


TIMSS 1999 BENCHMARKING

Introduction





Originally conducted in 1994-1995,⁵ TIMSS compared the mathematics and science achievement of students in 41 countries at five grade levels. Using questionnaires, videotapes, and analyses of curriculum materials, TIMSS also investigated the contexts for learning mathematics and science in the participating countries. TIMSS results, which were first reported in 1996, have stirred debate, spurred reform efforts, and provided important information to educators and decision makers around the world. The findings from TIMSS 1999, a follow-up to the earlier study, add to the richness of the TIMSS data and their potential to have an impact on policy and practice in mathematics and science teaching and learning.

Twenty-seven jurisdictions from all across the nation, including 13 states and 14 districts or consortia, participated in the Benchmarking Study (see Exhibit 1). To conduct the Benchmarking Study, the TIMSS 1999 assessments were administered to representative samples of eighth-grade students in each of the participating districts and states in the spring of 1999, at the same time and following the same guidelines as those established for the 38 countries.


In addition to testing achievement in mathematics and science, the TIMSS 1999 Benchmarking Study involved administering a broad array of questionnaires. TIMSS collected extensive information from students, teachers, and school principals as well as system-level information from each participating entity about mathematics and science curricula, instruction, home contexts, and school characteristics and policies. The TIMSS data provide an abundance of information making it possible to analyze differences in current levels of performance in relation to a wide variety of factors associated with classroom, school, and national contexts within which education takes place.

Why Did Countries, States, Districts, and Consortia Participate?

The decision to participate in any cycle of TIMSS is made by each country according to its own data needs and resources. Similarly, the states, districts, and consortia that participated in the Benchmarking Study decided to do so for various reasons.

Primarily, the Benchmarking participants are interested in building educational capacity and looking at their own situations in an international context as a way of improving mathematics and science teaching and learning in their jurisdictions. International assessments provide an excellent basis for gaining multiple perspectives on educational issues and

⁵ TIMSS was administered in the spring of 1995 in northern hemisphere countries and in the fall of 1994 in southern hemisphere countries, both at the end of the school year.




examining a variety of possible reasons for observed differences in achievement. While TIMSS helps to measure progress towards learning goals in mathematics and science, it is much more than an educational Olympics. It is a tool to help examine such questions as:

- How demanding are our curricula and expectations for student learning?
- Is our classroom instruction effective? Is the time provided for instruction being used efficiently?
- Are our teachers well prepared to teach science concepts? Can they help students understand science?
- Do our schools provide an environment that is safe and conducive to learning?

