1.7)	7 (0.8)
Pennsylvania	36 (2.1)	44 (1.1)	20 (1.3)	30 (1.3)	49 (1.2)	21 (1.2)	52 (1.9)	40 (1.1)	8 (1.1)
South Carolina	46 (1.4)	40 (1.2)	14 (0.7)	39 (0.8)	44 (1.1)	18 (0.9)	66 (1.2)	30 (1.2)	3 (0.5)
Texas	43 (1.2)	41 (1.2)	16 (1.1)	36 (1.5)	46 (0.9)	18 (1.6)	60 (1.2)	34 (1.1)	6 (0.7)
Districts and Consortia									
Academy School Dist. #20, CO	42 (1.3)	41 (1.4)	17 (1.1)	37 (1.1)	47 (1.5)	16 (1.1)	60 (1.6)	36 (1.5)	4 (0.5)
Chicago Public Schools, IL	43 (3.1)	43 (2.2)	14 (1.5)	26 (2.0)	44 (1.9)	30 (2.0)	60 (3.4)	35 (2.9)	4 (0.9)
Delaware Science Coalition, DE	45 (1.0)	40 (1.5)	16 (1.1)	33 (1.3)	47 (1.8)	20 (1.3)	55 (1.2)	40 (1.2)	6 (0.7)
First in the World Consort., IL	35 (1.0)	40 (2.2)	26 (2.0)	28 (2.3)	50 (2.0)	22 (1.2)	55 (1.6)	40 (1.3)	5 (0.9)

Background data provided by students.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates a 70-84% student response rate.

Countries					
United States					
Belgium (Flemish)					
Canada					
Chinese Taipei					

Background data provided by students.

1 Average hours based on: No time=0; less than 1 hour=.5; 1-2 hours=1.5; 3-5 hours=4; more than 5 hours=7.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available.

Background data provided by students.

1 Average scale value based on: Strongly disagree=4; disagree=3; agree=2; strongly agree=1.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Background date provided by students.

1 Average scale value based on: Like a lot=4; like=3; dislike=2; dislike a lot=1.

States in *italics*

reference 2

The Mathematics Curriculum

Countries										
United States	r	49 (4.7)	r	49 (4.2)	r	79 (2.8)	r	64 (3.9)	r	37 (4.2)
Belgium (Flemish)		66 (5.1)		11 (3.2)		36 (5.0)		81 (4.7)		100 (0.0)
Canada	s	77 (3.4)	s	43 (4.3)	s	66 (3.8)	s	87 (2.5)	s	17 (3.0)
Chinese Taipei		50 (4.2)		25 (3.7)		88 (2.7)		81 (3.5)		18 (3.1)
Czech Republic		68 (4.3)		44 (5.0)		29 (3.9)		62 (4.3)		7 (3.0)
England	r	78 (3.6)	r	57 (4.7)	r	48 (5.0)	r	61 (4.8)	r	0 (0.0)

Background data provided by schools.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates school response data available for 70-84% of students. An "s" indicates school response data available for 50-69% of students. An "x" indicates school response data available for <50% of students.

	Whole numbers – including place values, factorization and operations (+, –, x, ÷)				Computations with decimal fractions				
Countries									
United States									
Belgium (Flemish)									
Canada									
Chinese Taipei									
Czech Republic									
England									
Hong Kong, SAR									
Italy									
Japan									
Korea, Rep. of									
Netherlands									
Russian Federation									
Singapore									
States									
Connecticut									
Idaho									
Illinois									
Indiana									
Maryland									
Massachusetts									
Michigan									
Missouri									
North Carolina									
Oregon									
Pennsylvania									
South Carolina									
Texas									
Districts and Consortia									
Academy School Dist. #20, CO	–			–	–	–	–	–	–
Chicago Public Schools, IL									
Delaware Science Coalition, DE									
First in the World Consort., IL									
Fremont/Lincoln/WestSide PS, NE									
Guilford County, NC									
Jersey City Public Schools, NJ									
Miami-Dade County PS, FL									
Michigan Invitational Group, MI									
Montgomery County, MD									
Naperville Sch. Dist. #203, IL									
Project SMART Consortium, OH									
Rochester City Sch. Dist., NY									
SW Math/Sci. Collaborative, PA	–			–	–	–	–	–	–

Background data provided by coordinators from participating jurisdictions.

Countries										
United States	●									
Belgium (Flemish)	●									
Canada	●									
Chinese Taipei	●									
Czech Republic	●									
England	●									
Hong Kong, SAR	●									
Italy	●									
Japan	●									
Korea, Rep. of	●									
Netherlands	●									
Russian Federation	●									
Singapore	●									
States										
Connecticut	●									
Idaho	●									
Illinois	●									
Indiana	●									
Maryland	●									
Massachusetts	●									
Michigan	●									
Missouri	●									
North Carolina	●									
Oregon										
Pennsylvania										
South Carolina										
Texas										
Districts and Consortia										
Academy School Dist. #20, CO	–	–	–	–	–	–	–	–	–	–
Chicago Public Schools, IL										
Delaware Science Coalition, DE										
First in the World Consort., IL										
Fremont/Lincoln/WestSide PS, NE										
Guilford County, NC										
Jersey City Public Schools, NJ										
Miami-Dade County PS, FL										
Michigan Invitational Group, MI										
Montgomery County, MD										
Naperville Sch. Dist. #203, IL										
Project SMART Consortium, OH										
Rochester City Sch. Dist., NY										
SW Math/Sci. Collaborative, PA	–	–	–	–	–	–	–	–	–	–

Background data provided by coordinators from participating jurisdictions.

Countries					
United States	●				
Belgium (Flemish)	●				
Canada	●				
Chinese Taipei	●				
Czech Republic	●				
England	●				
Hong Kong, SAR	●				
Italy	●				
Japan	●				
Korea, Rep. of	●				
Netherlands	●				
Russian Federation	●				
Singapore	●				
States					
Connecticut	●				
Idaho	●				
Illinois	●				
Indiana	●				
Maryland	●				
Massachusetts	●				
Michigan	●				
Missouri	●				
North Carolina	●				
Oregon	●				
Pennsylvania	●				
South Carolina	●				
Texas	●				
Districts and Consortia					
Academy School Dist. #20, CO	–	–	–	–	–
Chicago Public Schools, IL	●				
Delaware Science Coalition, DE	●				
First in the World Consort., IL	●				
Fremont/Lincoln/WestSide PS, NE					
Guilford County, NC					
Jersey City Public Schools, NJ					
Miami-Dade County PS, FL					
Michigan Invitational Group, MI					
Montgomery County, MD					
Naperville Sch. Dist. #203, IL					
Project SMART Consortium, OH					
Rochester City Sch. Dist., NY					
SW Math/Sci. Collaborative, PA	–	–	–	–	–

Background data provided by coordinators from participating jurisdictions.

Countries							
United States		3 (1.0)	7 (1.4)	14 (2.2)	42 (2.9)	10 (2.0)	25 (2.9)
Belgium (Flemish)		0 (0.0)	5 (1.4)	10 (1.9)	47 (3.5)	15 (2.1)	22 (2.4)
Canada	r	2 (0.5)	3 (1.0)	14 (2.9)	52 (3.2)	12 (2.2)	18 (2.6)
Chinese Taipei		1 (0.0)	1 (0.5)	6 (2.1)	18 (3.3)	42 (4.1)	33 (4.1)
Czech Republic		35 (4.6)	23 (4.8)	4 (2.3)	17 (3.1)	17 (3.8)	4 (1.9)
England	s	13 (2.4)	18 (3.1)	2 (0.8)	29 (2.5)	23 (3.4)	15 (2.7)
Hong Kong, SAR		13 (2.7)	21 (3.5)	5 (2.0)	16 (2.7)	30 (4.0)	14 (3.2)
Italy		2 (1.0)	10 (2.8)	9 (2.2)	29 (3.6)	41 (3.9)	9 (2.3)
Japan		2 (1.5)	21 (3.2)	8 (2.4)	35 (4.1)	32 (4.4)	1 (1.0)
Korea, Rep. of		5 (1.8)	6 (1.8)	12 (2.4)	57 (4.4)	19 (3.4)	1 (0.0)
Netherlands		3 (1.3)	17 (4.5)	15 (5.1)	24 (5.1)	25 (4.8)	17 (4.9)
Russian Federation		– –	– –	– –	– –	– –	– –
Singapore		1 (0.0)	1 (0.0)	24 (4.1)	62 (4.4)	5 (2.0)	7 (2.4)
States							
Connecticut	r	1 (1.2)	10 (4.6)	8 (3.4)	34 (6.9)	8 (4.5)	39 (6.5)
Idaho	r	3 (2.2)	6 (2.7)	7 (2.4)	43 (7.6)	8 (4.3)	32 (5.6)
Illinois		6 (2.2)	11 (4.2)	10 (3.1)	49 (6.3)	10 (3.9)	13 (3.7)
Indiana		2 (1.3)	8 (3.4)	8 (3.4)	37 (7.5)	19 (5.1)	27 (5.8)
Maryland	r	4 (1.9)	11 (3.5)	10 (2.3)	31 (6.4)	13 (4.6)	32 (5.8)
Massachusetts	r	2 (1.5)	9 (3.1)	13 (3.8)	31 (6.0)	7 (2.8)	38 (5.7)
Michigan	r	8 (3.7)	17 (4.8)	16 (4.5)	41 (5.4)	5 (2.8)	14 (3.1)
Missouri		4 (1.9)	5 (2.5)	4 (2.0)	62 (6.1)	7 (2.2)	19 (5.3)
North Carolina		1 (1.1)	6 (2.3)	14 (3.2)	64 (4.7)	4 (1.8)	12 (3.5)
Oregon		0 (0.0)	2 (1.4)	14 (4.6)	64 (6.5)	5 (2.7)	15 (4.3)
Pennsylvania		7 (6.0)	7 (2.9)	6 (2.2)	43 (5.1)	9 (2.9)	28 (7.4)
South Carolina		1 (1.0)	8 (3.7)	15 (4.5)	59 (6.9)	6 (2.8)	10 (3.2)
Texas		4 (1.9)	9 (3.3)	11 (2.6)	63 (4.8)	9 (3.9)	4 (2.3)
Districts and Consortia							
Academy School Dist. #20, CO		2 (0.1)	0 (0.0)	21 (0.3)	22 (0.3)	6 (0.1)	49 (0.4)
Chicago Public Schools, IL		2 (2.4)	6 (0.6)	17 (7.3)	55 (8.4)	1 (0.7)	19 (5.1)
Delaware Science Coalition, DE	r	0 (0.0)	10 (5.2)	21 (6.3)	38 (7.4)	11 (2.2)	20 (5.0)
First in the World Consort., IL		3 (1.0)	11 (3.5)	24 (9.2)	36 (9.1)	20 (4.9)	6 (3.0)
Fremont/Lincoln/WestSide PS, NE	r	0 (0.0)	14 (1.4)	22 (1.3)	31 (8.6)	7 (3.6)	26 (9.7)
Guilford County, NC		0 (0.0)	19 (3.4)	18 (5.4)	41 (6.5)	9 (5.4)	13 (4.9)

Background data provided by teachers.

