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.[1] To collect data about the implemented curriculum, the mathematics teachers of the students tested in TIMSS 1999 completed questionnaires about whether students had been taught the various mathematics topics covered in the test.

1 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.

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 different levels of authority. Some systems are highly centralized, with the ministry of education (or highest authority in the system) being exclusively responsible for the major decisions governing the direction of education. In others, such decisions are made regionally or locally. Each approach has its strengths and weaknesses. Centralized decision making can add coherence and uniformity in curriculum coverage, but may constrain a school or teacher's flexibility in tailoring instruction to the needs of students.

Exhibit 5.1 presents information for each TIMSS 1999 country about the highest level of authority responsible for making curricular decisions and gives the curriculum's current status. The data reveal that 35 of the 38 countries reported that the specifications for students' curricular goals were developed as national curricula. Australia determined curricula at the state level, with local input; the United States did so at both the state and local (district and school) levels, with variability across states; and Canada did so at the provincial level.

In recent decades, it has become common for intended curricula to be updated regularly. At the time of the TIMSS 1999 testing, the official mathematics curricula in 29 countries had been in place for less than a decade, and more than half of them were in revision. Of the eight countries with a mathematics curriculum of more than 10 years' standing, five were being revised. In Australia, Canada, and the United States, curriculum change is made at the state, provincial, or local level, and some mathematics curricula were in revision at the time of testing. The curricula in these three countries were relatively recent, having been developed within the 10 years preceding the study.

The development and implementation of academic content standards and subject-specific curriculum frameworks has been a central focus of educational change in the United States at both the state and local level. There has been concerted effort across the United States in writing and revising academic standards that has very much included attention to mathematics. 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] 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.[3]

In all 13 states that participated in TIMSS 1999 Benchmarking, curriculum frameworks or content standards in mathematics were published between 1995 and 2000 (see Exhibit 5.2). Four states detailed the standards for every grade including the eighth grade, seven states detailed them by a cluster or pair of grades that included the eighth grade, and two states reported the eighth grade as a benchmark grade at which certain standards should be met. Most states provided standards documents to guide districts and schools in developing their own curriculum, while some states, such as North Carolina, developed a statewide curriculum for all schools to use.

Exhibit 5.3 presents information about the curriculum of participating districts and consortia. Of the eight districts that participated, one reported that it uses the statewide curriculum in all schools (Guilford County); five had a district-wide curriculum that supported the state-developed frameworks or standards (the Jersey City Public Schools, the Miami-Dade County Public Schools, Montgomery County, the Naperville School District, and the Rochester City School District); and two had a curriculum developed at the school level (the Academy School District and the Chicago Public Schools), with Chicago also offering an optional structured curriculum district-wide. Each participating consortium indicated that all or most of its districts developed their own curriculum at the district level.

2 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.

3 Raimi, R.A. (2000), "The State of State Standards in Mathematics" in C.E. Finn and M.J. Petrilli (eds.), *The State of State Standards*, Washington, DC: Thomas B. Fordham Foundation; Glidden, H. (1999), *Making Standards Matter 1999*, Washington, DC: American Federation of Teachers.

	National or Regional Curriculum	Year Curriculum Introduced	Status of Curriculum
United States [1]	Regional & Local	1994-1999	As of 1999, 49 of 50 states completed standards
Australia	Regional & Local	1995-1998	In revision (2 states); not being revised (3 states); no curriculum statement (3 states)
Belgium (Flemish)	National	1997	As introduced
Bulgaria	National	1997	As introduced
Canada	Regional	1997-1998 (most provinces)	As introduced
Chile	National	1980	In revision
Chinese Taipei	National	1997	In revision
Cyprus	National	1987	In revision
Czech Republic	National	1996	In revision
England	National	1995	In revision, same structure with minor revisions (to be implemented 2000/01)
Finland	National	1994	As introduced
Hong Kong, SAR	National	1987	In revision
Hungary	National	1986	In revision
Indonesia	National	1994	In revision
Iran, Islamic Rep.	National	1985	As introduced
Israel	National	1990	As introduced
Italy	National	1979	As introduced
Japan	National	1993	As introduced
Jordan	National	1993-1994	In revision
Korea, Rep. of	National	1995	As introduced
Latvia (LSS)	National	1992	In revision
Lithuania	National	1997	In revision
Macedonia, Rep. of	National	1979 (adaptations in 1995)	As introduced
Malaysia	National	1990	In revision
Moldova	National	1991	In revision
Morocco	National	1991	In revision
Netherlands	National	1993	As introduced
New Zealand	National	1993	As introduced
Philippines	National	1998	In revision
Romania	National	1993	In revision
Russian Federation	National	1997	In revision
Singapore	National	1993	In revision
Slovak Republic	National	–	–
Slovenia	National	1983	In revision
South Africa	National	1996	In revision
Thailand	National	1990	In revision
Tunisia	National	1997	As introduced
Turkey	National	1991	In revision

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

Background data provided by National Research Coordinators.

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.

A dash (–) indicates data are not available.

Exhibit 5.2 States' Curriculum Frameworks/Content Standards

8th Grade Mathematics

	Curriculum Framework/Content Standards and Year[1]	Grades/Clusters Detailed in Framework/Standards
Connecticut	Connecticut's K-12 Mathematics Curriculum Framework (1998)	Grade clusters: K-4, 5-8, 9-12
Idaho	Skills-Based Scope and Sequence Guides K-6 (1996); Achievement Standards K-8 (In draft); Achievement Standards 9-12 (1999)	Every grade: K-6; Grade clusters: 7-8, 9-12
Illinois	Illinois Learning Standards for Mathematics (1997)	Grade clusters: Early Elementary, Late Elementary, Middle/Junior High School, Early High School, Late High School
Indiana	Indiana Mathematics Proficiency Guide (1997); revised Indiana Academic Standards for Mathematics (2000)	Every grade K-8, individual courses in high school
Maryland	Learning Outcomes (1990); Content Standards (2000)	Grade clusters: K-3, 4-5, 6-8, 9-12
Massachusetts	Massachusetts Mathematics Curriculum Frameworks (1996; revised 2000)	Grade clusters: pK-4, 5-8, 9-10, 11-12; revised pairs: pK-K, 1-2, 3-4, 5-6, 7-8, 9-10, 11-12
Michigan	Michigan Curriculum Frameworks (1995); Michigan Essential Goals and Objectives for Mathematics Education (1985)	Grade clusters: Elementary, Middle, High School
Missouri	Frameworks for Curriculum Development in Mathematics (1996)	Grade clusters: K-4, 5-8, 9-12
North Carolina	North Carolina Standard Course of Study (1998)	Every grade: K-8, individual courses in high school
Oregon	Oregon Mathematics Content Standards (1996, 1998)	Benchmark grades: 3, 5, 8, 10, 12
Pennsylvania	Academic Standards (1999)	Benchmark grades: 3, 5, 8, 11
South Carolina	South Carolina Curriculum Standards (1998)	Every grade: K-8, individual courses in high school
Texas	Texas Essential Knowledge and Skills (1998)	Every grade: K-8, individual courses in high school

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

Background data provided by coordinators from participating jurisdictions.

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

Exhibit 5.3 Districts' and Consortia's Curriculum

8th Grade Mathematics

	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.

How Do Education Systems Support and Monitor Curriculum Implementation?

During the past decade, content-driven systemic school reform has emerged as a promising model for school improvement.[4] That is, curriculum frameworks establishing what students should know and be able to do provide a coherent direction for improving the quality of instruction. Teacher preparation, instructional materials, and other aspects of the system are then aligned to reflect the content of the frameworks in an integrated way to reinforce and sustain high-quality teaching and learning in schools and classrooms.

Education systems use different ways to achieve this desired connection between the intended and the implemented curriculum. The methods used by the TIMSS 1999 countries to monitor curriculum implementation are shown in Exhibit 5.4, and by states, districts, and consortia in Exhibits 5.5 through 5.7. For example, teachers can be trained in the content and pedagogical approaches specified in the curriculum guides. Another way to help ensure alignment is to develop instructional materials, including textbooks, instructional guides, and ministry notes, that are tailored to the curriculum. Systems can also monitor implementation of the intended curriculum by means of school inspection or audit.

Of the methods for supporting and monitoring curriculum implementation shown in Exhibit 5.4, 10 countries reported using all six, and a further 14 countries used five. Support for the national/regional mathematics curriculum as part of pre-service education was reported by 26 of the 38 countries. Nearly all countries (34) used in-service teacher education, and most countries (31) used mandated or recommended textbooks. Ministry notes and directives were used in 30 countries, as was a system of school inspection or audit.

States, districts, and consortia provided data on policies related to textbook selection, pedagogical guides, and accreditation. As shown in Exhibit 5.5, seven of the Benchmarking states reported that they do not select textbooks for use at the local level. The other six states issue a list of books from which districts can choose. Almost all districts and consortia reported that their state does not select textbooks, while three reported state involvement in textbook selection. Ten jurisdictions indicated that textbooks were chosen or recommended at the district level, and four that selection occurs at the school level or, in the consortia, at the school and district level depending on the district.

4 O'Day, J.A. and Smith, M.S. (1993), "Systemic Reform and Educational Opportunity" in S.H. Fuhrman (ed.), *Designing Coherent Education Policy: Improving the System*, San Francisco, CA: Jossey-Bass, Inc.

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.

Exhibit 5.4 Countries' Use of Methods to Support or Monitor Implementation of the Curriculum*

8th Grade Mathematics

	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	●	●	●		●	●
Canada [3]	●	●	●	●	●	
Chile			●		●	
Chinese Taipei	●	●	●	●		●
Cyprus		●	●		●	●
Czech Republic	●		●		●	●
England	●	●				●
Finland	●	●	●	●		
Hong Kong, SAR	●	●	●	●	●	●
Hungary	●	●	●	●	●	
Indonesia		●	●	●	●	●
Iran, Islamic Rep.	●	●	●	●	●	●
Israel	●	●	●		●	
Italy		●		●	●	●
Japan		●	●	●	●	●
Jordan		●	●	●	●	●
Korea, Rep. of	●	●	●	●	●	●
Latvia (LSS)	●	●	●	●	●	●
Lithuania		●	●		●	
Macedonia, Rep. Of	●	●	●	●		●
Malaysia	●	●	●	●	●	●
Moldova		●	●		●	●
Morocco	●	●	●	●	●	●
Netherlands	●	●		●	●	●
New Zealand	●	●				●
Philippines		●	●	●	●	●
Romania	●	●	●	●	●	●
Russian Federation	●	●	●	●	●	●
Singapore	●	●	●	●	●	●
Slovak Republic	●		●		●	●
Slovenia	●	●	●	●		●
South Africa	●	●	●	●		●
Thailand	●	●	●	●	●	●
Tunisia		●	●	●	●	●
Turkey		●	●		●	●

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

● Country reported that method is used to support or monitor the implementation of the national/regional curriculum at grade 8

\+ Not applicable nationally

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.

Exhibit 5.5 States', Districts' and Consortia's Use of Textbooks and Instructional Materials to Support Implementation of the Curriculum

States	Policy on Textbooks and Instructional Materials
Connecticut	The state does not select textbooks.
Idaho	The state approves a list of textbooks and materials from which districts/schools must choose. The textbooks selection criteria include alignment with Idaho Skills-Based Scope and Sequence Guide, which specifies skills that all students should know at different levels. Schools are required to select all their basic instructional materials from the Idaho Adoption Guide produced by the adoption committee. Schools not choosing from this adoption list can lose accreditation points.
Illinois	The state does not select textbooks.
Indiana	The state selects a list of textbooks from which districts/schools can choose; however, waivers are granted. The state texts are not necessarily based on the state standards. The state intends to align textbooks selections with Indiana's new Academic Standards (2000).
Maryland	The state does not select textbooks.
Massachusetts	The state does not select textbooks.
Michigan	The state does not select textbooks.
Missouri	The state does not select textbooks.
North Carolina	The state selects a list of textbooks and materials based on the curriculum from which districts can choose.
Oregon	The state selects a list of textbooks and materials from which districts can choose. Districts may submit a waiver for an independent adoption to select textbooks and instructional materials of their own choice. These district-level adoptions must meet the state selection criteria.
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	The State Textbook Review Committee selects textbooks and instructional materials to support the state curriculum framework. Districts choose textbooks and/or instructional materials using local criteria. The state funds the purchase of textbooks and/or instructional materials that are on the selected list. Districts may waiver, at own expense, from selected textbooks or instructional materials.