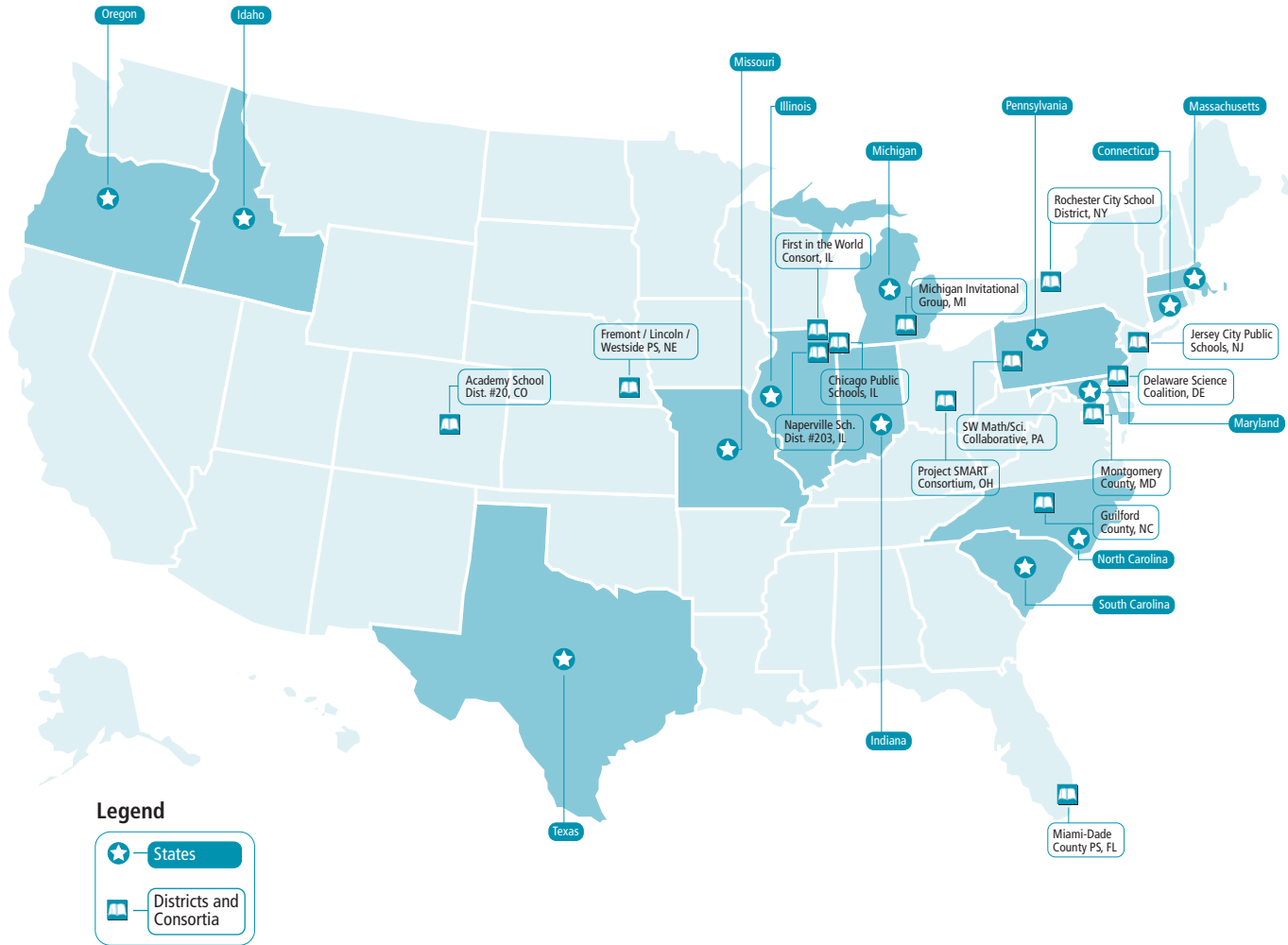
Unlike in many countries around the world where educational decision making is highly centralized, in the United States the opportunities to learn science derive from an educational system that operates through states and districts, allocating opportunities through schools and then through classrooms. Improving students' opportunities to learn requires examining every step of the educational system, including the curriculum, teacher quality, availability and appropriateness of resources, student motivation, instructional effectiveness, parental support, and school safety.

Which Countries, States, Districts, and Consortia Participated?



Project SMART Consortium. SMART (Science & Mathematics Achievement Required For Tomorrow) is a consortium of 30 diverse school districts in northeast Ohio committed to continuous improvement, long term systemic change, and improved student learning in science and mathematics in grades K-12. It is jointly funded by the Ohio Department of Education and the Martha Holden Jennings Foundation. The schools that participated in the project represent 17 of the 30 districts.

Southwest Pennsylvania Math and Science Collaborative. The Southwest Pennsylvania Math and Science Collaborative, established in 1994, coordinates efforts and focuses resources on strengthening math and science education in the entire southwest Pennsylvania workforce region that has Pittsburgh as its center. Committed to gathering and using good information that can help prepare its students to be productive citizens, the Collaborative is composed of all 118 “local control” public districts, as well as the parochial and private schools in the nine-county region. Several of these districts are working together in selecting exemplary materials, developing curriculum frameworks, and building sustained professional development strategies to strengthen math and science instruction.



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

The results for the 38 countries participating in TIMSS 1999, including those for the United States, were reported in December 2000 in two companion reports – the *TIMSS 1999 International Science Report* and the *TIMSS 1999 International Mathematics Report*.⁶ Performance in the United States relative to that of other nations was reported by the U.S. National Center for Education Statistics in *Pursuing Excellence*.⁷ The results for the United States in those reports, as well as in this volume and its companion mathematics report,⁸ were based on a nationally representative sample of eighth-grade students drawn in accordance with TIMSS guidelines for all participating countries.