* Categories of topic coverage for geometry are based on combined responses to questions about the individual mathematics subtopics in the content area described in Exhibit 5.23.

1 For each topic in Exhibit 5.23, teachers were asked if the topic was taught before this year, taught 1-5 periods this year, taught more than 5 periods this year, or not yet taught. Topics taught during this year are included in this category regardless if taught before this year.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

reference 3

Teachers and Instruction

Countries						
United States	99 (0.8)	97 (1.1)	84 (2.0)	97 (1.1)	86 (2.7)	75 (2.9)
Belgium (Flemish)	97 (1.4)	93 (1.7)	62 (4.1)	92 (2.0)	93 (2.1)	89 (3.1)
Canada	91 (2.1)	89 (2.4)	r			

Background data provided by teachers

1 Does not include students whose teachers report that they do not teach the topic.

2 Percentage of students averaged across topics.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Countries							
United States	82 (2.6)	94 (1.6)	95 (1.3)	93 (1.5)	94 (1.5)	90 (2.1)	90 (1.2)
Belgium (Flemish)	71 (3.9)	85 (3.1)	86 (2.6)	83 (3.3)	64 (2.9)	30 (4.6)	80 (1.4)
Canada	r 64 (3.6)	r 83 (2.5)	82 (2.5)	r 74 (2.8)	79 (2.9)	r 70 (3.3)	79 (1.7)
Chinese Taipei	81 (3.2)	82 (2.9)	85 (2.9)	84 (3.0)	74 (3.7)	73 (3.7)	78 (2.6)
Czech Republic	84 (4.2)	88 (3.6)	95 (2.4)	97 (1.9)	75 (5.1)	52 (5.6)	88 (1.8)
England	– –	– –	– –	– –	– –	– –	– –
Hong Kong, SAR	82 (3.4)	85 (3.2)	87 (3.0)	74 (3.9)	58 (4.4)	58 (3.9)	72 (2.6)

Countries									
United States	r	62 (4.2)	514 (5.3)	23 (3.5)	497 (6.2)	13 (2.6)	461 (9.3)	3 (1.0)	446 (15.1)
Belgium (Flemish)		84 (3.6)	557 (4.5)	12 (3.3)	554 (22.2)	2 (1.2)	~ ~	1 (0.9)	~ ~
Canada		54 (3.1)	536 (3.1)	27 (3.2)	531 (4.3)	16 (2.4)	514 (7.7)	3 (0.8)	525 (18.6)
Chinese Taipei		43 (4.3)	591 (5.1)	36 (4.4)	584 (7.3)	12 (3.0)	590 (11.4)	9 (2.2)	551 (13.3)
Czech Republic		90 (2.9)	521 (4.7)	6 (2.6)	506 (15.6)	3 (1.8)	527 (26.2)	1 (0.9)	~ ~
England	r	71 (4.1)	508 (5.8)	19 (3.6)	482 (7.3)	8 (2.8)	485 (17.1)	2 (1.2)	~ ~
Hong Kong, SAR		55 (4.5)	596 (6.0)	28 (4.2)	555 (9.6)	10 (2.6)	583 (15.9)	7 (2.1)	602 (15.1)
Italy		38 (4.1)	478 (5.5)	36 (3.6)	483 (7.6)	20 (3.3)	473 (9.0)	6 (1.7)	487 (13.3)
Japan		65 (3.9)	579 (2.1)	17 (2.8)	583 (4.2)	8 (2.4)	577 (6.0)	10 (2.5)	572 (5.5)

Background data provided by schools.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report achievement.

An "r" indicates school response data available for 70-84% of students. An "s" indicates school response data available for 50-69% of students. An "x" indicates school response data available for <50% of students.

Chinese Taipei	
Rochester City Sch. Dist., NY	
Texas	r
Missouri	
Hong Kong, SAR	
Singapore	
Naperville Sch. Dist. #203, IL	
Jersey City Public Schools, NJ	
North Carolina	
South Carolina	
Massachusetts	
Project SMART Consortium, OH	
Montgomery County, MD	s
Maryland	r
Academy School Dist. #20, CO	
Connecticut	s
SW Math/Sci. Collaborative, PA	
Idaho	r
Miami-Dade County PS, FL	s
United States	
Guilford County, NC	
Michigan	
Oregon	
First in the World Consort., IL	
Delaware Science Coalition, DE	r
Pennsylvania	
Illinois	
Indiana	
Italy	
Japan	
Chicago Public Schools, IL	
England	s
Michigan Invitational Group, MI	
Canada	r
Korea, Rep. of	
Netherlands	
Belgium (Flemish)	
Russian Federation	
Czech Republic	

Czech Republic	
Belgium (Flemish)	
Chinese Taipei	
South Carolina	
England	s
Hong Kong, SAR	
Russian Federation	
Maryland	r
Texas	r
Canada	r
Netherlands	
Singapore	
Korea, Rep. of	
Naperville Sch. Dist. #203, IL	
Fremont/Lincoln/WestSide PS, NE	
Oregon	
Pennsylvania	
Indiana	
Rochester City Sch. Dist., NY	
North Carolina	
United States	
Project SMART Consortium, OH	
Idaho	r
Massachusetts	
Missouri	
Connecticut	r
Miami-Dade County PS, FL	s
Illinois	
Academy School Dist. #20, CO	
Michigan	
Jersey City Public Schools, NJ	
Japan	
First in the World Consort., IL	
Guilford County, NC	
SW Math/Sci. Collaborative, PA	
Montgomery County, MD	s
Chicago Public Schools, IL	
Michigan Invitational Group, MI	
Italy	
Delaware Science Coalition, DE	r

Background data provided by teachers.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

	Remember Formulas and Procedures
Rochester City Sch. Dist., NY	
South Carolina	
Russian Federation	
Jersey City Public Schools, NJ	
Idaho r	
Guilford County, NC	
North Carolina	
Academy School Dist. #20, CO	
Project SMART Consortium, OH	
Maryland r	
Canada	
Belgium (Flemish)	

	Be Able to Think Creatively
Jersey City Public Schools, NJ	
Chinese Taipei	
Japan	
Chicago Public Schools, IL	
Miami-Dade County PS, FL s	
Naperville Sch. Dist. #203, IL	
Delaware Science Coalition, DE r	
Korea, Rep. of	
First in the World Consort., IL	
Massachusetts	
Czech Republic	

Background data provided by teachers.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Background data provided by teachers.

1 Includes individual curriculum planning and cooperative curriculum planning.

2 Includes student supervision (other than teaching), student counseling/appraisal, other non-student contact time, and other activities.

3 Netherlands: Data in other activities category reflects the total reported for curriculum planning, administrative duties, and other activities.

4 Russian Federation: Formally scheduled school time is for instruction only; teachers are not formally scheduled for other activities.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students. An "x" indicates teacher response data available for <50% of students.

Background data provided by teachers.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Countries								
United States	23 (0.9)	489 (5.1)	31 (0.8)	509 (3.8)	34 (0.7)	515 (4.1)	12 (0.7)	493 (6.8)
Belgium (Flemish)	7 (0.7)	531 (13.8)	20 (0.8)	560 (4.4)	47 (1.1)	567 (4.0)	27 (1.1)	552 (4.8)
Canada	19 (0.7)	518 (3.6)	33 (0.8)	534 (4.3)	36 (0.9)	536 (2.7)	11 (0.7)	531 (4.6)
Chinese Taipei	11 (0.5)	596 (6.2)	31 (0.8)	600 (4.0)	43 (0.8)	590 (4.4)	15 (0.7)	540 (6.5)
Czech Republic	11 (0.9)	522 (8.1)	36 (1.4)	530 (4.2)	37 (1.5)	519 (5.0)	16 (1.2)	499 (8.3)
England	14 (0.8)	486 (6.3)	41 (1.3)	499 (5.2)	34 (1.0)	505 (4.9)	11 (0.8)	489 (8.2)
Hong Kong, SAR	6 (0.3)	573 (8.0)	24 (0.8)	583 (6.5)	56 (0.9)	587 (4.0)	15 (0.7)	570 (6.1)
Italy	10 (0.6)	456 (7.7)	19 (0.8)	494 (6.2)	38 (1.0)	489 (4.0)	33 (1.2)	471 (4.5)
Japan	2 (0.2)	~ ~	17 (0.7)	590 (3.5)	55 (0.8)	583 (2.1)	27 (1.0)	564 (3.3)
Korea, Rep. of	3 (0.3)	580 (7.5)	12 (0.6)	602 (3.2)	47 (0.8)	595 (2.3)	37 (0.8)	573 (2.7)
Netherlands	7 (0.6)	544 (10.2)	20 (0.9)	549 (8.5)	49 (1.6)	542 (8.1)	23 (1.5)	530 (8.4)
Russian Federation	14 (0.8)	506 (6.7)	23 (1.2)	538 (8.3)	46 (1.4)	533 (6.0)	17 (0.9)	521 (6.3)
Singapore	16 (0.8)	578 (7.8)	34 (0.9)	606 (6.9)	36 (1.1)	617 (6.3)	14 (0.8)	599 (6.1)
States								
Connecticut	24 (1.3)	497 (7.9)	33 (1.4)	518 (10.1)	32 (1.1)	525 (9.6)	11 (1.7)	508 (15.3)
Idaho	24 (1.4)	480 (9.7)	29 (1.3)	498 (8.1)	36 (1.9)	508 (6.7)	12 (1.2)	481 (8.7)
Illinois	22 (1.5)	487 (8.9)	33 (1.2)	513 (7.4)	35 (1.5)	525 (6.9)	10 (1.1)	500 (8.0)
Indiana	23 (1.7)	497 (8.2)	29 (2.0)	518 (8.5)	36 (1.9)	528 (7.5)	12 (1.4)	515 (11.9)
Maryland	26 (1.0)	484 (6.1)	36 (1.3)	507 (6.3)	27 (1.0)	506 (6.9)	11 (0.8)	480 (8.9)
Massachusetts	20 (1.2)	497 (8.0)	34 (1.4)	518 (6.5)	35 (1.3)	519 (6.0)	12 (1.0)	517 (10.0)
Michigan	23 (1.3)	508 (8.5)	33 (1.6)	527 (7.2)	33 (1.4)	527 (7.4)	11 (1.0)	496 (10.2)
Missouri	26 (1.5)	480 (6.4)	30 (1.8)	491 (6.3)	32 (1.7)	500 (5.3)	11 (1.0)	483 (12.2)
North Carolina	29 (1.3)	477 (6.2)	33 (1.5)	501 (9.4)	29 (1.2)	511 (7.9)	9 (1.0)	492 (7.7)
Oregon	20 (1.1)	500 (7.6)	32 (1.3)	521 (6.2)	37 (1.4)	526 (5.9)	11 (1.1)	496 (10.1)
Pennsylvania	20 (0.9)	484 (7.1)	32 (1.1)	514 (5.7)	36 (1.3)	521 (7.0)	13 (0.8)	499 (9.5)
South Carolina	23 (1.5)	478 (7.2)	32 (1.3)	505 (8.8)	33 (1.5)	519 (7.8)	12 (1.4)	500 (11.5)
Texas	21 (1.5)	497 (13.4)	31 (1.1)	527 (9.4)	36 (1.5)	536 (7.7)	13 (1.1)	503 (13.8)
Districts and Consortia								

Background data provided by students.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report achievement.