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

Background data provided by coordinators from participating jurisdictions.

Districts and Consortia	Policy on Textbooks and Instructional Materials
Academy School Dist. #20, CO	STATE: The state does not select textbooks. LOCAL: Schools can select materials based on guidelines with acceptance by the Board of Education.
Chicago Public Schools, IL	STATE: The state does not select textbooks. LOCAL: Schools in districts choose instructional materials.
Delaware Science Coalition, DE	STATE: The state does not select textbooks. LOCAL: Textbook selection may be made at the school or district level. Due to the influence of two NSF-funded Teacher Enhancement Grants in Delaware, by Fall 2000 every school district in the state will be using an NSF-funded standards-based mathematics curriculum with some students.
First in the World Consort., IL	STATE: The state does not select textbooks. LOCAL: Texts and materials selected and recommended at the district level. The FIW Consortium is reviewing materials to recommend as well.
Fremont/Lincoln/ WestSide PS, NE	STATE: The state does not select textbooks. LOCAL: Districts select textbooks/textbook series and schools select supplemental materials.
Guilford County, NC	STATE: The state selects a list of textbooks and materials based on the state content standards from which districts can choose. LOCAL: One textbook used throughout county. A system-wide committee reviews the state selected list and one textbook per grade level is selected to be used system-wide.
Jersey City Public Schools, NJ	STATE: The state does not select textbooks. LOCAL: A committee is formed at the district level to facilitate the selection of mathematics textbooks and materials. There is a "standard operating procedure" for the formulation of the committee so as to include all constituent groups. All selected textbooks and materials are aligned with the district's grade-level mathematics curricula, the NJ Core Curriculum Content Standards in mathematics, and the national standards in mathematics.
Miami-Dade County PS, FL	STATE: The state recommends the textbooks and instructional materials. LOCAL: The district selection committee narrows the selection to two or three textbooks. The schools pick one of the selected textbooks. The new legislation makes waivers for using non-adopted texts more difficult, but schools are allotted some money to spend on non-state adopted materials with review at the district level.
Michigan Invitational Group, MI	STATE: The state does not select textbooks. LOCAL: Textbook selection is made at the school/district level.
Montgomery County, MD	STATE: The state does not select textbooks. LOCAL: The district recommends a few textbooks.
Naperville Sch. Dist. #203, IL	STATE: The state does not select textbooks. LOCAL: District uses criteria based on the learning outcomes to select instructional materials. No one textbook selected.
Project SMART Consortium, OH	STATE: The state does not select textbooks, but approves a liberal textbook list from which districts can choose. LOCAL: The districts select instructional materials that are closely aligned to the curriculum.
Rochester City Sch. Dist., NY	STATE: The state does not select textbooks. LOCAL: The district chooses one text series for all schools to use.
SW Math/Sci. Collaborative, PA	STATE: The state does not select textbooks. LOCAL: Each district selects a textbook. The Collaborative encourages consideration of exemplary NSF-developed materials.

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

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	Pedagogical Guides
Academy School Dist. #20, CO	No specific "how-to" instructional manuals are provided. The district provides all schools with best-practice examples from NCTM. The state has provided districts with grade-appropriate sample assessments, released items, and samples of scored student work which the district has expanded upon.
Chicago Public Schools, IL	An optional structured curriculum provides daily lesson plans at all grade levels. For high schools, test blueprints of the "Chicago Academic Standards Exam" (CASE) are provided to teachers for instructional purposes.
Delaware Science Coalition, DE	The "Delaware Curriculum Framework" (1995) contains several classroom activities and a vignette for each standard at each grade band. A "Teacher's Desk Reference" has been published that provides indicators at each grade level serving as a reference for district curriculum committees in developing local curriculum and as a reference for teachers in planning lessons and units of study.
First in the World Consort., IL	Each district in the consortium develops mathematics guides to support their own curriculum (teacher guides, manipulations, peer coaching, etc.).
Fremont/Lincoln/ WestSide PS, NE	Two of the districts have curriculum guides in mathematics with instructional activities. The third district uses commercially-developed materials.
Guilford County, NC	There is a state-written book, Strategies for Instruction, detailing best practices, lessons, assessments, and teaching methods based on the North Carolina Course of Study.
Jersey City Public Schools, NJ	The "New Jersey Framework for Teaching" in Mathematics, published in May 1996, discusses essential components of a quality K-12 mathematics program. The framework is not a curriculum, but a comprehensive digest of activities, curriculum connections, and instructional strategies related to the NJ Core Curriculum Content Standards in Mathematics. In addition to the state standards and the state frameworks, the district's curriculum guides provide content guidelines based on grade-level competencies. In the district curriculum materials, manipulatives, resources, and learning activities are provided at each grade level.
Miami-Dade County PS, FL	The Florida Department of Education released the "Curriculum Planning Tool" (CPT) which includes a bank of activities linked to the strands and standards. It also maintains a website with information of Grade Level Expectations and other guidelines for instruction. The state also produced the Florida Curriculum Frameworks for Mathematics and a "Mathematics Best Practices" CD-ROM. All guides and curriculum materials developed at the district level are aligned with the Sunshine State Standards. Some of the district level guides are: "The Competency-Based Curriculum" (1992, revised 1999), Supplement to the "Competency-Based Curriculum" (1999), "Here Comes the Sunshine State Standards" (1998), "Awesome Activities for Achieving Success on the Sunshine State Standards K-8" (1999), "Focus on Algebra I through a Sunshine State Standards Lens" (1999), and "Summer School Curriculum K-5" (1996, 2000), "Summer 2000 Balanced Assessment for Middle School", and numerous packages of materials produced for individual workshops.
Michigan Invitational Group, MI	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.
Montgomery County, MD	"Better Mathematics" produced at state level and "State of the Art Instruction that Ensures Classroom Success for Every Student: A Handbook for Educators" produced at the local level, both address pedagogy. Local curriculum documents are written for each mathematics course which include: goals, objectives, lessons, and strategies. The curriculum document exists for K-12.
Naperville Sch. Dist. #203, IL	District-level guide connects outcomes to resources and provides general teaching strategies and guidance for using manipulatives.
Project SMART Consortium, OH	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.
Rochester City Sch. Dist., NY	New York State provides core curriculum guides based on the standards at all grades levels. The district has developed mathematics curriculum guides and pacing charts that align NYS standards with instruction for students in grades pK-8. Guides for grades 9-10 are being developed.
SW Math/Sci. Collaborative, PA	In 2000, the Collaborative and the local intermediate unit convened teachers from 30 districts to develop a grade-by-grade conceptual framework linked to lessons from exemplary materials.

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

	Use of Accreditation
States	
Connecticut	No accreditation system.
Idaho	Accreditation requires that curriculum developed at the local level be aligned with state standards. Schools must establish educational standards for all grade levels and develop high school exiting standards for graduation; these standards must be aligned with exiting standards established by the State Board of Education. It also requires that schools participate in state testing and adhere to textbook adoption policies.
Illinois	There are periodic quality-assurance site visits to schools.
Indiana	The accreditation system requires K-8 schools to self-report alignment of curriculum with state standards (proficiencies); grade 9-12 schools submit a master schedule and course descriptions to verify compliance with state standards. Performance on the ISTEP+ is also considered in accreditation. Technical assistance is available to schools that do not meet the accreditation standards.
Maryland	No accreditation system.
Massachusetts	No accreditation system.
Michigan	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.
Missouri	The Missouri School Improvement Program, designed to accredit districts, assesses districts progress on the Show-Me Standards as measured by the Missouri Assessment Program. There are "success teams" that help districts improve student achievement in all subject areas.
North Carolina	No accreditation system.
Oregon	All schools are state accredited through a system of "standard" assurances, Consolidated District and School Improvement Plans, Annual Performance Reports, and Schools Reviews. State accreditation is based on the Oregon Performance Accountability System (OPAS), that assesses school mathematics performance. Any school falling in the low or unacceptable category receives targeted assistance including alignment with standards, instructional improvement and professional development.
Pennsylvania	No accreditation system.
South Carolina	The accreditation system is in revision. Schools must meet a battery of standards in the current accreditation system, but student academic performance is not included. The new accreditation system will include student academic performance and will go into effect in 2001.
Texas	Although not considered an accreditation system, the state's accountability system includes a variety of on-site evaluations designed to provide feedback for improvement.

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

Background data provided by coordinators from participating jurisdictions.

	Use of Accreditation
Districts and Consortia	
Academy School Dist. #20, CO	The state will be implementing an accreditation system beginning in Fall 2001 based primarily on the success and/or progress on the standards-referenced state assessment (CSAP).
Chicago Public Schools, IL	No accreditation system.
Delaware Science Coalition, DE	No accreditation system.
First in the World Consort., IL	No accreditation system.
Fremont/Lincoln/ WestSide PS, NE	No accreditation system.
Guilford County, NC	No accreditation system.
Jersey City Public Schools, NJ	No accreditation system.
Miami-Dade County PS, FL	No accreditation system.
Michigan Invitational Group, MI	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.
Montgomery County, MD	No accreditation system.
Naperville Sch. Dist. #203, IL	No accreditation system.
Project SMART Consortium, OH	No accreditation system.
Rochester City Sch. Dist., NY	No accreditation system.
SW Math/Sci. Collaborative, PA	No accreditation system.

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

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). Thirty-seven countries reported having public examinations or awards, at one or more grades, that included testing achievement in mathematics. Most countries held their examinations in the final year of schooling for certification and selection to higher education (often, university education). In about one-third of the countries, public examinations were also used for selection or course assignment (tracking) within secondary schools.

Exhibit 5.8 Countries' System-Wide Assessments in Mathematics

	System-Wide Assessments[1]	Grades: Entire Grade Level	Grades: Sample from Grade Level	Purpose/Consequences
United States	Yes		4, 8, 12	National and state-level feedback
Australia [2]	Yes	3, 5 (all states) 7 (four states)		System-level, school-level, and individual student-level feedback
Belgium (Flemish)	No			
Bulgaria	Yes		4, 8	System-level feedback, administered only in 1998
Canada [3]	Yes	3, 6, 9 (5 provinces); 5, 8, 11 (1 province); 4, 7, 10 (1 province); 12 (1 province)	Ages 13 and 16 nationally (most provinces)	System- and school-level feedback
Chile	Yes	4, 8, 10		System-level, school-level, class-level feedback; top 25% of teachers are given monetary rewards; usually one grade level assessed each year
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	System-level feedback, assessments given irregularly at different primary grades
Iran, Islamic Rep.	No			
Israel	Yes		4, 8	System-level feedback
Italy	Yes		6, 8, 10, 13	System-level feedback; first administered in 1999 with a grade 4 assessment instituted in 2000
Japan	Yes		5, 6, 7, 8, 9	System-level feedback
Jordan	Yes		4, 5, 8, 10	System-level feedback; monitoring reform impact; curricular revisions
Korea, Rep. Of	Yes	4, 5, 6, 7, 8, 10, 11		System-level feedback
Latvia (LSS)	No			
Lithuania	No			
Macedonia, Rep. Of	Yes		4, 5, 6, 7, 8	System-level feedback and research purposes (projects and curriculum development)
Malaysia	Yes	6, 9, 11, 13		System- and school-level feedback; "good schools" publicized
Moldova	No			
Morocco	Yes	6, 9, 10, 11, 12		System- and school-level feedback
Netherlands	Yes	10, 11, 12	6	System-level feedback
New Zealand	Yes		3, 7	System-level feedback
Philippines	Yes	6, 10		System- and school-level feedback (the assessment was sample-based up until 1999)
Romania	No			
Russian Federation	Yes		various grades	Irregularly for research purposes
Singapore	Yes	6,10,12		System- and school-level feedback; selection into courses, certification and entry to university
Slovak Republic	No			
Slovenia	No			Assessments administered in grades 1-8 from 1991-1996
South Africa	No			
Thailand	Yes	6, 9, 12		System-level feedback
Tunisia	Yes	4, 6, 9, 13		System- and school-level feedback; may lead to redistribution of teachers in the regions; assessments at grades 4 and 6 developed regionally
Turkey	Yes		5, 8, 11	System- and school-level feedback

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

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.