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

For the most part, the U.S. TIMSS 1999 national sample was separate from the students assessed in each of the Benchmarking jurisdictions. Each Benchmarking participant had its own sample to provide comparisons with each of the TIMSS 1999 countries including the United States. In general, the Benchmarking samples were drawn in accordance with the TIMSS standards, and achievement results can be compared with confidence. Deviations from the guidelines are noted in the exhibits in the reports. The TIMSS 1999 sampling requirements and the outcomes of the sampling procedures for the participating countries and Benchmarking jurisdictions are described in Appendix A. Although taken collectively the Benchmarking participants are not representative of the United States, the effort was substantial in scope involving approximately 1,000 schools, 4,000 teachers, and 50,000 students.

⁶ Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., Gregory, K.D., Smith, T.A., Chrostowski, S.J., Garden, R.A., and O'Connor, K.M. (2000), *TIMSS*



How Was the TIMSS 1999 Benchmarking Study Conducted?

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

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

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

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

Funding for TIMSS 1999 was provided by the United States, the World Bank, and the participating countries. Within the United States, funding agencies included NCES, NSF, and OERI, the same group of organizations supporting major components of the TIMSS 1999 Benchmarking Study for states, districts, and consortia, including overall coordination as well as data analysis, reporting, and dissemination.


What Was the Nature of the Science Test?

The TIMSS curriculum frameworks developed for 1995 were also used for 1999. They describe the content dimensions for the TIMSS tests as well as the performance expectations (behaviors that might be expected of students in school science).⁹ Six content areas were covered in the TIMSS 1999 science test. These areas and the percentage of the test items devoted to each are earth science (15 percent), life science (27 percent), physics (27 percent), chemistry (14 percent), environmental and resource issues (nine percent), and scientific inquiry and the nature of science (eight percent). The performance expectations include understanding simple information (39 percent), understanding complex information (31 percent), theorizing, analyzing, and solving problems (19 percent), using tools, routine procedures, and science processes (seven percent), and investigating the natural world (four percent).

The test items were developed through a cooperative and iterative process involving the National Research Coordinators (NRCS) of the participating countries. All of the items were reviewed thoroughly by subject matter experts and field tested. Nearly all the TIMSS 1999 countries participated in field testing with nationally representative samples, and the NRCS had several opportunities to review the items and scoring criteria. The TIMSS 1999 science test contained 146 items representing a range of science topics and skills.

About one-fourth of the questions were in the free-response format, requiring students to generate and write their answers. These questions, some of which required extended responses, were allotted about one-third of the testing time. Responses to the free-response questions were evaluated to capture diagnostic information, and some were scored using procedures that permitted partial credit. Chapter 2 of this report contains 20 example items illustrating the range of science concepts and processes covered in the TIMSS 1999 test. Appendix D contains descriptions of the topics and skills assessed by each item.

⁹ Robitaille, D.F., McKnight, C.C., Schmidt, W.H., Britton, E.D., Raisen, S.A., and Nicol, C. (1993), *TIMSS Monograph No. 1: Curriculum Frameworks for Mathematics and Science*, Vancouver, BC: Pacific Educational Press.



Testing was designed so that no one student took all the items, which would have required more than three hours of testing time. Instead, the test was assembled in eight booklets, each requiring 90 minutes to complete. Each student took only one booklet, and the items were rotated through the booklets so that each item was answered by a representative sample of students.

How Does TIMSS 1999 Compare with NAEP?

The National Assessment of Educational Progress (NAEP) is an ongoing program that has reported the science achievement of U.S. students for some 30 years. TIMSS and NAEP were designed to serve different purposes, and this is evident in the types of assessment items as well as the content areas and topics covered in each assessment. TIMSS and NAEP both assess students at the eighth grade, and both tend to focus on science as it is generally presented in classrooms and textbooks. However, TIMSS is based on the curricula that students in the participating countries are likely to have encountered by the eighth grade, while NAEP is based on an expert consensus of what students in the United States should know and be able to do in science and other academic subjects at that grade. For example, TIMSS 1999 appears to place more emphasis on the physical sciences (physics and chemistry) than does NAEP, while NAEP appears to distribute its focus more equally among physical science, earth science, and life science.¹⁰