An "r" indicates a 70-84% student response rate.

Countries								
United States	42 (2.3)	516 (5.1)	28 (1.1)	506 (4.6)	22 (1.5)	493 (4.8)	8 (1.2)	471 (7.4)

Background data provided by students.

* The use of calculators on TIMSS was not allowed in 1995 or in 1999.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report achievement.

An "r" indicates a 70-84% student response rate.

Countries						
United States	5 (1.2)	69 (3.5)	45 (3.2)	62 (3.9)	75 (3.2)	59 (3.2)
Belgium (Flemish)	7 (2.5)	55 (4.6)	34 (3.5)	45 (4.7)	53 (4.5)	27 (4.0)
Canada	3 (1.0)	82 (2.3)	58 (2.9)	r 80 (2.8)	91 (1.8)	r 69 (3.0)
Chinese Taipei	55 (4.6)	5 (1.7)	2 (1.0)	9 (2.5)	9 (2.5)	8 (2.3)
Czech Republic	5 (2.3)	60 (4.9)	18 (3.6)	49 (4.9)	60 (5.0)	22 (4.6)
England	0 (0.4)	s 74 (3.6)	s 32 (3.4)	s 76 (3.0)	s 72 (3.8)	s 41 (4.1)
Hong Kong, SAR	1 (0.9)	85 (2.8)	58 (4.2)	88 (2.8)	74 (3.6)	39 (3.9)
Italy	13 (2.1)	66 (2.8)	14 (2.8)	58 (3.2)	68 (3.4)	21 (3.3)
Japan	81 (3.3)	0 (0.0)	1 (0.7)	5 (2.0)	4 (1.7)	1 (1.0)
Korea, Rep. of	72 (3.4)	1 (0.9)	1 (0.9)	2 (1.2)	5 (1.7)	2 (1.2)
Netherlands	1 (0.1)	91 (2.9)	68 (5.4)	97 (1.8)	90 (3.0)	65 (6.3)

Background data provided by teachers.

* The use of calculators on TIMSS was not allowed in 1995 or in 1999.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

	Percentage of Students Taught by Teachers						
	Assigning Homework Three Times a Week or More Often		Assigning Homework Once or Twice a Week		Assigning Homework Less Than Once a Week		Never Assigning Homework
	30 Minutes or Less	More Than 30 Minutes	30 Minutes or Less	More Than 30 Minutes	30 Minutes or Less	More Than 30 Minutes	
Countries							
United States	63 (2.8)	27 (2.4)	7 (1.6)	1 (0.6)	1 (0.7)	0 (0.0)	1 (0.7)
Belgium (Flemish)	15 (2.7)	2 (0.9)	48 (4.9)	9 (2.0)	18 (3.3)	3 (1.2)	5 (3.2)
Canada	58 (3.5)	16 (2.6)	22 (2.8)	3 (1.5)	1 (0.7)	0 (0.0)	0 (0.0)
Chinese Taipei	21 (3.1)	25 (3.6)	27 (3.4)	23 (3.4)	2 (1.1)	2 (1.1)	0 (0.0)
Czech Republic	15 (3.7)	0 (0.2)	69 (5.1)	2 (1.3)	13 (3.8)	0 (0.0)	0 (0.0)
England	3 (1.4)	1 (0.6)	48 (3.9)	46 (4.1)	2 (0.8)	1 (0.3)	0 (0.0)
Hong Kong, SAR	30 (4.0)	19 (3.1)	26 (3.1)	23 (3.7)	2 (1.2)	1 (0.0)	0 (0.0)
Italy	15 (2.6)	68 (3.8)	5 (1.7)	12 (2.5)	0 (0.0)	0 (0.0)	0 (0.0)
Japan	14 (2.7)	3 (1.4)	27 (4.0)	8 (2.1)	34 (4.3)	6 (2.0)	9 (2.3)
Korea, Rep. of	24 (3.3)	9 (2.3)	29 (3.4)	15 (2.7)	14 (2.6)	6 (2.0)	2 (0.7)
Netherlands	73 (4.4)	9 (2.6)	13 (3.3)	3 (1.3)	1 (0.6)	0 (0.0)	1 (0.6)
Russian Federation	42 (4.5)	57 (4.6)	0 (0.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Singapore	26 (4.2)	54 (4.3)	8 (2.1)	12 (2.4)	0 (0.0)	0 (0.0)	0 (0.0)
States							
Connecticut	69 (6.9)	30 (6.5)	1 (1.4)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Idaho	59 (5.4)	18 (4.1)	12 (4.5)	0 (0.0)	4 (1.3)	0 (0.0)	7 (4.3)
Illinois	72 (5.6)	27 (5.5)	0 (0.4)	0 (0.4)	0 (0.0)	0 (0.0)	0 (0.3)
Indiana	78 (5.7)	18 (4.9)	4 (1.9)	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)
Maryland	73 (4.2)	16 (3.3)	8 (2.0)	1 (1.0)	2 (1.8)	0 (0.0)	0 (0.1)
Massachusetts	57 (7.2)	41 (7.0)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	2 (1.9)
Michigan	52 (5.0)	31 (4.5)	9 (3.3)	5 (2.1)	0 (0.0)	0 (0.0)	3 (2.7)
Missouri	59 (6.1)	26 (5.9)	12 (3.9)	0 (0.0)	1 (1.1)	0 (0.0)	1 (0.7)
North Carolina	57 (6.4)	23 (5.4)	16 (3.4)	1 (0.5)	4 (2.4)	0 (0.0)	0 (0.0)
Oregon	64 (5.5)	22 (4.8)	9 (2.3)	0 (0.0)	3 (2.1)	0 (0.0)	2 (1.5)
Pennsylvania	69 (5.7)	26 (5.7)	5 (2.4)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.1)
South Carolina	54 (7.6)	32 (6.3)	14 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.1)
Texas	41 (6.7)	34 (6.8)	14 (4.3)	7 (4.0)	2 (1.8)	0 (0.0)	2 (1.5)
Districts and Consortia							
Academy School Dist. #20, CO	20 (0.3)	77 (0.3)	1 (0.0)	0 (0.0)	2 (0.1)	0 (0.0)	0 (0.0)
Chicago Public Schools, IL	56 (9.1)	39 (9.1)	3 (0.2)	2 (2.2)	0 (0.0)	0 (0.0)	0 (0.0)
Delaware Science Coalition, DE	75 (5.8)	17 (5.1)	8 (2.8)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
First in the World Consort., IL	61 (5.2)	39 (5.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Fremont/Lincoln/WestSide PS, NE	72 (3.2)	23 (3.2)	5 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Guilford County, NC	59 (8.1)	28 (6.3)	10 (5.0)	2 (0.1)	2 (0.1)	0 (0.0)	0 (0.0)
Jersey City Public Schools, NJ	51 (5.7)	46 (6.4)	2 (2.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Miami-Dade County PS, FL	53 (9.1)	24 (5.7)	21 (7.3)	2 (2.0)	0 (0.0)	0 (0.0)	0 (0.0)
Michigan Invitational Group, MI	61 (9.8)	29 (7.0)	10 (6.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Montgomery County, MD	49 (4.5)	42 (4.9)	3 (1.4)	4 (4.4)	1 (0.2)	0 (0.0)	1 (0.6)
Naperville Sch. Dist. #203, IL	68 (2.4)	30 (2.3)	0 (0.0)	0 (0.0)	2 (0.1)	0 (0.0)	0 (0.0)
Project SMART Consortium, OH	68 (6.6)	23 (6.4)	6 (3.2)	3 (2.5)	0 (0.0)	0 (0.0)	0 (0.0)
Rochester City Sch. Dist., NY	60 (5.1)	21 (5.4)	15 (3.4)	0 (0.0)	0 (0.0)	5 (0.4)	0 (0.0)
SW Math/Sci. Collaborative, PA	59 (6.2)	35 (5.5)	5 (2.4)	0 (0.0)	1 (0.9)	0 (0.0)	0 (0.0)
International Avg. (All Countries)	41 (0.6)	26 (0.5)	16 (0.5)	10 (0.4)	4 (0.2)	2 (0.2)	1 (0.1)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Background data provided by teachers.

Countries						
United States	40 (1.6)	491 (3.7)	46 (1.3)	520 (4.3)	14 (0.9)	493 (6.1)
Belgium (Flemish)	19 (0.9)	534 (4.1)	56 (1.7)	568 (4.1)	25 (1.6)	558 (8.8)
Canada	25 (1.6)	516 (3.9)	50 (1.4)	534 (2.9)	25 (1.1)	541 (4.1)
Chinese Taipei	27 (1.2)	589 (5.1)	46 (1.0)	590 (4.2)	27 (1.5)	576 (6.5)
Czech Republic	7 (1.2)	494 (10.9)	33 (1.7)	522 (4.9)	60 (2.3)	522 (4.5)
England	14 (0.9)	463 (5.6)	46 (1.6)	500 (4.8)	40 (1.9)	507 (5.4)
Hong Kong, SAR	9 (0.7)	569 (7.3)	37 (1.6)	579 (4.9)	54 (2.2)	587 (5.2)
Italy	9 (0.8)	452 (8.7)	19 (0.9)	476 (6.3)	72 (1.3)	485 (3.7)
Japan	12 (1.4)	571 (6.1)	30 (1.5)	582 (3.2)	58 (2.1)	579 (2.6)
Korea, Rep. of	7 (0.5)	587 (6.9)	18 (0.8)	601 (4.5)	75 (1.2)	584 (1.9)
Netherlands	14 (1.5)	510 (10.5)	47 (1.9)	538 (6.7)	39 (1.7)	555 (8.2)
Russian Federation	26 (1.1)	517 (6.6)	50 (1.3)	541 (6.5)	24 (1.3)	510 (6.5)
Singapore	19 (0.9)	597 (8.3)	45 (1.0)	609 (6.5)	36 (1.4)	602 (6.4)
States						
Connecticut	41 (1.9)	500 (9.2)	48 (1.7)	528 (9.7)	11 (1.1)	501 (11.3)

Background data provided by students.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates a 70-84% student response rate.

reference 4

Background data provided by schools.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates school response data available for 70-84% of students. An "s" indicates school response data available for 50-69% of students.