Exhibit 5.9 Countries' Public Examinations in Mathematics

	Public Exams/ Awards	Grade(s)	Purpose/Consequences
United States [1]	Yes	varies	Primarily feedback to system and schools; in 8 states grade promotion is dependent on results; in 18 states graduation is dependent on results of grade 12 exams
Australia	Yes	12	Certification and selection for tertiary education
Belgium (Flemish)	No		
Bulgaria	Yes	7/8, 12	Candidates for profile schools (grade 7 or 8); certification and entrance to university -- not taken by all students (grade 12)
Canada [2]	Yes	3,6,8 (1province); 10, 11(1 province); 12 (4 provinces)	Feedback to system and schools; certification (grade 12)
Chile	Yes	12	Entry to university
Chinese Taipei	Yes	9, 12	Entry to secondary school (grade 9); entry to university (grade 12)
Cyprus	Yes	12	Certification and entry to university (grade 12); a certification exam occurs on a local level for grade 9
Czech Republic	Yes	13	Certification (mathematics can be chosen as one of four subjects for leaving examination)
England	Yes	10, 12	Certification (grade 10), certification and entry to university (grade 12); feedback to system and schools
Finland	Yes	12	Certification and selection for tertiary education
Hong Kong, SAR	Yes	6, 11, 13	School placement (grade 6); certification and placement for 12th grade (grade 11); placement in tertiary institutions (grade 13)
Hungary	Yes	12	Certification and entry to university
Indonesia	Yes	6, 9, 12	Leaving exam and selection for junior secondary school (grade 6); selection for senior secondary school (grade 9); leaving exam (grade 12); system-level feedback, in some cases school- and classroom-level feedback
Iran, Islamic Rep.	Yes	11, 12	Certification (grade 11); entry to tertiary education (grade 12); in addition, provincial exams are administered at grade 8
Israel	Yes	11 or 12	Entry to higher education
Italy	Yes	13	Certification and entry to university
Japan	Yes	9, 12	Entry to prefectural and municipal upper secondary schools (grade 9); entry to national, prefectural and municipal universities (grade 12)
Jordan	Yes	12	Certification and entry to tertiary education
Korea, Rep. of	Yes	12	College entrance exam for selection of students
Latvia (LSS)	Yes	9, 12	Certification
Lithuania	Yes	9, 12	Graduation from Basic and Upper Secondary schools
Macedonia, Rep. Of	Yes	12	Certification and entry to university; the exam constitutes 40% of the required points for entry to university with the remaining points based on university entry exams
Malaysia	Yes	6, 9, 11, 13	Feedback to system and schools; achievement test (grade 6); entry to course tracks (grade 9); certification and end of secondary (grade 11); certification and entry to university (grade 13)
Moldova	Yes	9, 11/12	Certification and selection for high school (grade 9); graduation (grade 11 or 12 depending on school)
Morocco	Yes	6, 9, 10, 11, 12	Remedial test for retention purposes (grade 6); certification, selection to secondary and selection to courses (grade 9); certification and entry to tertiary (grade 12); feedback to system and schools
Netherlands	Yes	10, 11, 12	End-of-track examinations; exams recommended at grades 6 and 8
New Zealand	Yes	10, 12	Certification and course selection (grade 10); entry to tertiary education (grade 12); feedback to system and schools; informal between-school comparisons
Philippines	Yes	6, 10	Feedback to system and schools
Romania	Yes	8, 12	Certification (grade 8); certification (grade 12; mathematics can be chosen as one of 7 subjects)
Russian Federation	Yes	9, 11	Certification
Singapore	Yes	6, 10, 12	Selection into courses; certification and entry to university; feedback to system and schools
Slovak Republic	Yes	12	Certification (mathematics can be chosen as one of four subjects for leaving exam)
Slovenia	Yes	8, 12	Entry to secondary school (grade 8); certification and entry to tertiary education (grade 12)
South Africa	Yes	12	Certification and selection for tertiary education
Thailand	Yes	12	Entry to university
Tunisia	Yes	6, 9, 13	Regional exam for promotion (grade 6); feedback to system and schools, selection for schools and courses, and promotion (grade 9); certification and entry to university (grade 13)
Turkey	Yes	8, 11	Placement in specialized schools for some students (grade 8); entry to university (grade 11)

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

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 policies. As an incentive, students meeting the standards in Michigan and Missouri could receive state funds to support their academic careers through scholarship money and funds for advanced course work, respectively. No consequences for students based on test results were reported in Idaho, Maryland, and Massachusetts, and no additional consequences beyond that of the high school exit exam for students in Indiana.

Benchmarking states also reported a range of consequences at the district or school level. Connecticut, Massachusetts, Michigan, and North Carolina reported that additional funding was made available to low-performing schools and districts to support remediation. In Indiana, Oregon, and South Carolina, districts were required to provide remediation to students with low scores on the state assessments. States had the right to take over schools or districts in Maryland, Massachusetts, Michigan, and Pennsylvania. While consequences of assessments for schools or districts usually involved remediation activities or sanctions, Connecticut, Indiana, and Maryland provided monetary rewards to districts and/or schools that showed improvement.

As shown in Exhibit 5.13, almost all the Benchmarking districts and consortia (13 of 14) participated in the mathematics assessments administered by their state. The Fremont/Lincoln/Westside Public Schools of Nebraska was the only district or consortium that reported having no state-administered assessments. Most districts and consortia also conducted district-wide assessments at the local level. Four districts reported using local standards-based assessments: Jersey City, Miami-Dade, Montgomery County, and Naperville. The Chicago Public Schools and the First in the World Consortium reported that they are developing district-wide mathematics assessments. Some districts in the Project SMART Consortium also administered district-developed assessments. Eight districts and consortia reported that norm-referenced tests were used for student assessment at the district level. Guilford County was the only district or consortium that reported having no assessments beyond those administered by the state.

	State-Developed Criterion-Referenced Mathematics Assessment[1]	Other Mathematics Assessments	Participated in NAEP	
			1996	2000
Connecticut	Connecticut Mastery Test (CMT): In revision - Grades 4, 6, 8 Connecticut Academic Performance Test (CAPT): In revision - Grade 10	None	Yes	Yes
Idaho	Direct Mathematics Assessment (DMA): In revision - Grades 4, 8 (2001-02)	ITBS: Grades 3-8 TAP: Grades 9-11	No	Yes
Illinois	Illinois Goal Assessment Program (IGAP): Grades 3, 6, 8, 10 (1988-99) Illinois Standard Achievement Test (ISAT): Grades 3, 5, 8 (2000) Prairie State Achievement Examination (PSAE): Grade 11 (2001)	ISAT is also reported as a norm-referenced assessment: Grades 3, 5, 8, 10	Yes[2]	Yes
Indiana	Indiana Statewide Testing for Educational Progress-Plus (ISTEP+): In revision - Grades 3, 6, 8, 10	ISTEP+ includes a norm-referenced component: Grades 3, 6, 8, 10	Yes	Yes
Maryland	Maryland School Performance Assessment Program (MSPAP): In revision - Grades 3, 5, 8	CTBS/5: Grades 2, 4, 6 Maryland Functional Tests: Grades 9, 11	Yes	Yes
Massachusetts	Massachusetts Comprehensive Assessment System (MCAS): Grades 4, 8, 10 (Revised 2000)	None	Yes	Yes
Michigan	Michigan Educational Assessment Program (MEAP): Grades 4, 7, 11. In revision/development - Grades 4, 8, 11.	None	Yes	Yes
Missouri	Missouri Assessment Program (MAP): Grades 4, 8, 10	MAP includes the Terra Nova	Yes	Yes
North Carolina	North Carolina Testing Program: In revision - end-of-grade exams in Grades 3-8, North Carolina Competency Test, end-of-course exams in high school North Carolina High School Comprehensive - Grade 10 In development - Grade 11	ITBS: Grades 4 and 8	Yes	Yes
Oregon	Oregon State-wide Assessment System: Grades 3, 5, 8, 10	None	Yes	No
Pennsylvania	Pennsylvania System of School Assessment (PSSA): Grades 5, 8, 11	None	No	No
South Carolina	Basic Skills Assessment Program (1981-1999) Palmetto Achievement Challenge Test (PACT): Grades 3-8 (2000) In development - Grade 10 (2002-03)	MAT7: Grades 4, 5, 7, 9, 11 (1995-1999) Terra Nova: Grades 3, 6, 9 (1999) Terra Nova: Grades 5, 8, 11 (2000) Terra Nova: Grades 4, 7, 10 (2001) Terra Nova: Grades 3, 6, 9 (2002)	Yes	Yes
Texas	Texas Assessment of Academic Skills (TAAS): Grades 3-8, 10, end-of-course tests in high school (Revised 2000)	None	Yes	Yes

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

Background data provided by coordinators from participating jurisdictions.

1 Specifically developed to be aligned with the curriculum framework/content standards indicated in Exhibit 5.2.

2 Illinois participated in NAEP in 1996 but results were not reported due to low participation rates.

	Status of State-Developed Mathematics Assessment
Connecticut	The Connecticut Mastery Test (CMT) was developed to be aligned with Connecticut's 1981 Guide to Curriculum Development in Mathematics. The Connecticut Academic Performance Test (CAPT), first administered in 1995, was developed to be aligned with the 1987 Common Core of Learning. The assessments are being revised for the 2000-01 school year based on Connecticut's 1998 K-12 Mathematics Curriculum Framework. The CMT is administered in the fall and the CAPT is administered in the spring.
Idaho	The Idaho Direct Mathematics Assessment (DMA) is administered at grades 4 and 8. This formative, performance assessment was aligned with state standards for the 2001 and 2002 assessments. The Grade 11 assessment was field tested in December 2000 and will be administered in 2002.
Illinois	Illinois Standard Achievement Test (ISAT) administered at grades 3, 5, 8, replaced the Illinois Goal Assessment Program (IGAP) which was administered from 1988-1999 at grades 3, 6, 8, and 10. 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.
Indiana	The Indiana Statewide Testing for Educational Progress (ISTEP+) is a state developed assessment system designed to assess the standards detailed in the 1997 Proficiency Guide. The assessments are administered at grades 3, 6, 8, and 10. Voluntary state assessments of high school courses (Core 40 assessments) are available. All assessments are being revised for 2002 based on Indiana's Academic Standards (2000).
Maryland	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. The High School Assessment, in development, is proposed as an end-of-course test which will be part of the graduation requirement.
Massachusetts	Massachusetts Comprehensive Assessment System (MCAS) was first administered in 1998 to grades 4, 8, and 10. Grade 6 will be included from 2001. The Mathematics MCAS was developed to assess the 1996 Curriculum Frameworks which are currently in revision. The Mathematics revision was released in November 2000.
Michigan	The Michigan Educational Assessment Program (MEAP) currently administers assessments at grades 4, 7, and 11. The tests at grades 4 and 7 are based upon the Michigan Essential Goals and Objectives for Mathematics Education (1985). These tests are being revised to assess the 1995 Michigan Curriculum Frameworks and will be administered at grades 4 and 8 starting in 2001/2002. The Grade 11 test was first administered in 1996 and revised in 1998 based on the 1995 High School Proficiency Test Framework and will be revised for the 2002 administration to assess the 1995 curriculum framework.
Missouri	The Missouri Assessment Program (MAP) has been developed for mathematics in grades 4, 8, and 10. Each test includes multiple-choice, short constructed-response, and performance-event items. The test consist of three sessions. The first two sessions include items designed to assess the Show-Me Standards (1996) which are directly related to the curriculum frameworks. Items that match the Show-Me Standards from the norm-referenced Terra Nova are administered in the third session.
North Carolina	The North Carolina Testing Program includes the end-of-grade exams, first administered in 1994, at grades 3-8, and the end-of-course exams (Algebra, Geometry, Algebra II) in high school. These tests are currently based on the 1989 Standard Course of Study. The new tests will be revised to assess the 1998 curriculum by 2000-01. The North Carolina High School Competency Test is administered at grade 10 to measure student growth from grade 8 to grade 10. Students who do not score at the proficient level on the grade 8 end-of-grade exam are required to pass the North Carolina Competency Test in order to graduate from high school. The North Carolina Competency Test will be replaced by an 11th grade exit exam, developed to assess the high school standards through the eleventh grade.
Oregon	The Oregon Statewide Assessment System includes a knowledge and skills state test at grades 3, 5, 8, and 10; a performance state test at grades 4, 5, 6, 8, and 10; and local Classroom Work Samples at grades 3, 5, 8, and 10. All assessments are based on the content standards. As of 1999-2000, the mathematics knowledge and skills tests are achievement level tests: Levels A, B, and C. Students are administered one of the three versions of the test based on their ability level.
Pennsylvania	The Pennsylvania System of School Assessment (PSSA) is administered at grades 5, 8, and 11 and were revised for the 1999 administration to assess the 1999 standards.
South Carolina	The Palmetto Achievement Challenge Test (PACT) is administered at grades 3-8 and is based on the standards. PACT replaces the Basic Skills Assessment Program (BSAP) administered from 1981-1999 at grades 3, 6, and 8. Currently, the basic skills exit exam is given at 10th grade. As of 2002-03, the PACT High School exit exam, based on the 10th grade standards, will be required for graduation.
Texas	The Texas Assessment of Academic Skills (TAAS) were revised to more specifically assess the current standards for the 2000 administration. TAAS is administered in grades 3-8 and the TAAS end-of-course tests are administered in high school. The 10th grade standards-based exit-level exam is based on the 8th, 9th, and 10th grade standards.