Countries					
United States	r 47 (4.2)	r 48 (4.1)	r 16 (3.4)	r 29 (4.0)	r 25 (3.2)

Background data provided by schools.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates school response data available for 70-84% of students. An "s" indicates school response data available for 50-69% of students.

	Percentage of Students by Number of Students per Computer[1]				Percentage of Students in Schools Without Any Computers
	Fewer than 15 Students per Computer	15-30 Students per Computer	31-50 Students per Computer	More than 50 Students per Computer	
Countries					
United States	97 (1.8)	3 (1.8)	0 (0.0)	0 (0.0)	0 (0.0)
Belgium (Flemish)	83 (3.0)	9 (2.2)	1 (0.8)	4 (1.7)	4 (1.6)
Canada	100 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Chinese Taipei	90 (2.5)	9 (2.6)	1 (0.8)	0 (0.0)	0 (0.0)
Czech Republic	89 (3.0)	2 (1.4)	5 (2.4)	0 (0.0)	3 (1.2)
England	100 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Hong Kong, SAR	86 (3.3)	3 (1.5)	4 (1.8)	3 (1.3)	5 (2.2)
Italy	64 (3.4)	19 (2.9)	7 (2.2)	3 (1.3)	6 (1.6)
Japan	92 (2.7)	5 (1.8)	0 (0.0)	0 (0.0)	3 (1.9)
Korea, Rep. of	75 (3.6)	14 (3.2)	6 (1.8)	5 (1.8)	1 (0.0)
Netherlands	99 (1.0)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)
Russian Federation	37 (4.9)	6 (2.0)	1 (0.0)	3 (1.5)	53 (4.8)
Singapore	98 (1.3)	2 (1.3)	0 (0.0)	0 (0.0)	0 (0.0)
States					
Connecticut	x x	x x	x x	x x	x x
Idaho	100 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Illinois	100 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Indiana	100 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Maryland		3 (3.2)	0 (0.0)	0 (0.0)	0 (0.0)
Massachusetts		6 (3.9)	0 (0.0)	0 (0.0)	0 (0.0)
Michigan		0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Missouri		0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
North Carolina		3 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)
Oregon		0 (0.0)	0 (0.0)	2 (2.0)	0 (0.0)
Pennsylvania		2 (0.3)	0 (0.3)	0 (0.0)	6 (5.2)
South Carolina		3 (2.6)	0 (0.0)	0 (0.0)	0 (0.0)
Texas		0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Districts and Consortia					
Academy School Dist. #20, CO		0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Chicago Public Schools, IL		x x	x x	x x	x x
Delaware Science Coalition, DE		3 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)
First in the World Consort., IL		0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Fremont/Lincoln/WestSide PS, NE		0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Guilford County, NC		0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Jersey City Public Schools, NJ		10 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)
Miami-Dade County PS, FL		x x	x x	x x	x x
Michigan Invitational Group, MI		0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Montgomery County, MD		x x	x x	x x	x x
Naperville Sch. Dist. #203, IL		0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Project SMART Consortium, OH		0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Rochester City Sch. Dist., NY		0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
SW Math/Sci. Collaborative, PA		0 (0.0)	1 (0.2)	0 (0.0)	0 (0.0)
International Avg. (All Countries)		6 (0.3)	3 (0.2)	6 (0.3)	25 (0.4)

Background data provided by schools.

1 Based on ratio of grade 8 enrollment to total computers for instructional use by grade 8 teachers and students.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates school response data available for 70-84% of students. An "s" indicates school response data available for 50-69% of students. An "x" indicates school response data available for <50% of students.

Percentage of Students by Level of Access			
Access to World Wide Web (with or without e-mail)	Access to E-mail Only	No Internet Access but Planning to Get Internet Access by 2001	No Access and No Immediate Plans to Obtain Access

Background data provided by schools.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates school response data available for 70-84% of students. An "s" indicates school response data available for 50-69% of students. An "x" indicates school response data available for <50% of students.

appendix A

Overview of TIMSS Benchmarking Procedures: Mathematics Achievement

A

History

timss 1999 represents the continuation of a long series of studies conducted by the International Association for the Evaluation of Educational Achievement (iea

extended responses with students showing their work or providing explanations for their answers. The remaining questions used a multiple-choice format. In scoring the tests, correct answers to most questions were worth one point. Consistent with the approach of allotting students longer response time for the constructed-response questions than for multiple-choice questions, however, responses to some of these questions (particularly those requiring extended responses) were evaluated for partial credit, with a fully correct answer being awarded two points (see later section on scoring). The total number of score points available for analysis thus somewhat exceeds the number of items.

Every effort was made to help ensure that the tests represented the curricula of the participating countries and that the items exhibited no bias towards or against particular countries. The final forms of the tests were endorsed by the nrcs of the participating countries.[3]

3 For a full discussion of the TIMSS 1999 test development effort, please see Garden, R.A. and Smith, T.A. (2000), "TIMSS Test Development" in M.O. Martin, K.D. Gregory, K.M. O'Connor, and S.E. Stemler (eds.), *TIMSS 1999 Benchmarking Technical Report*, Chestnut Hill, MA: Boston College.

Content Category	Percentage of Items	Total Number of Items	Number of Multiple-Choice Items	Number of Free-Response Items[1]	Number of Score Points[2]
Fractions and Number Sense					
Measurement					
Data Representation, Analysis and Probability					
Total					

Performance Category	Percentage of Items	Total Number of Items	Number of Multiple-Choice Items	Number of Free-Response Items[1]	Number of Score Points[2]
Knowing					
Using Routine Procedures					
Using Complex Procedures					
Investigating and Solving Problems					
Communicating and Reasoning					
Total					

1 Free-response items include both short-answer and extended-response types.

2 In scoring the tests, correct answers to most items were worth one point. However, responses to some free-response items were evaluated for partial credit with a fully correct answer awarded up to two points. Thus, the number of score points exceeds the number of items in the test.

Translation and Verification

The timss instruments were prepared in English and translated into 33 languages, with 10 of the 38 countries collecting data in two languages.

Within countries, timss used a two-stage sample design, in which the first stage involved selecting about 150 public and private schools in each country. Within each school, countries were to use random procedures to select one mathematics class at the eighth grade. All of the students in that class were to participate in the timss testing. This approach was designed to yield a representative sample of about 3,750 students per country. Typically, between 450 and 3,750 students

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

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

	International Desired Population		National Desired Population		
	Coverage	Notes on Coverage	School-Level Exclusions	Within-Sample Exclusions	Overall Exclusions
States					
Connecticut	100%		0%	5%	5%
Idaho	100%	Included private schools	0%	2%	2%
Illinois	100%		0%	4%	4%
Indiana	100%	Included private schools	0%	6%	6%
Maryland	100%		0%	6%	6%
Massachusetts	100%		0%	5%	5%
Michigan	100%	Included private schools	0%	2%	2%
Missouri	100%		0%	4%	4%
North Carolina	100%		0%	4%	4%
Oregon	100%		0%	5%	5%
Pennsylvania	100%	Included private schools	0%	6%	6%
South Carolina	100%		0%	2%	2%
Texas	100%		0%	4%	4%
Districts and Consortia					
Academy School Dist. #20, CO	100%		NA	2%	2%
Chicago Public Schools, IL	100%		NA	4%	4%
Delaware Science Coalition, DE	100%		NA	5%	5%
First in the World Consort., IL	100%		NA	2%	2%
Fremont/Lincoln/WestSide PS, NE	100%		NA	2%	2%
Guilford County, NC	100%		NA	10%	10%
Jersey City Public Schools, NJ	100%		NA	6%	6%
Miami-Dade County PS, FL	100%		NA	7%	7%
Michigan Invitational Group, MI	100%		NA	2%	2%
Montgomery County, MD	100%		NA	17%	17%
Naperville Sch. Dist. #203, IL	100%		NA	7%	7%
Project SMART Consortium, OH	100%		NA	2%	2%
Rochester City Sch. Dist., NY	100%		NA	1%	1%
SW Math/Sci. Collaborative, PA	100%	Included private schools	NA	4%	4%

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

	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
United States					
Australia					
Belgium (Flemish)					
Bulgaria					
Canada					
Chile					
Chinese Taipei					
Cyprus					
Czech Republic					
England					
Finland					
Hong Kong, SAR					
Hungary					
Indonesia					
Iran, Islamic Rep. of					
Israel					
Italy					
Japan					
Jordan					
Korea, Rep. of					
Latvia (LSS)					
Lithuania					

Number of Schools in Original Sample	Number of Eligible Schools in Original Sample	Number of

	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
United States	94%	9981	115	142			
Australia	90%	4600	96	53			
Belgium (Flemish)	97%	5387	12	0			
Bulgaria	96%	3461	63	0			
Canada	96%	9490	84				
Chile	96%	6283	119				
Chinese Taipei	99%	5889	30				
Cyprus	97%	3296	38				
Czech Republic	96%	3640	24				
England	90%	3400	27				
Finland	96%	3060	17				
Hong Kong, SAR	98%	5310	18				
Hungary	95%	3350	0				
Indonesia	97%	6162	106				
Iran, Islamic Rep. of	98%	5497	104				
Israel	94%	4670	29				
Italy	97%	3531	23				
Japan	95%	4996	15				
Jordan	99%	5300	130				
Korea, Rep. of	100%	6285	29				
Latvia (LSS)	93%	3128	16				
Lithuania	89%	2668	0				
Macedonia, Rep. of	98%	4096	0				
Malaysia	99%	5713	98				
Moldova	98%	3824	23				
Morocco	92%	5841	42				
Netherlands	95%	3099	12				
New Zealand	94%	3966	96				
Philippines	92%	7591	461				
Romania	98%	3514	36				
Russian Federation	97%	4557	48				
Singapore	98%	5100	37				
Slovak Republic	98%	3695	149				
Slovenia	95%	3287	0				
South Africa	93%	9071	256				
Thailand	99%	5831	59				
Tunisia	98%	5189	45				
Turkey	99%	7972	49				

	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
States							
Connecticut	94%	2190	6				
Idaho	95%	1968	17				
Illinois	96%	5144	30				
Indiana	95%	2175	9				
Maryland	94%	3877	21				
Massachusetts	95%	2538	18				
Michigan	96%	2811	7				
Missouri	94%	2147	27				
North Carolina	94%	3502	34				
Oregon	93%	2044	24				
Pennsylvania	95%	3463	18				
South Carolina	94%	2177	18				
Texas	93%	2189	18				
Districts and Consortia							
Academy School Dist. #20, CO	94%	1329	0				
Chicago Public Schools, IL	94%	1227	13				
Delaware Science Coalition, DE	92%	1389	16				
First in the World Consort., IL	96%	782	1				
Fremont/Lincoln/WestSide PS, NE	95%	1178	20				
Guilford County, NC	92%	1215	17				
Jersey City Public Schools, NJ	94%	1116	5				
Miami-Dade County PS, FL	91%	1356	23				
Michigan Invitational Group, MI	91%	994	0				
Montgomery County, MD		1481	13				
Naperville Sch. Dist. #203, IL		1343	9				
Project SMART Consortium, OH		1188	11				
Rochester City Sch. Dist., NY		1165	8				
SW Math/Sci. Collaborative, PA		1638	14				

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

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

	Before Replacement	After Replacement
States		
Connecticut		
Idaho		
Illinois		
Indiana		
Maryland		
Massachusetts		
Michigan		
Missouri		
North Carolina		
Oregon		
Pennsylvania		
South Carolina		
Texas		
Districts and Consortia		
Academy School Dist. #20, CO		
Chicago Public Schools, IL		
Delaware Science Coalition, DE		
First in the World Consort., IL		
Fremont/Lincoln/WestSide PS, NE		
Guilford County, NC		
Jersey City Public Schools, NJ		
Miami-Dade County PS, FL		

As a parallel quality control effort for the Benchmarking project, the International Study Center recruited and trained a team of 18 quality control observers, and sent them to observe the data collection activities of the Westat test administrators in a sample of about 10 percent of the schools in the study (98 schools in all).[8] In line with the experience internationally, the observers reported that the data collection was conducted successfully according to the prescribed procedures, and that no serious problems were encountered.

Scoring the Free-Response Items

Because about one-third of the written test time was devoted to free-response items, timss needed to develop procedures for reliably evaluating student responses within and across countries. Scoring used two-digit codes with rubrics specific to each item. The first digit designates the correctness level of the response. The second digit, combined with the first, represents a diagnostic code identifying specific types of approaches, strategies, or common errors and misconceptions. Although not used in this report, analyses of responses based on the second digit should provide insight into ways to help students better understand mathematics concepts and problem-solving approaches.

To ensure reliable scoring procedures based on the timss rubrics, the International Study Center prepared detailed guides containing the rubrics and explanations of how to implement them, together with example student responses for the various rubric categories. These guides, along with training packets containing extensive examples of student responses for practice in applying the rubrics, were used as a basis for intensive training in scoring the free-response items. The training sessions were designed to help representatives of national centers who would then be responsible for training personnel in their countries to apply the two-digit codes reliably. In the United States, the

free-response items in the mathematics test for 37 of the 38 countries. A high percentage of exact agreement was observed, with an overall average of 99 percent across the 37 countries. The timss data from the reliability studies indicate that scoring procedures were robust for the mathematics items, especially for the correctness score used for the analyses in this

A dash (–) indicates data are not available.

Countries	Reliability Coefficient[1]
United States	0.90
Australia	0.90
Belgium (Flemish)	0.89
Bulgaria	0.90
Canada	0.88
Chile	0.83
Chinese Taipei	0.94
Cyprus	0.87
Czech Republic	0.90
England	0.90
Finland	0.86
Hong Kong, SAR	0.89
Hungary	0.91
Indonesia	0.87
Iran, Islamic Rep.	0.83
Israel	0.90
Italy	0.89
Japan	0.91
Jordan	0.89
Korea, Rep. of	0.91
Latvia (LSS)	0.89
Lithuania	0.89
Macedonia, Rep. of	0.88
Malaysia	0.90
Moldova	0.88
Morocco	0.69
Netherlands	0.89
New Zealand	0.91
Philippines	0.76
Romania	0.90
Russian Federation	0.91
Singapore	0.90
Slovak Republic	0.89
Slovenia	0.90
South Africa	0.77
Thailand	0.87
Tunisia	0.79
Turkey	0.86
International Median	0.89

States	Reliability Coefficient[1]
Connecticut	0.90
Idaho	0.89
Illinois	0.89
Indiana	0.89
Maryland	0.91
Massachusetts	0.90
Michigan	0.90
Missouri	0.88
North Carolina	0.90
Oregon	0.90
Pennsylvania	0.90
South Carolina	0.91
Texas	0.91

Districts and Consortia	
Academy School Dist. #20, CO	0.89
Chicago Public Schools, IL	0.84
Delaware Science Coalition, DE	0.89
First in the World Consort., IL	0.91
Fremont/Lincoln/WestSide PS, NE	0.90
Guilford County, NC	0.90
Jersey City Public Schools, NJ	0.89
Miami-Dade County PS, FL	0.86
Michigan Invitational Group, MI	0.87
Montgomery County, MD	0.90
Naperville Sch. Dist. #203, IL	0.88
Project SMART Consortium, OH	0.89
Rochester City Sch. Dist., NY	0.86
SW Math/Sci. Collaborative, PA	0.89

1 For each country and jurisdiction, the reliability coefficient is the median KR-20 reliability across the eight test booklets.

lation means and proportions in a manner that reflects the uncertainty associated with the sample estimates. An estimated sample statistic plus or minus two standard errors represents a 95 percent confidence interval for the corresponding population result.

Making Multiple Comparisons

This report makes extensive use of statistical hypothesis-testing to provide a basis for evaluating the significance of differences in percentages and in average achievement scores. Each separate test follows the usual convention of holding to 0.05 the probability that reported differences could be due to sampling variability alone. However, in exhibits where statistical significance tests are reported, the results of many tests are reported simultaneously, usually at least one for each country and Benchmarking participant in the exhibit. The significance tests in these exhibits are based on a Bonferroni procedure for multiple comparisons that hold to 0.05 the probability of erroneously declaring a statistic (mean or percentage) for one entity to be different from that for another entity. In the multiple comparison charts (Exhibit 1.2 and those in Appendix B), the Bonferroni procedure adjusts for the number of entities in the chart, minus one. In exhibits where a country or Benchmarking participant statistic is compared to the international average, the adjustment is for the number of entities.[12]

Setting International Benchmarks of Student Achievement

International benchmarks of student achievement were computed at each grade level for both mathematics and science. The benchmarks are points in the weighted international distribution of achievement scores that separate the 10 percent of students located on top of the distribution, the top 25 percent of students, the top 50 percent, and the bottom 25 percent. The percentage of students in each country and Benchmarking jurisdiction meeting or exceeding the international benchmarks is reported. The benchmarks correspond to the 90th, 75th, 50th, and 25th percentiles of the international distribution of achievement. When computing these percentiles, each country contributed as many students to the distribution as there were students in the target population in the country. That is, each country's contribution to setting the international benchmarks was proportional to the estimated population enrolled at the eighth grade.

In order to interpret the timss scale scores and analyze achievement at the international benchmarks, timss conducted a scale anchoring analysis to describe achievement of students at those four points on the scale.

points on a scale in terms of what they know and can do. It involves a statistical component, in which items that discriminate between successive points on the scale are identified, and a judgmental component in which subject-matter experts examine the items and generalize to students' knowledge and understandings.[13]

Mathematics Curriculum Questionnaire

In an effort to collect information about the content of the intended curriculum in mathematics, timss asked National Research Coordinators and Coordinators from the Benchmarking jurisdictions to complete a questionnaire about the structure, organization, and content coverage of their curricula. Coordinators reviewed 56 mathematics topics and reported the percentage of their eighth-grade students for which each topic was intended in their curriculum. Although most topic descriptions were used without modification, there were occasions when Coordinators found it necessary to expand on or qualify the topic description to describe their situation accurately. The country-specific adaptations to the mathematics curriculum questionnaire are presented in Exhibit A.9. No adaptations to the list of topics were necessary for the U.S. national version, nor were any adaptations made by any Benchmarking participants.

[13] The scale anchoring procedure is described fully in Gregory, K., and Mullis, I. (2000), "Describing International Benchmarks of Student Achievement" in M.O. Martin, K.D. Gregory, K.M. O'Connor, and S.E. Stemler (eds.), *TIMSS 1999 Benchmarking Technical Report*, Chestnut Hill, MA: Boston College. An application of the procedure to the 1995 TIMSS data may be found in Kelly, D.L., Mullis, I.V.S., and Martin, M.O. (2000), *Profiles of Student Achievement in Mathematics at the TIMSS International Benchmarks: U.S. Performance and Standards in an International Context*, Chestnut Hill, MA: Boston College.

	Topic	Response	Comments
Bulgaria	Geometry: Congruence and similarity	All or almost all of the	

appendix B

Multiple Comparisons of Average

Singapore
Hong Kong, SAR
Chinese Taipei
Korea, Rep. of
Japan
Naperville Sch. Dist. #203, IL
First in the World Consort., IL
Belgium (Flemish)
Netherlands
Montgomery County, MD
Michigan Invitational Group, MI
Academy School Dist. #20, CO
Canada
Malaysia
Finland
Project SMART Consortium, OH
Slovenia
Texas
Indiana
Hungary
Slovak Republic
Michigan
SW Math/Sci. Collaborative, PA
Connecticut
Massachusetts
Oregon
Australia
Pennsylvania

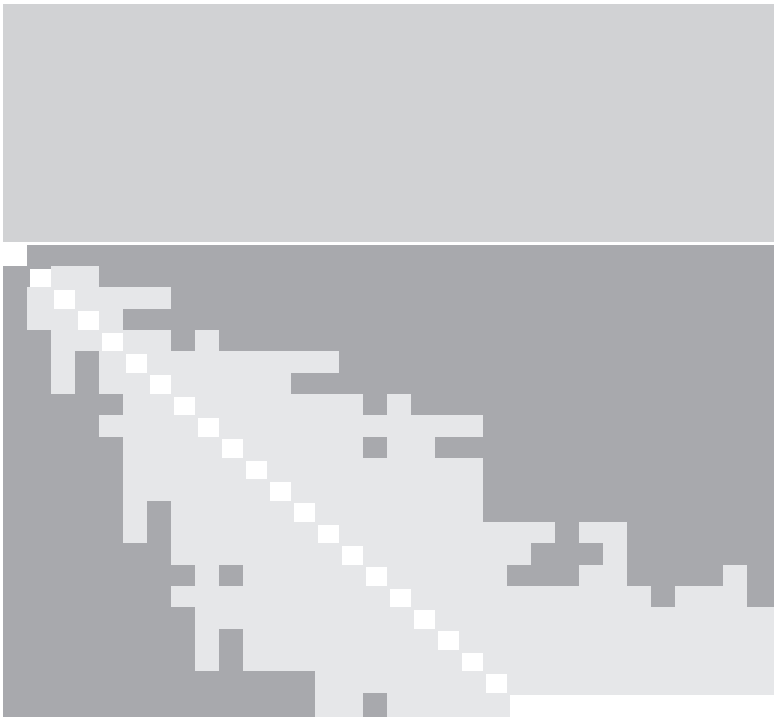
▲ Average achievement significantly higher than comparison participant