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

Background data provided by coordinators from participating jurisdictions.

Exhibit 5.12 States' Use of Mathematics Assessments with Consequences

	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.

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

	Mathematics Assessments	
	State	Local
Academy School Dist. #20, CO	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.
Chicago Public Schools, IL	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.
Delaware Science Coalition, DE	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.
First in the World Consort., IL	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.
Fremont/Lincoln/ WestSide PS, NE	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).
Guilford County, NC	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.
Jersey City Public Schools, NJ	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 district exams are designed to measure student progress and are aligned to the district curriculum and to the ESPA and GEPA in format and content. At the high school level, mid-terms and final exams are given in the areas of Algebra I and II, Geometry, Pre-Calculus, Calculus I, and AP Calculus (general level and honors courses).

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

Background data provided by coordinators from participating jurisdictions.

	Mathematics Assessments	
	State	Local
Miami-Dade County PS, FL	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.
Michigan Invitational Group, MI	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.
Montgomery County, MD	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.
Naperville Sch. Dist. #203, IL	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.	Criterion-referenced and performance-based assessments developed to assess the curriculum are administered at all grades.
Project SMART Consortium, OH	There are state assessments developed to assess the standards at grades 4, 6, 9, and 12. Students must pass the 9th grade mathematics test to graduate from high school. These tests are based on 8th grade standards. The class of 2005 will be the first required to pass the new 10th grade tests based on the 10th-grade standards to graduate. Mathematics performance on state assessments is tied to the local district report card accountability system. If seventy-five percent of students do not perform at the state pass rate, the district must put an intervention system in place.	District assessments are given at grades 1-3, 5, and 7 to assess student progress. Tests are both commercial achievement tests and district-developed assessments.
Rochester City Sch. Dist., NY	Beginning in 1999, New York assessed student performance using state-developed tests based on the standards. New York is phasing out the high school competency exams administered to students in grades 9-12. All the students in the class of 2003 will be required to take the New York State Regents Examinations. Students in grade 4 take a NYS Elementary Mathematics Assessment. Students in grade 8 take a NYS Intermediate Mathematics Assessment. New York State has developed a school accountability system that will be phased in by 2003. School districts must provide academic intervention services to students scoring below the state designated performance level on state assessments or to students at risk of not achieving the state learning standards.	The Stanford 9 is administered to students (grades 1-7) not assessed by state programs.
SW Math/Sci. Collaborative, PA	The Pennsylvania System of School Assessment (PSSA) is administered at grades 5, 8, and 11. Beginning in 2001-02, districts will be required 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.	Each district has its own assessment system in addition to the state assessments. Many of these are standardized tests like the IOWA or Stanford. Some districts use New Standards-Reference Exams.

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

How Do Education Systems Deal with Individual Differences?

The challenge of maximizing opportunity to learn for students with widely differing abilities and interests is met differently in different education systems. Exhibit 5.14 summarizes questionnaire and interview data on how selected comparison countries, as well as states, districts, and consortia, organized their curricula to deal with this issue.

Some participants indicated using more than one method of dealing with individual differences among students, and in these cases the category describing the main method was reported. In the United States, and in Canada, Chinese Taipei, Hong Kong, and Korea among the comparison countries, the same curriculum was intended for all students, but it was recommended that teachers adapt the level and scope of their teaching to the abilities and interests of their students. In the Czech Republic and England, the mathematics curriculum was taught at different levels to different groups, four in the Czech Republic and nine in England – so many because in England the levels are defined in terms of progressively more complex performance to be demonstrated. Another approach to differentiated provision was followed in Belgium (Flemish), the Netherlands, the Russian Federation, and Singapore, which assign different curricula to students of different levels of ability and interest. Two of the comparison countries, Italy and Japan, reported that their official mathematics curricula did not address the issue of differentiating instruction for eighth-grade students with different abilities or interests.

All of the Benchmarking states and most of the districts and consortia generally resembled the United States in that they provided the same curriculum for all, but expected teachers to adapt the level and scope of their teaching to their students' needs. The First in the World Consortium and Miami-Dade provided the same curriculum to all, but at different levels for different groups, while Naperville provided a different curriculum to students of different abilities.

Schools' reports on how they organize to accommodate students with different abilities or interests are shown in Exhibit R2.1 in the reference section. Compared with the international average, substantial percentages of students in many Benchmarking jurisdictions were in schools reporting that different classes study different content, including the states, districts and consortia reporting that their frameworks or standards were developed for all students with teachers adapting to students' needs.

Exhibit 5.14 Differentiation of Curriculum for Students with Different Abilities or Interests

TIMSS 1999 Benchmarking
Boston College

8th Grade Mathematics

	Curriculum Addresses Differentiation	Approaches to Addressing Students with Different Abilities or Interests at Grade 8			
		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
Countries					
United States [1]	Yes	Yes	No	No	1
Belgium (Flemish)	Yes	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	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
Singapore	Yes	No	No	Yes	3
States					
Connecticut	Yes	Yes	No	No	1
Idaho	Yes	Yes	No	No	1
Illinois	Yes	Yes	No	No	1
Indiana	Yes	Yes	No	No	1
Maryland	Yes	Yes	No	No	1
Massachusetts	Yes	Yes	No	No	1
Michigan	Yes	Yes	No	No	1
Missouri	Yes	Yes	No	No	1
North Carolina	Yes	Yes	No	No	1
Oregon	Yes	Yes	No	No	1
Pennsylvania	Yes	Yes	No	No	1
South Carolina	Yes	Yes	No	No	1
Texas	Yes	Yes	No	No	1
Districts and Consortia					
Academy School Dist. #20, CO	Yes	Yes	No	No	1
Chicago Public Schools, IL	Yes	Yes	No	No	1
Delaware Science Coalition, DE	Yes	Yes	No	No	1
First in the World Consort., IL	Yes	No	Yes	No	3
Fremont/Lincoln/WestSide PS, NE	Yes	Yes	No	No	1
Guilford County, NC	Yes	Yes	No	No	1
Jersey City Public Schools, NJ	Yes	Yes	No	No	1
Miami-Dade County PS, FL	Yes	No	Yes	No	2
Michigan Invitational Group, MI	Yes	Yes	No	No	1
Montgomery County, MD	Yes	Yes	No	No	1
Naperville Sch. Dist. #203, IL	Yes	No	No	Yes	2
Project SMART Consortium, OH	Yes	Yes	No	No	1
Rochester City Sch. Dist., NY	Yes	Yes	No	No	1
SW Math/Sci. Collaborative, PA [3]	–	–	–	–	–

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

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.

Exhibit 5.15 Emphasis on Approaches and Processes

	Mastering Basic Skills	Understanding Mathematics Concepts	Real-life Applications of Mathematics	Communicating Mathematically	Solving Non-Routine Problems	Deriving Formal Proofs	Working on Mathematics Projects	Integration of Mathematics with Other School Subjects	Thematic Approach	Multicultural Approach	Assessing Student Learning
Countries											
United States	●	●	◉	◉	●	○	◉	◉	◉	◉	●
Belgium (Flemish)	●	●	◉	●	◉	○	○	◉	○	○	●
Canada [1]	◉	●	●	◉	◉	○	●	●	●	○	●
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]	–	–	–	–	–	–	–	–	–	–	–

● Major Emphasis
◉ Moderate Emphasis
○ Minor/No Emphasis
– Data not available

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

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.

What Mathematics Content Do Teachers Emphasize at the Eighth Grade?

Teachers of the mathematics classes tested were asked what subject matter they emphasized most in their classes (e.g., geometry, algebra, various combinations of content, etc.). Their responses, presented in Exhibit 5.16, reveal that most eighth-grade students around the world are being taught mathematics with an integration of content areas. Internationally on average, more than half the students were taught a combination of mathematics topics (i.e., combined algebra, geometry, number, etc.), and almost 20 percent were in classes emphasizing algebra and geometry combined.

Just as in TIMSS 1995,[6] the mathematics curriculum in the U.S. at the eighth grade does not appear to be as advanced as in other countries. About one-third of the U.S. eighth-grade students were in mathematics classes where the emphasis was on the combination of algebra, geometry, number, etc., but more than one-quarter were in classes emphasizing mainly number. None of the reference countries except Canada had a comparable proportion of students in classes emphasizing mainly number, and across all the TIMSS 1999 countries a mere 14 percent of students were in such classes.

Even when U.S. eighth graders were being taught algebra, it was usually as a single emphasis. More than one-quarter of the students were in classes emphasizing only algebra, compared with six percent in classes with a combined algebra and geometry emphasis. This is almost a reverse of the international pattern of 20 percent in algebra and geometry combined compared with eight percent in algebra only.

The Benchmarking states generally resembled the United States overall in the percentages of students in classes emphasizing various mathematics subject matter. Relative emphasis on mathematics subject matter varied more across the districts and consortia. Similar to the United States overall, most Benchmarking jurisdictions had much higher percentages of students whose teachers reported emphasizing mainly number at the eighth grade than did those in the top-performing comparison countries. These data suggest that many students in the U.S. continue to be taught number concepts at the eighth grade while their peers in other countries study topics in geometry and algebra, as discussed below. This is supported by previous TIMSS studies that showed that U.S. eighth-grade students who were not in Algebra 1 courses (approximately 75 to 80 percent of students) continued to receive instruction in arithmetic,

6 Peak, L. (1996), *Pursuing Excellence: A Study of U.S. Eighth-Grade Mathematics and Science Teaching, Learning, Curriculum, and Achievement in International Context*, NCES 97-198, Washington, DC: National Center for Education Statistics.

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 and radicals," and on geometry, algebra, and proportionality topics.[7]

In the Benchmarking states, the percentages of students in classes emphasizing mainly number is striking, and ranged from 20 percent in Indiana and Massachusetts to 39 percent in Idaho and Illinois. In Chicago and the Fremont/Lincoln/Westside Public Schools, 47 and 40 percent of students, respectively, had teachers who reported emphasizing mainly number at the eighth grade, while only four percent had teachers who did so in high-performing Naperville. Less than 10 percent of students were in mainly number classes in only six of the Benchmarking jurisdictions: the First in the World Consortium, Guilford County, Jersey City, the Michigan Invitational Group, Naperville, and Rochester.