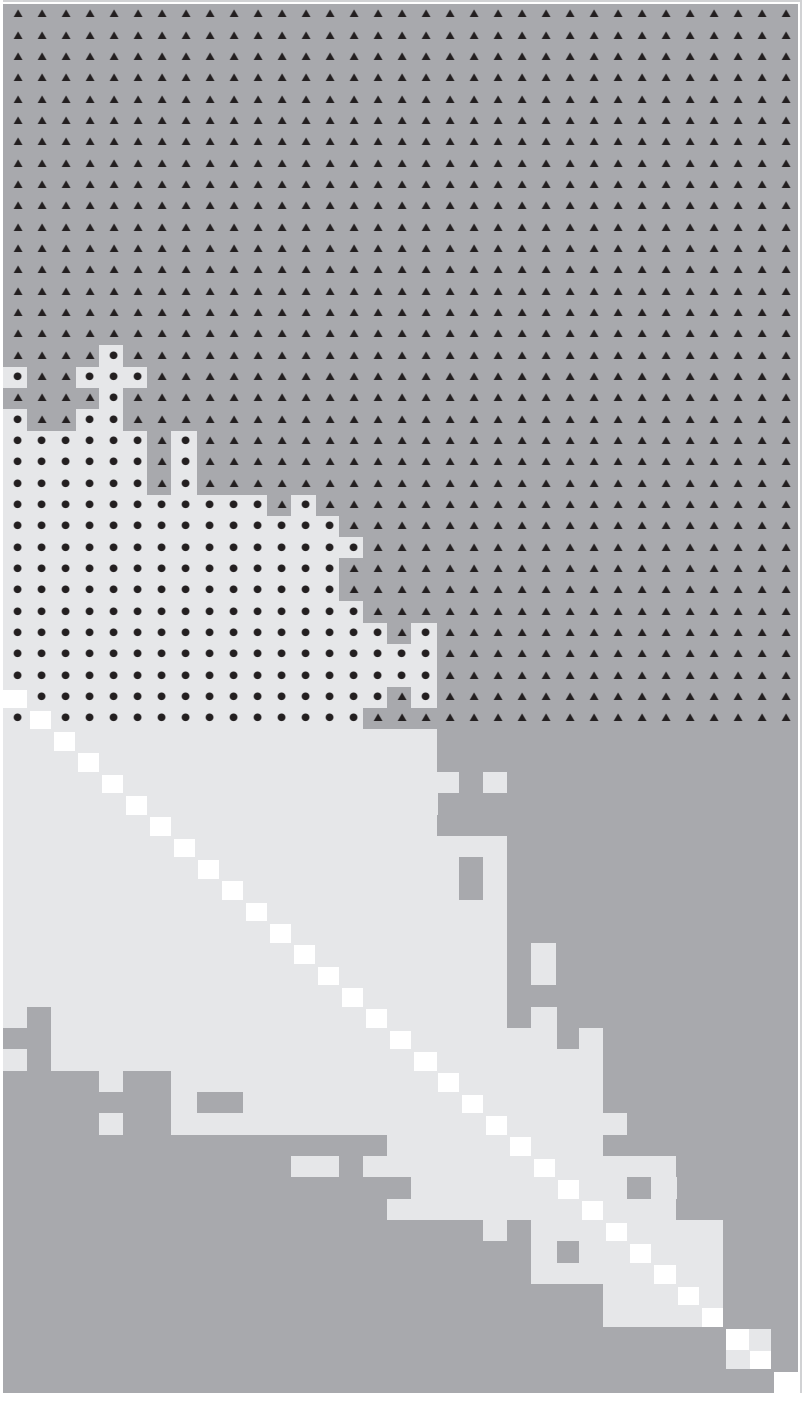
● No statistically significant difference from comparison participant

▼ Average achievement significantly lower than comparison participant

Significance tests adjusted for multiple comparisons

Instructions: Read across the row for a participant to compare performance with the participants listed along the top of the chart. The symbols indicate whether the average achievement of the participant in the row is significantly lower than that of the comparison participant, significantly higher than that of the comparison participant, or if there is no statistically significant difference between the average achievement of the two participants.



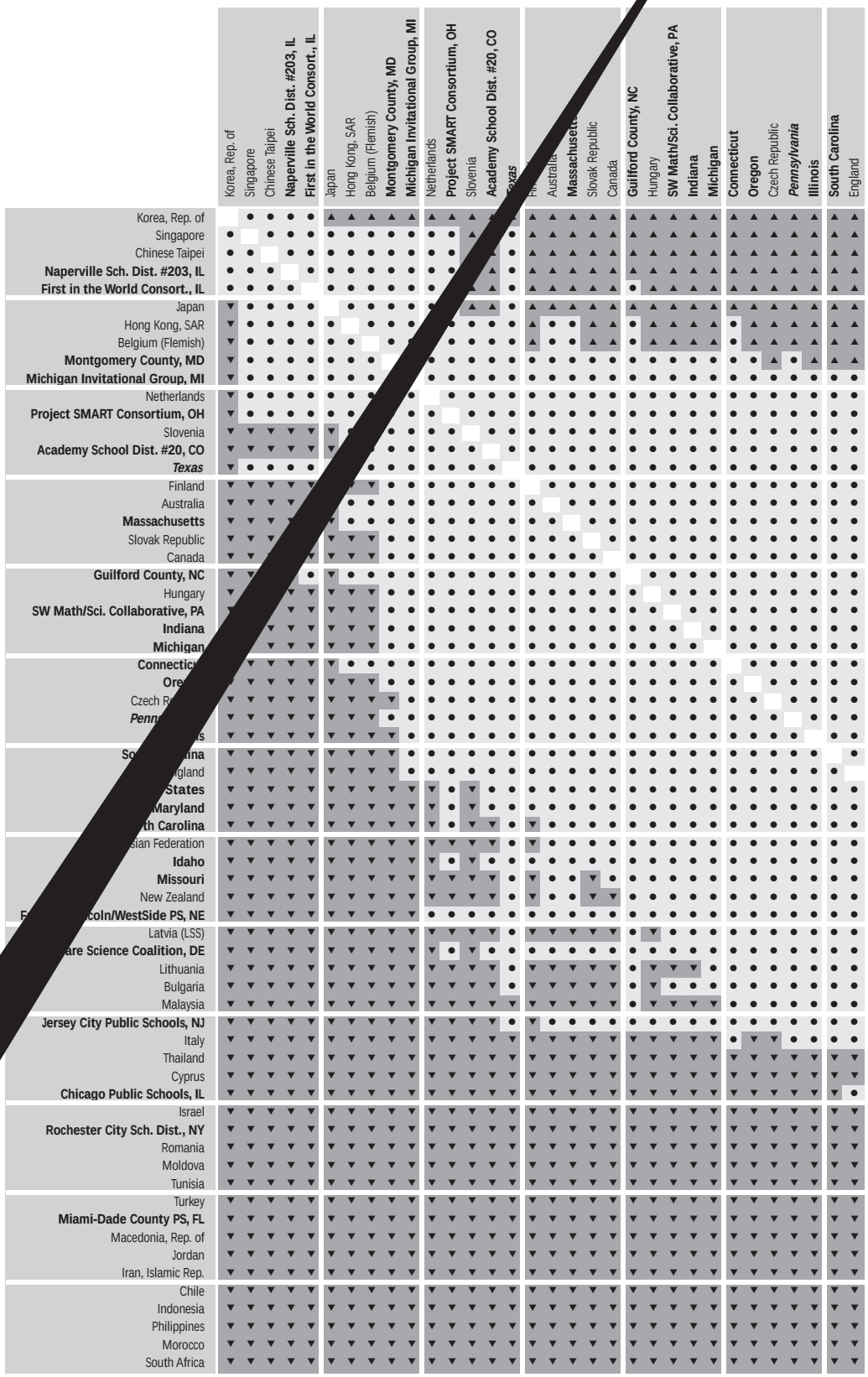


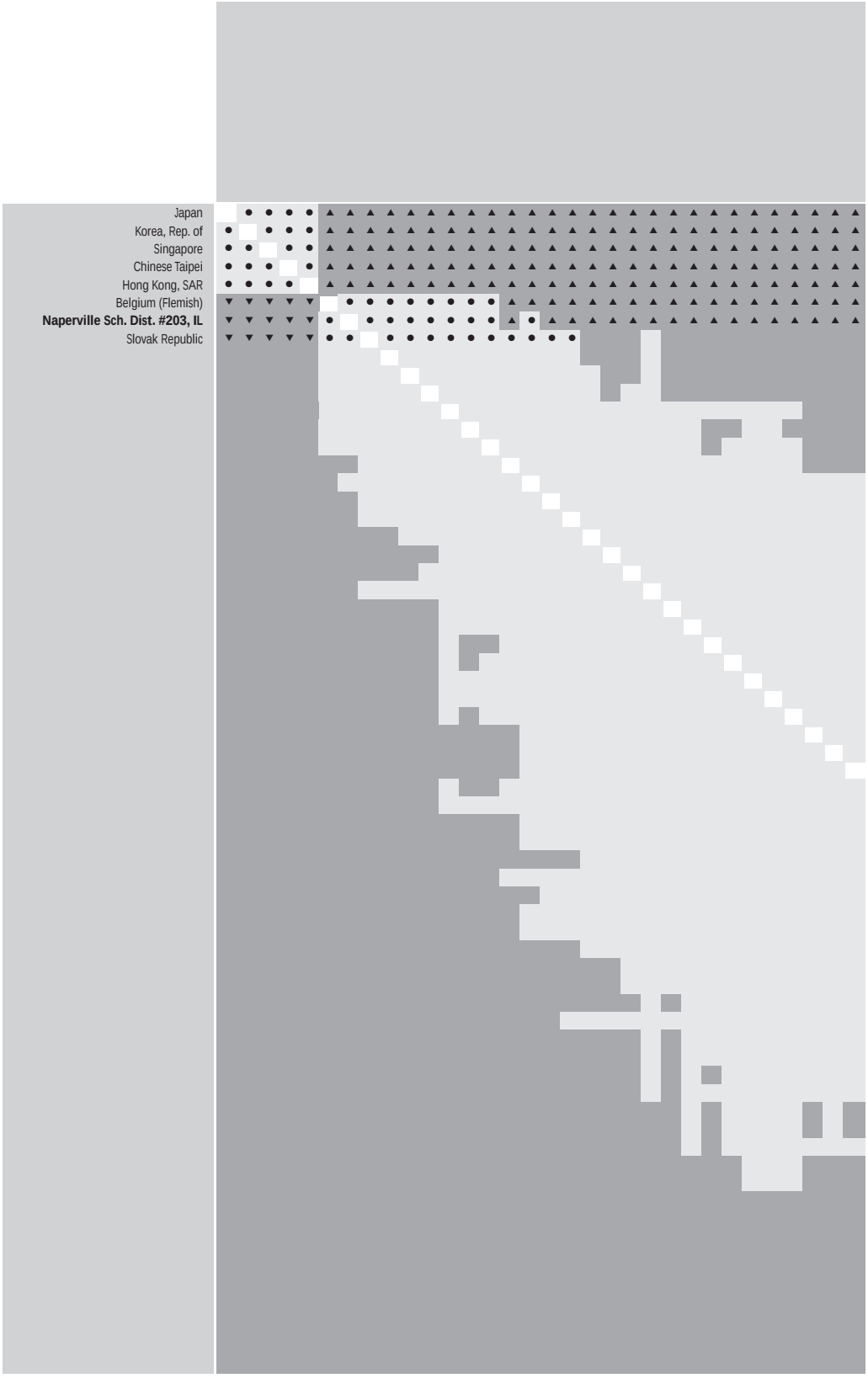
Singapore
Korea, Rep. of
Hong Kong, SAR
Chinese Taipei
Japan
Belgium (Flemish)
Naperville Sch. Dist. #203, IL
Hungary
Netherlands
Slovak Republic
First in the World Consort., IL
Czech Republic
Australia
Russian Federation
Slovenia
Canada
Finland
Michigan Invitational Group, MI
Montgomery County, MD
Malaysia
England
Academy School Dist. #20, CO
Latvia (LSS)
Italy
Oregon
Project SMART Consortium, OH
Bulgaria
New Zealand
SW Math/Sci. Collaborative, PA
Michigan
Connecticut
Massachusetts
Illinois