There was even more variation among districts and consortia in the percentage of students in classes emphasizing algebra, ranging from two to five percent in Chicago, Jersey City, and Rochester to 91 percent in Naperville. Districts and consortia with more than one-third of their students in classes emphasizing algebra were the Academy School District, First in the World, Guilford County, Miami-Dade, the Michigan Invitational Group, Montgomery County, Naperville, and the Southwest Pennsylvania Math and Science Collaborative. Nearly all Benchmarking jurisdictions had no more than three percent of their students in classes emphasizing geometry. Only the Academy School District and the First in the World Consortium had appreciable percentages of students in such classes (14 and 18 percent, respectively).

7 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.

	Percentage of Students Whose Teachers Report the Subject Matter Emphasized Most in Their Grade 8 Mathematics Class					
	Mainly Number	Combined Algebra, Geometry, Number, etc.	Combined Algebra and Geometry	Algebra	Geometry	Other
Countries						
United States	28 (3.0)	32 (3.4)	6 (1.6)	27 (2.7)	1 (0.8)	6 (1.4)
Belgium (Flemish)	10 (3.3)	65 (3.6)	17 (2.3)	3 (1.2)	2 (1.3)	3 (2.3)
Canada	r 26 (3.0)	r 53 (2.8)	r 6 (1.6)	r 6 (1.4)	r 1 (0.0)	r 9 (1.9)
Chinese Taipei	2 (1.1)	57 (4.2)	24 (3.6)	4 (1.7)	9 (2.6)	4 (1.6)
Czech Republic	0 (0.2)	76 (3.9)	19 (3.9)	4 (1.2)	0 (0.0)	0 (0.0)
England	s 0 (0.0)	s 100 (0.0)	s 0 (0.0)	s 0 (0.0)	s 0 (0.0)	s 0 (0.0)
Hong Kong, SAR	7 (2.4)	60 (4.8)	11 (2.8)	13 (3.3)	4 (1.8)	5 (2.1)
Italy	2 (1.0)	67 (3.8)	22 (3.3)	5 (1.8)	4 (1.4)	1 (0.0)
Japan	7 (2.0)	30 (4.1)	35 (4.0)	16 (3.1)	9 (2.5)	4 (1.6)
Korea, Rep. of	6 (1.9)	51 (4.0)	20 (3.1)	20 (3.4)	2 (1.1)	2 (0.9)
Netherlands	4 (3.2)	77 (4.6)	13 (2.9)	2 (1.1)	1 (0.8)	3 (1.6)
Russian Federation	0 (0.0)	0 (0.0)	100 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Singapore	8 (2.3)	46 (4.5)	12 (2.9)	29 (3.7)	0 (0.0)	5 (1.7)
States						
Connecticut	r 22 (4.1)	r 29 (4.7)	r 3 (2.1)	r 35 (6.9)	r 3 (2.6)	r 9 (4.0)
Idaho	r 39 (7.0)	r 23 (5.9)	r 4 (2.4)	r 30 (5.5)	r 0 (0.0)	r 4 (2.9)
Illinois	39 (5.2)	27 (4.5)	7 (2.3)	23 (4.7)	1 (0.6)	2 (1.5)
Indiana	20 (4.5)	31 (5.9)	6 (3.0)	40 (7.4)	0 (0.0)	3 (2.3)
Maryland	r 26 (5.5)	r 28 (5.7)	r 7 (2.7)	r 37 (5.1)	r 1 (0.7)	r 2 (1.1)
Massachusetts	20 (3.3)	22 (4.9)	2 (1.7)	44 (5.2)	0 (0.2)	12 (3.2)
Michigan	23 (3.9)	23 (4.9)	6 (1.4)	43 (4.2)	1 (1.1)	4 (2.2)
Missouri	31 (5.6)	29 (5.8)	3 (1.9)	27 (4.7)	2 (1.5)	8 (2.4)
North Carolina	26 (4.6)	43 (6.3)	4 (2.2)	24 (3.3)	1 (0.1)	3 (1.6)
Oregon	30 (4.9)	30 (5.9)	2 (1.4)	29 (5.0)	3 (1.5)	6 (2.0)
Pennsylvania	23 (5.7)	27 (6.5)	6 (2.1)	39 (5.0)	1 (0.5)	5 (1.7)
South Carolina	28 (5.6)	19 (4.7)	8 (3.2)	38 (5.4)	2 (1.5)	6 (2.7)
Texas	r 33 (5.8)	r 26 (6.0)	r 0 (0.0)	r 35 (6.1)	r 1 (0.1)	r 5 (2.4)
Districts and Consortia						
Academy School Dist. #20, CO	18 (0.3)	17 (0.3)	0 (0.0)	49 (0.4)	14 (0.3)	3 (0.1)
Chicago Public Schools, IL	47 (10.6)	38 (8.6)	13 (6.4)	2 (1.7)	0 (0.0)	0 (0.0)
Delaware Science Coalition, DE	r 22 (6.3)	r 38 (6.4)	r 0 (0.0)	r 25 (5.9)	r 0 (0.0)	r 15 (5.4)
First in the World Consort., IL	9 (3.9)	32 (4.3)	5 (3.5)	35 (8.5)	18 (8.0)	0 (0.0)
Fremont/Lincoln/WestSide PS, NE	40 (9.1)	15 (8.4)	5 (5.1)	22 (6.7)	0 (0.0)	18 (3.3)
Guilford County, NC	9 (4.2)	36 (7.7)	4 (1.0)	44 (7.9)	0 (0.0)	6 (3.5)
Jersey City Public Schools, NJ	r 8 (3.4)	r 73 (6.1)	r 8 (1.8)	r 5 (3.4)	r 0 (0.0)	r 6 (2.8)
Miami-Dade County PS, FL	s 18 (5.9)	s 33 (8.6)	s 4 (3.4)	s 40 (9.6)	s 0 (0.0)	s 6 (4.4)
Michigan Invitational Group, MI	9 (2.8)	35 (8.5)	4 (0.2)	50 (8.5)	0 (0.0)	2 (0.1)
Montgomery County, MD	s 30 (4.7)	s 15 (3.3)	s 3 (1.7)	s 48 (5.9)	s 1 (0.4)	s 4 (2.9)
Naperville Sch. Dist. #203, IL	4 (2.0)	1 (0.0)	5 (0.4)	91 (2.1)	0 (0.0)	0 (0.0)
Project SMART Consortium, OH	34 (7.5)	24 (4.8)	1 (1.2)	31 (8.0)	2 (2.2)	7 (4.0)
Rochester City Sch. Dist., NY	7 (2.1)	70 (4.5)	18 (3.4)	5 (2.0)	0 (0.0)	0 (0.0)
SW Math/Sci. Collaborative, PA	20 (5.8)	24 (5.7)	11 (4.5)	36 (5.7)	3 (2.1)	6 (2.2)
International Avg. (All Countries)	14 (0.4)	55 (0.6)	19 (0.5)	8 (0.4)	3 (0.2)	2 (0.2)

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.

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

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.

Exhibit 5.17 Policy on Calculator Usage*

	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	Restricted Use	In primary school, students are not allowed to use calculators in mathematics. In secondary school, the use of calculators is allowed from grade 7, though the use is restricted.
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	Calculators are expected to be used as a tool while supporting computation and estimation skills. Calculators are allowed on the grade 8 assessment.
Indiana	Yes	Restricted Use	In the early grades it is used as a means to explore number patterns and to solve problems. In the later grades, calculators are to be used as a tool for exploring higher order concepts.
Maryland	Yes	Unrestricted Use	Calculators are used as a tools in mathematics. Local systems and teachers decide when they are appropriate to 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	Restricted Use	The curriculum does not contain an explicit policy on classroom use of calculators. In the classroom, calculator use changes as the mathematical processes become more advanced. Early learners use a 4-function calculator and later progress to a scientific calculator. Older students use graphing calculators. The emphasis is on the use of the appropriate calculator for each grade level. Policy does dictate calculator usage on statewide assessments. For the end-of-grade tests, 4-function calculators are not permitted on the computation part of the test, but are allowed on the application part. Graphing calculators are used in Algebra I; the most advanced calculator allowed in Algebra II and Geometry is a symbolic manipulation calculator.
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	Unrestricted Use	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 does not include calculators.
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.

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

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.

	Curriculum Contains Recommendations About Use of Calculators	Type of Policy	Comments
Districts and Consortia			
Academy School Dist. #20, CO	No	–	In practice, calculator usage increases in middle school and high school.
Chicago Public Schools, IL	Yes	Restricted Use	In early grades, calculators are used to explore different aspects of number sense. As students progress through school, the calculator is used to perform complicated computations.
Delaware Science Coalition, DE	Yes	Unrestricted Use	The standards require the appropriate selection of methods of calculation including mental math, paper and pencil, calculators, and computers. The use of grade-level appropriate calculators is also recommended. In K-5, a basic 4-function calculator or one using an algebraic operating system is used. In middle and high school, a scientific or graphing calculator is used.
First in the World Consort., IL	Yes	Unrestricted/Restricted Use	Restriction varies across districts. Most districts that prescribe to the Everyday Mathematics program use calculators at primary grades to develop number sense with patterns and estimation. Calculator usage for computational purposes is not allowed until the middle grades. Graphing calculators are generally introduced in the accelerated grades 6-8 pre-algebra/algebra courses.
Fremont/Lincoln/WestSide PS, NE	Yes	Restricted Use	Calculators are used as problem-solving instruments but not used for regular computational instruction and practice.
Guilford County, NC	Yes	Restricted Use	Calculators are used on 70% of the end-of-grade tests in grades 3-8.
Jersey City Public Schools, NJ	Yes	Restricted Use	At the elementary level, the district encourages all students from grades 3-8 to utilize the calculator as a resource tool in the classroom as well as to use the calculator on certain parts of the Fourth Grade Elementary School Proficiency Assessment (ESPA) and on all of the Grade Eight Proficiency Assessment (GEPA). At the high school level, the district encourages all students from grades 9-12 to utilize the calculator as a resource tool in the classroom as well as to use the calculator on the HSPT 11.
Miami-Dade County PS, FL	Yes	Unrestricted Use	Basic 4-function calculators are mainly used at the elementary level. Scientific and graphing calculators are used more frequently at the senior high school level.
Michigan Invitational Group, MI [1]	–	–	–
Montgomery County, MD	Yes	Unrestricted Use	–
Naperville Sch. Dist. #203, IL	Yes	Restricted Use	Calculators are used across all grade levels. Restrictions vary depending on the instructional purpose and the critical mathematics objective. The sophistication of the calculator increases with the grade level to the use of graphing calculators for all 8th grade students.
Project SMART Consortium, OH	Yes	Unrestricted Use	Calculators of various types are used in classrooms. Students will use scientific calculators during the grade 10 state assessment.
Rochester City Sch. Dist., NY	Yes	Restricted Use	Calculators are mandated for NYS Regents' examinations (grades 9-12), and the NYS Intermediate Mathematics Examination (grade 8). Calculators are at the discretion of the building for standardized and district-developed assessments.
SW Math/Sci. Collaborative, PA [2]	–	–	–

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

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 (83 percent). About two-thirds of the topics in geometry (67 percent) and algebra (68 percent), internationally on average, were expected to have been taught to nearly all students. Four of the comparison countries, Italy, Japan, Korea, and Singapore, reported that at least 10 of the 11 algebra topics (91 percent ore more) were intended to be taught to at least 90 percent of the students.

In the United States overall, 93 percent of the mathematics topics – compared with the international average of 75 percent – were intended to be taught to 90 percent or more of the students. This relatively high level of coverage resulted from the inclusion of 100 percent of the topics in fractions and number sense, measurement, and data representation, analysis, and probability, and more than 80 percent of the topics in geometry and algebra. These results are supported by research based on TIMSS data from 1995 that shows that the U.S. is one of a number of countries whose mathematics curricula cover many topics each year and are comparatively more diverse than the curricula of many countries whose curricula are more focused.[8]

Benchmarking participants generally resembled the United States in topic coverage in the intended curriculum, although there were differences, particularly among the districts and consortia. With Connecticut the sole exception, all Benchmarking jurisdictions reported that at least 88 percent of the fractions and number sense topics were included in the curriculum for almost all students. Data representation, analysis, and probability was included in the curriculum for almost all students in almost all Benchmarking jurisdictions, but the coverage of geometry and algebra was much more variable. Among states the percentage of geometry topics intended for almost all students ranged from 54 percent in Idaho to 100 percent in Pennsylvania, and among districts and consortia from 46 percent in Chicago to 85 percent in First in the World, Jersey City, Miami-Dade, Montgomery County, and Naperville. Among states the percentage of algebra topics included ranged from 55 percent in Massachusetts and Missouri to 100 percent in Illinois and Pennsylvania, and among districts and consortia from just nine percent in Chicago to 91 percent in the Delaware Science Coalition, First in the World, and Miami-Dade.

It should be noted that some countries reported having different curricula or different levels of curriculum for different groups of students, as detailed in Exhibit 5.14. Not surprisingly, then, these countries often reported that about half, only the more able (25 percent), or the top 10 percent of students were expected to have been taught substantial percentages of the topics, in particular those in geometry and algebra. The two comparison countries with the lowest percentages of topics overall intended to be taught to nearly all students have differentiated curricula (England and the Netherlands). It should also be noted that if content within a topic area required different responses, coordinators from participating entities chose the response that best represented the entire topic area and noted the discrepancy (see Exhibit A.8 in the appendix for details).

8 Schmidt, W.H., McKnight, C.C., Valverde, G.A., Houang, R.T., and Wiley, D.E. (1997), *Many Visions, Many Aims Volume 1: A Cross-National Investigation of Curricular Intentions in School Mathematics*, Dordrecht, the Netherlands: Kluwer Academic Publishers.

Exhibit 5.18 Mathematics Topics Included in the TIMSS Questionnaires

Fractions and Number Sense

- ■ Whole numbers - including place values, factorization and operations (+, -, x, ÷)
- ■ Understanding and representing common fractions
- ■ Computations with common fractions
- ■ Understanding and representing decimal fractions
- ■ Computations with decimal fractions
- ■ Relationships between common and decimal fractions, ordering of fractions
- ■ Rounding whole numbers and decimal fractions
- ■ Estimating the results of computations
- ■ Number lines
- ◆ Whole number powers of integers
- ■ Computations with percentages and problems involving percentages
- ■ Simple computations with negative numbers
- ■ Square roots (of perfect squares less than 144), small integer exponents
- ◆ Prime factors, highest common factor, lowest common multiple, rules for divisibility
- ◆ Sets, subsets, union, intersection, Venn diagrams
- ◆ Rate problems
- ■ Concepts of ratio and proportion; ratio and proportion problems

Measurement

- ■ Units of measurement; standard metric units
- ■ Reading measurement instruments
- ■ Estimates of measurement; accuracy of measurement
- ◆ Conversions of units between measurement systems
- ■ Perimeter and area of simple shapes – triangles, rectangles and circles
- ■ Perimeter and area of combined shapes
- ■ Volume of rectangular solids – i.e., Volume = length x width x height
- ◆ Volume of other solids (e.g., pyramids, cylinders, cones, spheres)
- ◆ Computing with measurements (+, -, x, ÷)
- ■ Scales applied to maps and models

Data Representation, Analysis, and Probability

- ◆ Collecting and graphing data from a survey
- ■ Representation and interpretation of data in graphs, charts, and tables
- ■ Arithmetic mean
- ◆ Median and mode
- ■ Simple probabilities – understanding and calculations

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

■ Topics included in the curriculum and teacher questionnaires (intended and implemented curriculum).

◆ Topics also included in the curriculum questionnaire (intended curriculum).

Geometry

- ■ Cartesian coordinates of points in a plane
- ■ Coordinates of points on a given straight line
- ■ Simple two dimensional geometry – angles on a straight line, parallel lines, triangles and quadrilaterals
- ■ Congruence and similarity
- ◆ Angles – (acute, right, supplementary, etc.)
- ◆ Pythagorean theorem (without proof)
- ■ Symmetry and transformations (reflection and rotation)
- ■ Visualization of three-dimensional shapes
- ◆ Geometric constructions with straight-edge and compass
- ◆ Regular polygons and their properties – names (e.g., hexagon and octagon), sum of angles, etc.
- ◆ Proofs (formal deductive demonstrations of geometric relationships)
- ◆ Sine, cosine, and tangent in right-angle triangles
- ◆ Nets of solids

Algebra

- ■ Number patterns and simple relations
- ◆ Writing expressions for general terms in number pattern sequence
- ◆ Translating from verbal descriptions to symbolic expressions
- ■ Simple algebraic expressions
- ◆ Evaluating simple algebraic expressions by substitution of given value of variables
- ■ Representing situations algebraically; formulas
- ■ Solving simple equations
- ■ Solving simple inequalities
- ◆ Solving simultaneous equations in two variables
- ◆ Interpreting linear relations
- ◆ Using the graph of a relationship to interpolate/extrapolate

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

■ Topics included in the curriculum and teacher questionnaires (intended and implemented curriculum).

◆ Topics also included in the curriculum questionnaire (intended curriculum).

	Percentage of Topics Intended to Be Taught to All or Almost All (at least 90%) Students					
	Overall	Fractions and Number Sense	Measurement	Data Representation, Analysis, and Probability	Geometry	Algebra
Countries						
United States	93	100	100	100	85	82
Belgium (Flemish)	80	100	90	80	62	64
Canada	82	94	90	100	77	55
Chinese Taipei	59	82	50	40	46	55
Czech Republic	77	94	90	80	69	45
England	25	29	30	40	23	9
Hong Kong, SAR	79	94	80	40	77	73
Italy	91	100	80	80	92	91
Japan	89	82	100	80	85	100
Korea, Rep. of	80	82	100	80	54	91
Netherlands	46	53	40	60	54	27
Russian Federation	75	88	60	100	62	73
Singapore	89	94	100	80	77	91
States						
Connecticut	73	76	80	100	62	64
Idaho	73	88	70	100	54	64
Illinois	89	94	80	100	77	100
Indiana	84	88	90	100	69	82
Maryland	86	100	90	100	77	64
Massachusetts	82	94	100	100	69	55
Michigan	80	94	60	100	77	73
Missouri	80	100	90	100	62	55
North Carolina	88	100	90	100	77	73
Oregon	82	88	90	100	69	73
Pennsylvania	100	100	100	100	100	100
South Carolina	89	88	90	100	92	82
Texas	89	94	100	100	85	73
Districts and Consortia						
Academy School Dist. #20, CO [1]	–	–	–	–	–	–
Chicago Public Schools, IL	61	88	90	60	46	9
Delaware Science Coalition, DE	86	88	90	100	69	91
First in the World Consort., IL	95	100	100	100	85	91
Fremont/Lincoln/WestSide PS, NE	91	100	100	100	77	82
Guilford County, NC	89	100	90	100	77	82
Jersey City Public Schools, NJ	89	94	100	100	85	73
Miami-Dade County PS, FL	93	94	100	100	85	91
Michigan Invitational Group, MI	84	94	70	100	77	82
Montgomery County, MD	84	88	80	100	85	73
Naperville Sch. Dist. #203, IL	91	100	90	100	85	82
Project SMART Consortium, OH	84	94	80	100	69	82
Rochester City Sch. Dist., NY	91	100	100	100	77	82
SW Math/Sci. Collaborative, PA [2]	–	–	–	–	–	–
International Avg. (All Countries)	75	86	83	60	67	68

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

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 curricula analysis that showed that states in the U.S. intended to cover far more than the average number of mathematics topics commonly covered internationally, and that topics in the U.S. were often added as students progressed through school at the same rate as in other countries but without dropping other topics that had been taught previously.[9]

Instructional coverage was high for the measurement topics presented in Exhibit 5.21. At least 87 percent of students, on average internationally, were taught six of the seven topics. The topic with the lowest coverage was "scales applied to maps and models," with an international average of 77 percent. Two topics, "units of measurement; standards metric units" and "perimeter and area of simple shapes – triangles, rectangles, and circles," were taught to 96 percent of students on average internationally. The United States as a whole and most of the Benchmarking jurisdictions reported percentages above the international average for a majority of the topics. While teachers in Jersey City reported that all students were taught all measurement topics, teachers in the Fremont/Lincoln/Westside Public Schools reported percentages of students below the international averages for six of the seven measurement topics.

As indicated by Exhibit R2.8 in the reference section, measurement topics received less emphasis in the eighth grade than did fractions and number sense topics (see Exhibit R2.7). As with fractions and number sense, substantial percentages of students internationally had studied the measurement topics before the eighth grade, whereas among the Benchmarking jurisdictions, greater percentages began or continued to study them during the eighth grade. Montgomery County was the only jurisdiction reporting a greater percentage of students than internationally (22 percent, on average) who were taught more than 80 percent of the measurement topics before the eighth grade and not again during the eighth grade.

Corresponding to the reports for the intended curricula, teachers reported lower average percentages internationally across the data representation, analysis, and probability topics, shown in Exhibit 5.22. Teachers were asked about three topics in this content area, including "representation and interpretation of data in graphs, charts, and tables" and "arithmetic mean." While the international average for students who were taught these two topics was 75 and 70 percent, respectively, all Benchmarking jurisdictions and the United States overall reported that at least 88 percent of their students were taught each of these topics. The international average percentage of students taught the other topic in this content area, "simple probabilities – understanding and calculations," was

9 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.

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 the algebra topics, as shown in Exhibit 5.24. More than 85 percent of students internationally, in the U.S. overall, and in all the Benchmarking entities were taught each of these topics, with the exception of "solving simple inequalities," which had an international average of 66 percent. The percentages of students taught the algebra topics in the United States and in the Benchmarking entities generally exceeded the international averages. In North Carolina, the Academy School District, Jersey City, Montgomery County, and Naperville, 90 percent or more of the students were taught each of the algebra topics.

For many jurisdictions, teachers reported presenting algebra topics during the eighth grade for substantial percentages of students (see Exhibit R2.11). Teachers in all Benchmarking jurisdictions except Rochester reported that at least half the students were taught more than half the topics for more than five periods during the eighth grade. Similarly, teachers in all Benchmarking jurisdictions reported that less than 10 percent of the students had been taught half or more of the topics before the eighth grade only. In contrast, 85 percent of the students in Chinese Taipei and 35 percent in Japan were taught the topics before the eighth grade.

Exhibits 5.20-5.24

Exhibit 5.20 Percentages of Students Taught Fractions and Number Sense Topics*

	Whole numbers - including place values, factorization and operations (+, –, x, ÷)	Understanding and representing common fractions	Computations with common fractions	Understanding and representing decimal fractions	Computations with decimal fractions	Relationships between common and decimal fractions, ordering of fractions	Rounding whole numbers and decimal fractions
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)

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

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.