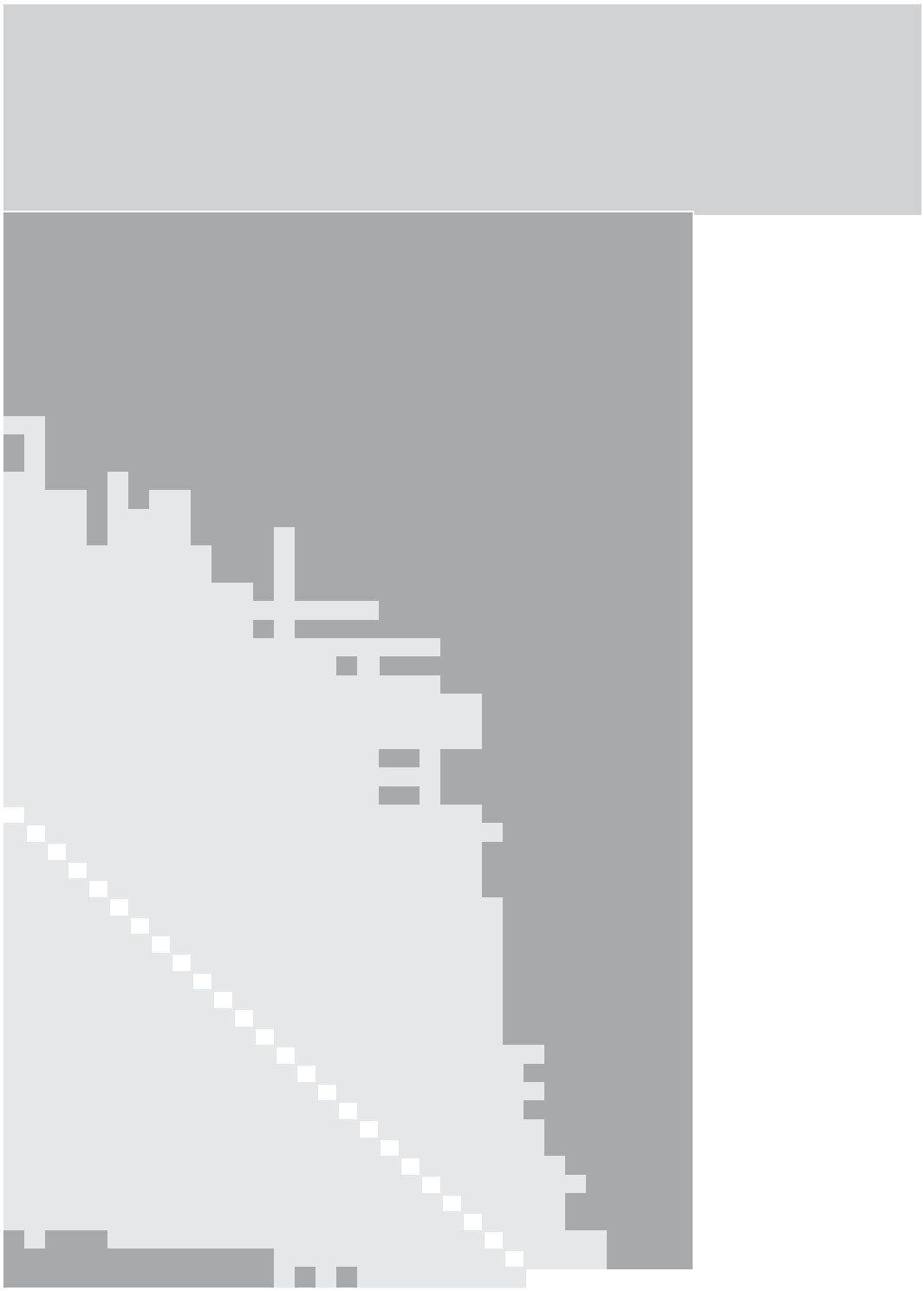
Exhibit B.3 Multiple Comparisons of Average Achievement in Data Representation, Analysis, and Probability

8th Grade Mathematics

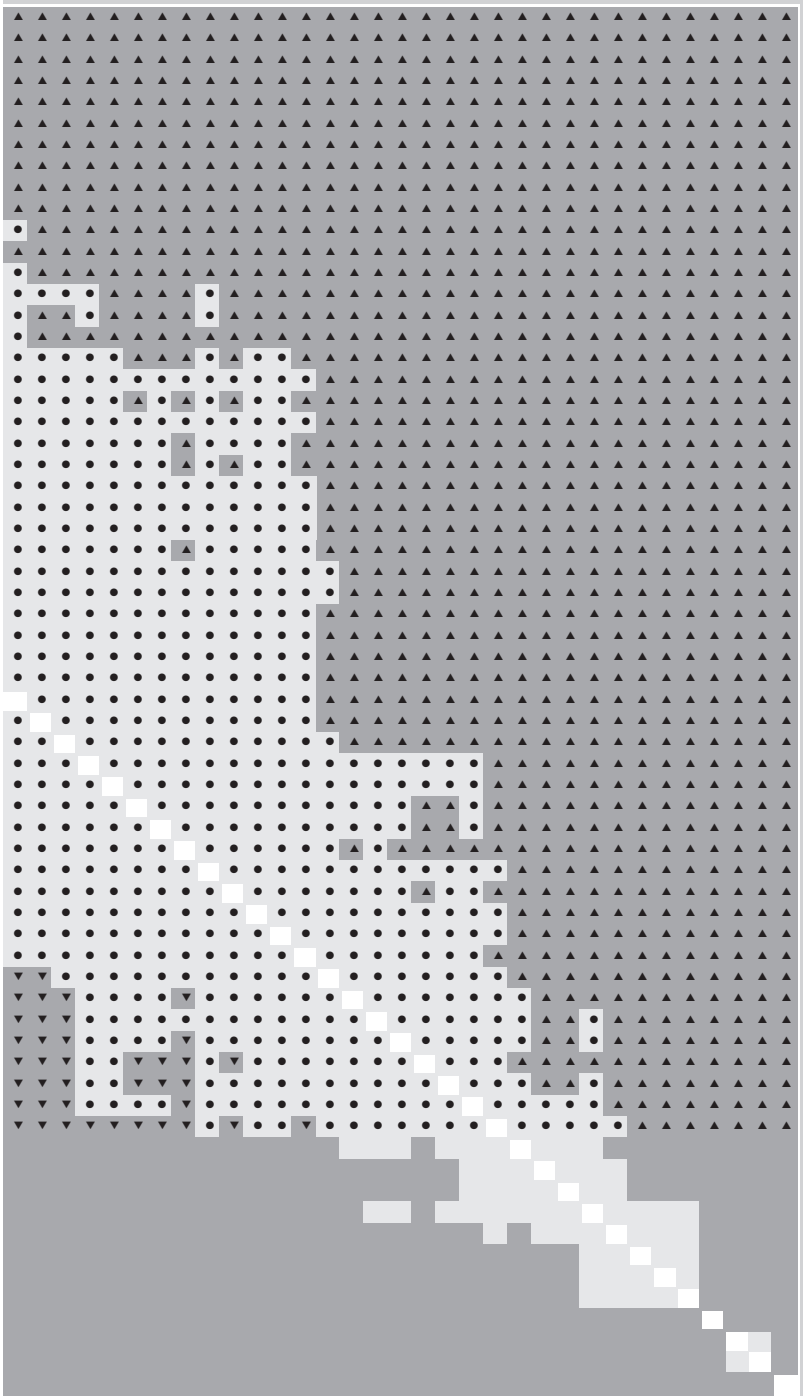
Instructions: Read across the row for a participant to compare performance with the participants listed along the top of the chart. The symbols indicate whether the average achievement of the participant in the row is significantly lower than that of the comparison participant, significantly higher than that of the comparison participant, or if there is no statistically significant difference between the average achievement of the two participants.




Japan
Korea, Rep. of
Singapore
Chinese Taipei
Hong Kong, SAR
Belgium (Flemish)
Naperville Sch. Dist. #203, IL
Slovak Republic



Instructions



Chinese Taipei
Korea, Rep. of
Singapore
Japan
Hong Kong, SAR
Naperville Sch. Dist. #203, IL
First in the World Consort., IL
Belgium (Flemish)
Montgomery County, MD
Hungary
Michigan Invitational Group, MI
Academy School Dist. #20, CO
Russian Federation
Slovak Republic
Slovenia
Canada
Guilford County, NC
Netherlands
Massachusetts
Project SMART Consortium, OH
Michigan
Australia
SW Math/Sci. Collaborative, PA
Oregon
Indiana
Czech Republic
Texas
Connecticut
Illinois
Bulgaria
South Carolina
Pennsylvania
North Carolina
United States
Malaysia
Idaho
Maryland
Latvia (LSS)
England
Finland
Delaware Science Coalition, DE
New Zealand
Jersey City Public Schools, NJ
Fremont/Lincoln/WestSide PS, NE
Missouri
Lithuania
Italy
Romania
Israel
Cyprus
Moldova
Chicago Public Schools, IL
Rochester City Sch. Dist., NY

appendix C

Percentiles and Standard Deviations of Mathematics Achievement

( ) Standard errors appear in parentheses.