	Estimating the results of computations	Number lines	Computations with percentages and problems involving percentages	Simple computations with negative numbers	Square roots (of perfect squares less than 144), small integer exponents	Concepts of ratio and proportions; ratio and proportion problems
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)
Canada	r 100 (0.3)	r 100 (0.1)	r 98 (0.8)	r 97 (1.6)	r 96 (1.2)	r 95 (1.3)
Chinese Taipei	95 (2.0)	99 (0.8)	94 (1.9)	100 (0.3)	96 (1.6)	90 (2.6)
Czech Republic	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.2)
England	s 96 (1.7)	s 97 (1.3)	s 96 (1.3)	s 96 (1.3)	s 87 (2.0)	s 79 (2.7)
Hong Kong, SAR	r 94 (2.2)	92 (2.6)	95 (1.9)	99 (0.8)	98 (1.2)	91 (2.5)
Italy	94 (2.0)	99 (0.8)	96 (1.6)	98 (1.1)	100 (0.0)	99 (0.8)
Japan	r 89 (3.3)	100 (0.0)	100 (0.0)	100 (0.0)	14 (3.0)	97 (1.6)
Korea, Rep. of	89 (2.5)	98 (1.2)	92 (2.0)	95 (1.8)	64 (4.1)	90 (2.3)
Netherlands	r 99 (1.0)	99 (0.9)	98 (1.2)	98 (1.4)	92 (3.1)	r 80 (5.8)
Russian Federation	– –	– –	– –	– –	– –	– –
Singapore	100 (0.4)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
States						
Connecticut	r 100 (0.0)	r 99 (1.2)	r 99 (1.4)	r 91 (3.3)	r 84 (5.1)	r 93 (3.5)
Idaho	r 99 (0.9)	r 96 (2.2)	r 94 (2.5)	r 92 (3.5)	r 80 (3.9)	r 89 (3.5)
Illinois	100 (0.0)	99 (0.1)	96 (2.0)	97 (1.6)	82 (5.1)	97 (1.8)
Indiana	100 (0.0)	99 (1.0)	94 (2.8)	95 (1.6)	76 (6.6)	95 (2.2)
Maryland	r 100 (0.0)	r 100 (0.0)	r 98 (1.1)	r 93 (3.2)	r 73 (5.1)	r 97 (1.6)
Massachusetts	100 (0.0)	r 99 (0.2)	r 97 (1.9)	97 (1.8)	r 74 (4.9)	r 89 (3.3)
Michigan	100 (0.0)	100 (0.0)	97 (2.1)	99 (0.7)	r 80 (3.6)	92 (3.8)
Missouri	100 (0.0)	100 (0.4)	93 (3.8)	98 (2.0)	77 (6.1)	93 (4.0)
North Carolina	100 (0.0)	100 (0.0)	100 (0.0)	99 (1.1)	92 (2.9)	98 (1.7)
Oregon	100 (0.0)	100 (0.0)	91 (4.4)	98 (1.1)	81 (5.5)	89 (3.9)
Pennsylvania	100 (0.0)	100 (0.0)	94 (2.2)	98 (0.9)	89 (2.6)	92 (2.3)
South Carolina	100 (0.0)	99 (0.9)	97 (2.0)	98 (1.3)	97 (1.6)	96 (2.3)
Texas	100 (0.2)	100 (0.1)	98 (1.3)	98 (1.3)	97 (1.6)	97 (2.0)
Districts and Consortia						
Academy School Dist. #20, CO	100 (0.0)	100 (0.0)	96 (0.2)	100 (0.0)	92 (0.2)	93 (0.3)
Chicago Public Schools, IL	100 (0.0)	100 (0.0)	93 (4.8)	96 (3.6)	90 (6.0)	98 (2.0)
Delaware Science Coalition, DE	r 97 (2.4)	r 98 (2.0)	r 92 (0.9)	r 99 (0.7)	r 77 (6.6)	r 87 (5.2)
First in the World Consort., IL	r 100 (0.0)	r 100 (0.0)	r 98 (2.4)	r 100 (0.0)	r 94 (2.9)	r 97 (2.7)
Fremont/Lincoln/WestSide PS, NE	100 (0.0)	100 (0.0)	95 (5.1)	100 (0.0)	93 (1.8)	r 86 (8.0)
Guilford County, NC	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	97 (2.3)	98 (2.4)
Jersey City Public Schools, NJ	r 100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	r 100 (0.0)	100 (0.0)
Miami-Dade County PS, FL	s 100 (0.0)	s 100 (0.0)	s 94 (3.2)	s 94 (3.6)	s 81 (6.2)	s 91 (4.7)
Michigan Invitational Group, MI	100 (0.0)	100 (0.0)	100 (0.0)	98 (2.2)	83 (6.9)	97 (2.0)
Montgomery County, MD	s 100 (0.0)	s 100 (0.0)	s 100 (0.1)	s 100 (0.0)	s 100 (0.2)	s 98 (2.0)
Naperville Sch. Dist. #203, IL	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	96 (1.8)	100 (0.0)
Project SMART Consortium, OH	100 (0.0)	94 (4.3)	98 (1.4)	91 (5.1)	83 (4.0)	97 (2.6)
Rochester City Sch. Dist., NY	100 (0.0)	100 (0.0)	92 (3.1)	98 (1.7)	49 (3.9)	90 (4.1)
SW Math/Sci. Collaborative, PA	100 (0.0)	100 (0.0)	90 (5.4)	91 (3.5)	86 (4.8)	82 (6.4)
International Avg. (All Countries)	93 (0.4)	92 (0.3)	95 (0.3)	97 (0.2)	83 (0.4)	87 (0.4)

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

Exhibit 5.21 Percentages of Students Taught Measurement Topics*

	Units of measurement, standard metric units	Reading measurement instruments	Estimates of measurement, accuracy of measurement	Perimeter and area of simple shapes – triangles, rectangles, and circles	Perimeter and area of combined shapes	Volume of rectangular solids – i.e., volume= length × width × height	Scales applied to maps and models
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)
Massachusetts	r 95 (2.2)	r 94 (2.7)	r 89 (4.3)	r 93 (3.3)	r 89 (3.5)	r 75 (6.3)	r 82 (5.5)
Michigan	98 (1.3)	r 98 (1.3)	r 97 (1.4)	96 (1.8)	r 91 (2.7)	91 (3.0)	r 89 (4.4)
Missouri	94 (4.4)	96 (3.0)	r 89 (4.6)	99 (0.9)	84 (4.6)	76 (4.5)	89 (4.4)
North Carolina	95 (1.8)	r 92 (2.4)	r 86 (3.2)	98 (1.4)	91 (3.0)	90 (3.9)	r 92 (3.1)
Oregon	100 (0.4)	96 (1.1)	96 (1.8)	97 (1.5)	90 (3.6)	82 (3.6)	88 (3.8)
Pennsylvania	96 (2.1)	86 (6.4)	r 94 (2.9)	97 (1.4)	89 (3.2)	74 (7.0)	92 (2.3)
South Carolina	98 (1.6)	100 (0.0)	98 (1.6)	98 (1.6)	93 (2.7)	92 (2.8)	97 (1.8)
Texas	98 (0.2)	98 (1.6)	97 (1.9)	100 (0.0)	95 (2.4)	96 (2.2)	94 (3.4)
Districts and Consortia							
Academy School Dist. #20, CO	92 (0.2)	87 (0.3)	79 (0.3)	97 (0.2)	89 (0.3)	76 (0.3)	85 (0.3)
Chicago Public Schools, IL	97 (2.7)	97 (2.7)	100 (0.0)	100 (0.0)	97 (2.6)	91 (5.3)	82 (8.8)
Delaware Science Coalition, DE	r 96 (2.9)	r 95 (3.5)	r 91 (3.1)	r 99 (0.7)	r 89 (2.7)	r 93 (3.3)	r 77 (5.7)
First in the World Consort., IL	r 96 (3.5)	r 96 (3.6)	r 91 (5.2)	r 95 (2.9)	r 94 (2.9)	r 92 (3.8)	r 98 (1.7)
Fremont/Lincoln/WestSide PS, NE	r 89 (6.7)	r 87 (6.7)	r 75 (6.7)	r 100 (0.0)	r 71 (6.4)	r 82 (3.5)	r 76 (9.5)
Guilford County, NC	96 (2.9)	93 (3.9)	93 (3.8)	92 (3.9)	91 (3.6)	91 (3.5)	86 (3.8)
Jersey City Public Schools, NJ	r 100 (0.0)	r 100 (0.0)	r 100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	r 100 (0.0)
Miami-Dade County PS, FL	s 92 (4.4)	s 83 (6.9)	s 82 (7.4)	s 99 (1.5)	s 95 (3.4)	s 89 (5.2)	s 68 (8.4)
Michigan Invitational Group, MI	95 (1.7)	100 (0.0)	100 (0.0)	98 (1.7)	98 (1.7)	96 (2.8)	91 (4.1)
Montgomery County, MD	s 98 (0.5)	s 99 (0.5)	s 96 (0.9)	s 100 (0.0)	s 99 (0.6)	s 94 (2.6)	s 97 (2.9)
Naperville Sch. Dist. #203, IL	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	93 (1.1)
Project SMART Consortium, OH	97 (0.9)	95 (2.1)	95 (1.6)	97 (3.4)	96 (2.9)	94 (4.3)	97 (2.7)
Rochester City Sch. Dist., NY	100 (0.0)	93 (2.0)	r 92 (2.2)	89 (1.5)	71 (3.2)	66 (4.4)	88 (3.7)
SW Math/Sci. Collaborative, PA	94 (4.4)	92 (5.0)	92 (4.2)	95 (2.7)	86 (4.1)	76 (6.4)	79 (6.9)
International Avg. (All Countries)	96 (0.3)	89 (0.5)	87 (0.5)	96 (0.3)	89 (0.5)	87 (0.5)	77 (0.6)

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

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.

		Representation and interpretation of data in graphs, charts, and tables		Arithmetic mean		Simple probabilities – understanding and calculations
Countries						
United States		96 (1.2)		93 (1.6)		79 (2.3)
Belgium (Flemish)		86 (4.1)		93 (2.1)	r	24 (3.0)
Canada	r	91 (2.4)	r	81 (2.7)	r	72 (3.3)
Chinese Taipei		11 (2.3)		12 (2.7)		4 (1.6)
Czech Republic		49 (5.6)		88 (3.4)		7 (2.8)
England	s	99 (0.4)	s	93 (2.3)	s	90 (2.4)
Hong Kong, SAR		65 (4.5)		30 (4.1)		10 (2.8)
Italy		84 (3.0)		62 (3.6)		49 (3.8)
Japan		43 (4.7)		38 (4.5)		3 (1.4)
Korea, Rep. of		95 (1.7)		78 (3.2)		99 (0.6)
Netherlands		87 (4.7)		77 (5.7)	r	46 (6.5)
Russian Federation		– –		– –		– –
Singapore		97 (1.7)		88 (3.2)	s	17 (4.2)
States						
Connecticut	r	100 (0.0)	s	98 (1.6)	s	81 (5.0)
Idaho	r	93 (2.8)	r	90 (3.7)	r	77 (5.6)
Illinois		99 (1.4)		98 (1.2)		82 (4.3)
Indiana		93 (6.4)		94 (3.7)		83 (4.9)
Maryland	r	100 (0.4)	r	97 (0.8)	r	82 (3.8)
Massachusetts	r	95 (2.0)	r	95 (2.1)	r	84 (2.8)
Michigan		98 (1.7)	r	97 (1.6)	r	87 (2.9)
Missouri		99 (1.4)		96 (2.8)		76 (5.0)
North Carolina		91 (3.4)		90 (4.0)		69 (6.8)
Oregon		98 (1.2)		96 (1.4)		92 (2.7)
Pennsylvania		92 (2.4)		92 (2.9)		79 (6.0)
South Carolina		100 (0.0)		97 (2.1)		97 (1.8)
Texas		97 (1.9)	r	98 (1.3)		100 (0.3)
Districts and Consortia						
Academy School Dist. #20, CO		98 (0.2)		96 (0.2)		83 (0.3)
Chicago Public Schools, IL		100 (0.0)		95 (3.6)		94 (3.4)
Delaware Science Coalition, DE	r	95 (3.6)	r	94 (3.2)	r	89 (4.7)
First in the World Consort., IL	r	100 (0.0)	r	100 (0.0)	r	73 (7.4)
Fremont/Lincoln/WestSide PS, NE		97 (0.2)		88 (2.9)		79 (7.5)
Guilford County, NC		97 (2.2)		88 (3.2)		87 (3.7)
Jersey City Public Schools, NJ		100 (0.0)		100 (0.0)		100 (0.0)
Miami-Dade County PS, FL	s	95 (3.8)	s	94 (4.1)	s	80 (7.5)
Michigan Invitational Group, MI		98 (2.2)		93 (6.3)		94 (4.3)
Montgomery County, MD	s	96 (3.2)	s	96 (2.6)	s	92 (3.3)
Naperville Sch. Dist. #203, IL		100 (0.0)		100 (0.0)		100 (0.0)
Project SMART Consortium, OH		95 (3.1)		97 (2.6)		89 (3.9)
Rochester City Sch. Dist., NY		91 (1.8)		88 (3.2)		85 (1.8)
SW Math/Sci. Collaborative, PA		99 (1.0)		89 (4.8)	r	86 (5.3)
International Avg. (All Countries)		75 (0.6)		70 (0.6)		43 (0.6)

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

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.