	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
States					
Connecticut					
Idaho					
Illinois					
Indiana					
Maryland					
Massachusetts					
Michigan					
Missouri					
North Carolina					
Oregon					
Pennsylvania					
South Carolina					
Texas					
Districts and Consortia					
Academy School Dist. #20, CO					
Chicago Public Schools, IL					
Delaware Science Coalition, DE					
First in the World Consort., IL					
Fremont/Lincoln/WestSide PS, NE					
Guilford County, NC					
Jersey City Public Schools, NJ					
Miami-Dade County PS, FL					
Michigan Invitational Group, MI					

	Overall		Girls		Boys	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
United States	502 (4.0)	88 (2.4)	498 (3.9)	84 (2.1)	505 (4.8)	91 (3.0)
Australia	525 (4.8)	80 (2.9)	524 (5.7)	77 (3.8)	526 (5.7)	83 (3.3)
Belgium (Flemish)	558 (3.3)	77 (2.8)	560 (7.2)	74 (4.8)	556 (8.3)	79 (5.6)
Bulgaria	511 (5.8)	86 (3.8)	510 (5.9)	84 (3.5)	511 (6.9)	88 (4.7)
Canada	531 (2.5)	73 (1.7)	529 (2.5)	72 (1.9)	533 (3.2)	74 (1.7)
Chile	392 (4.4)	85 (3.5)	388 (4.3)	82 (2.9)	397 (5.8)	89 (4.2)
Chinese Taipei	585 (4.0)	104 (1.8)	583 (3.9)	98 (2.4)	587 (5.3)	110 (2.1)
Cyprus	476 (1.8)	82 (1.7)	479 (2.1)	77 (2.2)	474 (2.7)	85 (1.9)
Czech Republic	520 (4.2)	79 (2.4)	512 (4.0)	78 (2.6)	528 (5.8)	80 (2.9)
England	496 (4.1)	83 (2.2)	487 (5.4)	79 (3.5)	505 (5.0)	86 (2.8)
Finland	520 (2.7)	65 (1.3)	519 (3.0)	63 (1.7)	522 (3.5)	68 (1.7)
Hong Kong, SAR	582 (4.3)	73 (3.0)	583 (4.7)	69 (2.8)	581 (5.9)	77 (4.4)
Hungary	532 (3.7)	85 (2.0)	529 (4.0)	82 (2.3)	535 (4.3)	88 (2.6)
Indonesia	403 (4.9)	101 (2.9)	401 (5.4)	102 (3.4)	405 (5.0)	101 (3.1)
Iran, Islamic Rep.	422 (3.4)	83 (2.3)	408 (4.2)	81 (2.5)	432 (4.8)	83 (2.5)
Israel	466 (3.9)	96 (2.6)	459 (4.2)	90 (2.4)	474 (4.8)	100 (3.8)
Italy	479 (3.8)	87 (2.3)	475 (4.5)	85 (2.8)	484 (4.3)	88 (2.8)
Japan	579 (1.7)	80 (1.1)	575 (2.4)	76 (2.1)	582 (2.3)	82 (1.3)
Jordan	428 (3.6)	103 (1.6)	431 (4.7)	96 (2.3)	425 (5.9)	109 (2.2)
Korea, Rep. of	587 (2.0)	79 (1.0)	585 (3.1)	79 (1.3)	590 (2.2)	80 (1.6)
Latvia (LSS)	505 (3.4)	78 (2.0)	502 (3.8)	75 (2.6)	508 (4.4)	81 (2.4)
Lithuania	482 (4.3)	78 (2.6)	480 (4.7)	76 (3.2)	483 (4.8)	80 (3.2)
Macedonia, Rep. of	447 (4.2)	93 (2.5)	446 (5.3)	92 (3.0)	447 (4.3)	94 (2.8)
Malaysia	519 (4.4)	81 (2.0)	521 (4.7)	79 (2.2)	517 (6.0)	83 (2.6)
Moldova	469 (3.9)	85 (2.1)	468 (4.1)	83 (2.6)	471 (4.7)	87 (2.6)
Morocco	337 (2.6)	91 (2.0)	326 (5.3)	90 (3.5)	344 (4.1)	91 (2.0)
Netherlands	540 (7.1)	73 (4.2)	538 (7.6)	73 (4.4)	542 (7.0)	74 (4.3)
New Zealand	491 (5.2)	89 (2.3)	495 (5.5)	87 (2.9)	487 (7.6)	91 (3.0)
Philippines	345 (6.0)	97 (2.8)	352 (6.9)	96 (4.1)	337 (6.5)	98 (2.8)
Romania	472 (5.8)	93 (3.5)	475 (6.3)	90 (3.8)	470 (6.2)	96 (3.8)
Russian Federation	526 (5.9)	86 (3.0)	526 (6.0)	83 (3.0)	526 (6.4)	90 (3.8)
Singapore	604 (6.3)	79 (2.9)	603 (6.1)	76 (3.0)	606 (7.5)	82 (3.3)
Slovak Republic	534 (4.0)	75 (1.6)	532 (4.2)	72 (1.9)	536 (4.5)	79 (2.3)
Slovenia	530 (2.8)	83 (2.0)	529 (3.0)	79 (1.9)	531 (3.6)	86 (2.8)
South Africa	275 (6.8)	109 (4.7)	267 (7.5)	110 (5.1)	283 (7.3)	108 (4.7)
Thailand	467 (5.1)	85 (2.5)	469 (5.7)	84 (2.8)	465 (5.5)	86 (2.9)
Tunisia	448 (2.4)	64 (0.9)	436 (2.4)	64 (1.2)	460 (2.9)	61 (1.3)
Turkey	429 (4.3)	86 (2.0)	428 (4.7)	83 (2.1)	429 (4.4)	87 (2.4)

( ) Standard errors appear in parentheses.

	Overall		Girls		Boys	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
States						
Connecticut						
Idaho						
Illinois						
Indiana						
Maryland						
Massachusetts						
Michigan						
Missouri						
North Carolina						
Oregon						
Pennsylvania						
South Carolina						
Texas						
Districts and Consortia						
Academy School Dist. #20, CO						
Chicago Public Schools, IL						
Delaware Science Coalition, DE						
First in the World Consort., IL						
Fremont/Lincoln/WestSide PS, NE						
Guilford County, NC						
Jersey City Public Schools, NJ						
Miami-Dade County PS, FL						
Michigan Invitational Group, MI						
Montgomery County, MD						
Naperville Sch. Dist. #203, IL						
Project SMART Consortium, OH						
Rochester City Sch. Dist., NY						
SW Math/Sci. Collaborative, PA						

appendix D

Descriptions of Mathematics Items at Each Benchmark

D

Lower Quarter Benchmark Items

Fractions and Number Sense

H09 Rounds to estimate the sum of two three-digit numbers.

R07 Subtracts a three-decimal-place number from another with multiple regrouping.

R13 Subtracts a four-digit number from another involving zeroes.

Data Representation, Analysis, and Probability

A06 Calculates and compares the averages of two sets of data.

P16 Reads a thermometer and locates the reading in a table.

Algebra

P09 Selects an expression in exponential notation for repeated multiplication.

Median Benchmark Items

Fractions and Number Sense

B08 Solves a word problem by finding the missing term in a proportion.

C06 Determines which is the most unreasonable estimate for two 3-digit numbers.

D12 Estimates the value, to one decimal place, of a point on a number line marked at whole number intervals.

E04 Arranges four given digits in descending and ascending order and finds the difference between those two numbers.

H08 Selects a figure with shaded parts that represents a familiar fraction.

I05 Solves a word problem involving subtraction of a two-place decimal number from another.

K01 Identifies a circular model of a fraction that best approximates a given rectangular model of the same fraction.

Upper Quarter Benchmark Items

Fractions and Number Sense

A01 Finds 4/5 of a region divided into 10 equal parts.

A04 Solvsca6nse S915uSk5St2equs0 Tc2p5 35eo 94 i1 c intod Nu13t1sk lte intoc792 reW nB.equa

P14 Estimates the product of two whole numbers in a word problem.

Q05 Selects the statement that describes the effect of adding the same amount to both terms of a ratio.

Q06 Estimates the product of a multiple of 1000 and a two-digit number in a word problem involving knowledge of units of time.

Q09 Multiplies and adds fractions with different denominators in the correct order.

R15 Solves a multi-step word problem that involves dividing a quantity in a given ratio.

T04 Solves a word problem that involves multiplying a decimal in thousandth by a multiple of a hundred.

V01 Provides an example of a measure that would round to a given value.

V03 Determines the ratio of part to total in a word problem.

Measurement

A03 Given a length rounded to the nearest centimeter, identifies what the actual length could have been in centimeters to one decimal place.

C01 Compares volume by visualizing and counting cubes.

I07 Finds the area between two rectangles when one is inside the other and their sides are parallel.

M01 Reads the value indicated by an unlabeled tick mark on a circular scale.

N15 Identifies an angle of a given size in a diagram.

O06 Given the start time, and the duration of an event expressed as a fraction of an hour, determines the end time.

S02A Finds a fraction of a given area of an irregular figure composed of squares of equal sides.

T03 Finds the area of a rectangle contained in a parallelogram of given dimensions.

Top 10% Benchmark Items

Fractions and Number Sense

C04 Identifies the pair of numbers satisfying given conditions involving ordering integers, decimals, and common fractions.

F07 Solves a time-distance-rate problem that involves division of decimals and conversion of minutes to seconds.

J14 Identifies the correct position for the decimal point in the quotient in a division of a decimal written in hundredths by a decimal written in thousandths.

M06 Given the total number and the ratio of the two parts, finds the value of one part.

M08 Multiplies a two-place decimal by a three-place decimal.

N16 Solves multi-step problem with fractions requiring analysis of the verbal relations described.

N17 Solves a word problem involving multiplication of two-digit one-place decimals and subtraction of decimals.

O02 Finds the percent change given the original and the new quantities.

P15 Solves a word problem involving both addition and subtraction of familiar fractions.

P17 Writes a decimal expressed in hundredths as a fraction in lowest terms.

Q08 Orders a set of decimals of up to three decimal places.

R08 In a word problem, finds an average by dividing a decimal by a multiple of 100.

R14 Solves a two-step problem involving multiplication of a whole number by a fraction.

T02A In a multi-step word problem, finds how many of each of two groups of different sizes are required to produce a given number.

Measurement

E06 Identifies the length of a rectangle given its perimeter and width.

F10 Recognizes that precision of measurement is related to the size of the unit of measurement.

I03 Applies knowledge of number of milliliters in a liter to solve a word problem.

J10 Finds the area between two rectangles when one is inside the other and their sides are parallel.

K05 Finds the perimeter of a square given that its area is a square number less than 150.

P12 Estimates the length of a curved piece of string adjacent to a ruler.

Q03 From a set of times expressed variously in days, hours, minutes, and seconds, determines which is least.

S02B Finds the length of a side of a square, given that its area is a square number.

Top 10% Benchmark Items continued

Geometry continued

M05 Identifies the image of a triangle under a rotation about a point in the plane.

N12 Locates a point on a number line given its distance from two given points.

P10 Uses properties of similar triangles to find the length of a corresponding side.

Q10 Solves a problem involving measures of overlapping angles.

Algebra

K04 Solves a linear inequality involving a fraction.

L15 Uses proportion to find missing values in a table.

R10 Recognizes properties of operations on real numbers represented in symbolic form.

S01B Knowing the first five terms of a sequence growing in one dimension, finds the seventh term.

T01 Solves a multi-step word problem in which there are two unknowns and displays the method of solution.

V04C Given the initial terms in a sequence and, for example, the 50th term of that sequence, generalizes to find the next term.

Items Above the Top 10% Benchmark

Fractions and Number Sense

S03 Solves a word problem involving multiplication and subtraction

appendix E

Acknowledgments

E

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