Exhibit 5.23 Percentages of Students Taught Geometry Topics*

	Cartesian coordinates of points in a plane	Coordinates of points on a given straight line	Simple two dimensional geometry – angles on a straight line, parallel lines, triangles and quadrilaterals	Congruence and similarity	Symmetry and transformations (reflection and rotation)	Visualization of three-dimensional shapes
Countries						
United States	r 83 (2.4)	82 (2.5)	89 (2.0)	r 80 (2.6)	r 62 (2.9)	r 61 (2.7)
Belgium (Flemish)	78 (3.0)	r 54 (3.9)	91 (4.1)	79 (2.5)	87 (2.9)	57 (4.0)
Canada	r 81 (2.5)	r 84 (2.6)	r 94 (1.8)	r 84 (2.7)	r 78 (2.4)	r 63 (3.2)
Chinese Taipei	100 (0.0)	99 (0.9)	78 (3.5)	60 (4.3)	29 (3.7)	42 (4.1)
Czech Republic	94 (2.6)	88 (4.9)	100 (0.0)	86 (3.7)	98 (1.1)	73 (5.2)
England	s 94 (1.3)	s 79 (3.1)	s 95 (1.6)	s 54 (4.1)	s 88 (2.6)	s 75 (3.0)
Hong Kong, SAR	98 (1.3)	95 (1.9)	97 (1.6)	89 (2.8)	r 31 (4.6)	r 29 (4.7)
Italy	93 (1.9)	79 (3.0)	98 (1.2)	91 (2.0)	65 (3.8)	89 (2.4)
Japan	100 (0.0)	99 (1.0)	97 (1.4)	98 (1.2)	98 (1.3)	82 (2.9)
Korea, Rep. of	98 (1.1)	99 (0.7)	99 (0.7)	99 (0.7)	71 (3.7)	52 (4.2)
Netherlands	r 97 (1.5)	r 97 (1.5)	98 (1.1)	49 (5.8)	78 (5.3)	r 60 (6.2)
Russian Federation	– –	– –	– –	– –	– –	– –
Singapore	91 (2.6)	93 (2.4)	96 (1.8)	96 (1.9)	84 (3.4)	r 72 (4.4)
States						
Connecticut	s 71 (6.1)	r 82 (5.6)	r 85 (4.0)	r 67 (6.6)	r 60 (6.0)	s 56 (6.9)
Idaho	r 64 (5.2)	r 71 (5.3)	r 81 (6.1)	r 71 (5.1)	s 57 (5.4)	s 50 (7.8)
Illinois	89 (3.7)	87 (4.1)	96 (2.4)	88 (4.2)	70 (5.5)	r 80 (5.2)
Indiana	77 (5.6)	82 (3.4)	85 (4.9)	75 (6.1)	r 54 (6.6)	r 54 (6.8)
Maryland	r 83 (3.8)	r 76 (4.0)	r 80 (5.3)	r 68 (5.7)	r 59 (6.7)	r 51 (5.3)
Massachusetts	r 88 (3.7)	r 77 (5.0)	r 84 (4.7)	r 63 (5.6)	r 59 (6.1)	r 57 (7.7)
Michigan	r 86 (3.3)	r 92 (3.0)	r 96 (1.7)	r 88 (3.4)	r 78 (5.2)	r 77 (5.0)
Missouri	83 (3.8)	75 (4.8)	91 (4.5)	84 (4.3)	61 (5.4)	54 (6.6)
North Carolina	94 (2.5)	92 (2.9)	93 (2.5)	90 (3.0)	77 (4.5)	74 (5.6)
Oregon	85 (5.2)	86 (4.6)	92 (2.4)	87 (4.2)	75 (5.5)	r 61 (6.6)
Pennsylvania	78 (5.8)	76 (6.2)	94 (1.7)	82 (5.0)	r 57 (7.5)	r 58 (9.0)
South Carolina	90 (3.4)	93 (2.0)	93 (2.6)	90 (4.0)	82 (4.3)	r 82 (5.1)
Texas	96 (2.1)	91 (4.1)	96 (2.1)	98 (1.7)	97 (1.7)	87 (4.6)
Districts and Consortia						
Academy School Dist. #20, CO	87 (0.3)	82 (0.3)	64 (0.4)	70 (0.4)	47 (0.4)	41 (0.4)
Chicago Public Schools, IL	86 (6.7)	89 (5.6)	96 (3.4)	95 (4.8)	70 (9.0)	78 (6.7)
Delaware Science Coalition, DE	r 84 (4.7)	r 83 (4.8)	r 87 (4.5)	r 79 (5.7)	r 72 (6.4)	r 61 (7.4)
First in the World Consort., IL	99 (1.5)	99 (1.5)	96 (2.8)	93 (3.2)	70 (3.7)	75 (4.8)
Fremont/Lincoln/WestSide PS, NE	97 (2.8)	r 94 (4.3)	r 97 (3.1)	r 74 (9.7)	r 45 (8.7)	r 56 (8.8)
Guilford County, NC	88 (4.7)	92 (3.1)	90 (4.0)	92 (3.1)	r 83 (5.9)	r 89 (4.8)
Jersey City Public Schools, NJ	r 95 (0.4)	97 (0.3)	97 (0.3)	r 98 (1.6)	100 (0.0)	94 (2.8)
Miami-Dade County PS, FL	s 66 (9.6)	s 74 (10.9)	s 87 (5.8)	s 68 (10.0)	s 24 (8.8)	s 32 (10.9)
Michigan Invitational Group, MI	87 (5.2)	93 (2.2)	98 (0.1)	87 (6.9)	72 (7.6)	72 (6.2)
Montgomery County, MD	s 94 (3.9)	s 97 (2.7)	s 100 (0.0)	s 100 (0.0)	s 97 (0.8)	s 92 (3.9)
Naperville Sch. Dist. #203, IL	100 (0.0)	100 (0.0)	97 (2.6)	97 (2.6)	93 (2.8)	90 (2.8)
Project SMART Consortium, OH	72 (5.1)	84 (6.0)	96 (2.9)	89 (4.3)	65 (5.8)	77 (5.9)
Rochester City Sch. Dist., NY	98 (1.7)	r 78 (2.7)	98 (1.7)	r 67 (5.3)	24 (5.7)	r 44 (4.6)
SW Math/Sci. Collaborative, PA	79 (6.3)	78 (7.6)	80 (5.6)	82 (5.1)	r 57 (7.3)	r 70 (6.6)
International Avg. (All Countries)	85 (0.4)	84 (0.5)	95 (0.3)	72 (0.6)	63 (0.6)	57 (0.7)

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

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.

Exhibit 5.24 Percentages of Students Taught Algebra Topics*

		Number patterns and simple relations		Simple algebraic expressions		Representing situations algebraically; formulas		Solving simple equations		Solving simple inequalities
Countries										
United States		97 (1.1)		98 (0.9)		96 (1.1)		98 (0.6)		83 (2.3)
Belgium (Flemish)	r	86 (2.9)		84 (1.9)		84 (3.1)		85 (2.8)	r	9 (2.1)
Canada	r	98 (1.0)	r	98 (0.8)	r	92 (2.1)	r	94 (2.3)	r	50 (3.2)
Chinese Taipei		92 (2.5)		99 (0.8)		99 (0.8)		98 (1.2)		43 (4.2)
Czech Republic	r	99 (1.2)		100 (0.0)		97 (1.9)		96 (2.0)		32 (5.2)
England	s	98 (0.6)	s	96 (1.1)	s	89 (1.8)	s	93 (1.5)	s	39 (3.7)
Hong Kong, SAR	r	87 (3.0)		100 (0.0)		100 (0.0)		100 (0.0)		27 (4.0)
Italy		98 (1.2)		100 (0.4)		95 (1.7)		95 (1.7)		27 (2.9)
Japan	r	94 (2.4)		100 (0.0)		98 (1.2)		100 (0.0)		99 (0.7)
Korea, Rep. of		95 (1.3)		99 (0.7)		96 (1.6)		99 (0.7)		99 (1.0)
Netherlands		87 (4.9)	r	86 (4.9)		81 (6.0)		76 (5.3)	r	39 (6.4)
Russian Federation		– –		– –		– –		– –		– –
Singapore		98 (1.4)		100 (0.0)		100 (0.0)		100 (0.0)		93 (2.3)
States										
Connecticut	r	92 (2.8)	r	95 (2.5)	r	95 (2.4)	r	95 (2.5)	r	79 (4.3)
Idaho	r	88 (5.3)	r	88 (5.3)	r	86 (5.5)	r	93 (3.5)	r	73 (7.0)
Illinois		100 (0.4)		99 (0.1)		95 (2.1)		100 (0.0)		86 (3.3)
Indiana		95 (2.6)		96 (1.7)		92 (2.6)		95 (2.0)		73 (7.2)
Maryland	r	91 (3.0)	r	95 (2.5)	r	91 (3.4)	r	95 (2.6)	r	73 (4.2)
Massachusetts		99 (1.1)		99 (0.7)	r	92 (3.0)	r	94 (3.0)	r	78 (4.2)
Michigan		99 (0.7)		99 (1.0)		98 (1.1)		96 (1.5)	r	84 (3.9)
Missouri		100 (0.2)		99 (1.0)		99 (0.4)		94 (3.3)		80 (4.3)
North Carolina		99 (1.1)		100 (0.0)		99 (1.4)		100 (0.0)	r	90 (3.2)
Oregon		99 (0.8)		100 (0.3)		93 (2.4)		99 (0.3)		84 (4.2)
Pennsylvania		97 (1.5)		98 (1.5)		97 (1.5)		99 (1.0)		86 (2.0)
South Carolina		97 (1.7)		97 (1.7)		96 (2.5)		97 (1.7)		88 (4.3)
Texas		100 (0.3)		96 (2.3)		98 (1.4)		98 (1.5)		87 (4.0)
Districts and Consortia										
Academy School Dist. #20, CO		100 (0.0)		98 (0.1)		96 (0.2)		100 (0.0)		94 (0.1)
Chicago Public Schools, IL		98 (2.4)		100 (0.0)		97 (2.7)		100 (0.0)		87 (5.8)
Delaware Science Coalition, DE	r	95 (3.4)	r	95 (3.4)	r	91 (4.8)	r	95 (3.3)	r	74 (6.6)
First in the World Consort., IL	r	100 (0.0)	r	100 (0.0)	r	100 (0.0)	r	100 (0.0)	r	87 (4.1)
Fremont/Lincoln/WestSide PS, NE		100 (0.0)		95 (0.2)		97 (3.0)		100 (0.0)		69 (10.3)
Guilford County, NC		100 (0.0)		100 (0.0)		98 (1.5)		100 (0.0)		89 (5.0)
Jersey City Public Schools, NJ	r	100 (0.0)	r	100 (0.0)	r	100 (0.0)	r	100 (0.0)	r	96 (2.3)
Miami-Dade County PS, FL	s	93 (4.4)	s	93 (4.1)	s	95 (3.3)	s	90 (6.9)	s	78 (10.1)
Michigan Invitational Group, MI		98 (1.5)		98 (2.2)		98 (2.2)		100 (0.0)		75 (7.5)
Montgomery County, MD	s	96 (3.2)	s	94 (3.3)	s	95 (3.3)	s	95 (3.2)	s	92 (4.3)
Naperville Sch. Dist. #203, IL		100 (0.0)		100 (0.0)		100 (0.0)		100 (0.0)		94 (3.6)
Project SMART Consortium, OH		97 (3.4)		92 (4.8)		97 (2.8)		94 (4.4)		79 (7.4)
Rochester City Sch. Dist., NY		100 (0.0)		93 (2.0)		93 (2.0)		100 (0.0)		63 (4.8)
SW Math/Sci. Collaborative, PA		100 (0.2)		99 (1.0)		97 (2.1)		98 (1.7)		75 (5.1)
International Avg. (All Countries)		88 (0.5)		94 (0.4)		90 (0.4)		94 (0.3)		66 (0.5)

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

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.

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.