Whereas NAEP is designed to provide comparisons among and between states and the nation as a whole, the major purpose of the TIMSS 1999 Benchmarking Study was to provide entities in the United States with a way to compare their achievement and instructional programs in an international context. Thus, the point of comparison or “benchmark” consists primarily of the high-performing TIMSS 1999 countries. The sample sizes were designed to place participants near the top, middle, or bottom of the TIMSS continuum of performance internationally, but not necessarily to detect differences in performance among different Benchmarking participants. For example, all 13 of the participating states performed similarly in science in relation to the TIMSS countries – in the upper half of the international distribution of results. As findings from the NAEP assessment in 2000 are released, it is important to understand the differences and similarities in the assessments to be able to make sense of the findings in relation to each other.

¹⁰ Nohara, D. (working paper 2001), *A Comparison of Three Educational Assessments: NAEP, TIMSS-R, and PISA*, Washington, DC: National Center for Education Statistics.

How Do Country Characteristics Differ?

International studies of student achievement provide valuable comparative information about student performance, instructional practice, and curriculum. Accompanying the benefits of international studies, though, are challenges associated with making comparisons across countries, cultures, and languages. TIMSS attends to these issues through careful planning and documentation, cooperation among the participating countries, standardized procedures, and rigorous attention to quality control throughout.¹¹

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

One fundamental way in which countries can differ is the way in which science instruction is organized at the eighth grade. In some countries science at the eighth grade is taught as a single general or integrated subject, while in others it is taught as separate science subjects, namely earth science, biology, physics, and chemistry. The majority of countries teach science at the eighth grade as a single integrated subject, although in many countries, particularly the European ones, it is common practice to teach science as separate subjects. In the U.S. it is more common to teach science at the eighth grade as a single subject. Exhibit 5.1 in the curriculum chapter details for each country and Benchmarking participant the science subjects offered up to and including the eighth grade.

¹¹ Appendix A contains an overview of the procedures used. More detailed information is provided in Martin, M.O., Gregory, K.A., and Stemler, S.E., eds., (2000), *TIMSS 1999 Technical Report*, Chestnut Hill, MA: Boston College.

	Population Size (in millions) ¹	Area of Country (1000 square kilometers) ²	Life Expectancy at Birth ³	Infant Mortality Rate (per 1000 live births) ⁴	Adult Literacy Rate (%) ⁵	Daily Newspaper Circulation (per 1000) ⁶
United States	267.6	9159	76	7	99.0	212
Australia	18.5	7682	78	5	99.0	296
Belgium (Flemish) ⁷	10.2	33	77	6	99.0	161
Bulgaria	8.3	111	71	18	98.2	254
Canada	30.3	9221	79	6	99.0	158
Chile	14.6	749	75	11	95.2	98
Chinese Taipei ⁸	22.1	36	75	8	–	–
Cyprus ⁹	0.8	9	–	6	95.9	111
Czech Republic	10.3	77	74	6	99.0	254
England ¹⁰	50.0	130	–	–	99.0	–
Finland	5.1	305	77	4	99.0	455
Hong Kong	6.5	1	79	5	92.4	786
Hungary	10.2	92	71	10	99.0	186
Indonesia	200.4	1812	65	47	85.0	23
Iran, Islamic Rep.	60.9	1622	69	32	73.3	26
Israel ¹¹	6.1	21	78	7	95.4	288
Italy	57.5	294	78	5	98.3	104
Japan	126.1	377	80	4	99.0	578
Jordan	4.4	89	71	29	87.2	42
Korea, Rep.	46.0	99	72	9	97.2	394
Latvia	2.5	62	69	15	99.0	247
Lithuania	3.7	65	71	10	99.0	93
Macedonia	2.0	25	72	16	94.0	21
Malaysia	21.7	329	72	11	85.7	163
Moldova	4.3	33	67	20	98.3	60
Morocco ¹²	27.3	711	67	51	45.9	27
Netherlands	15.6	34	78	5	99.0	306
New Zealand	3.8	268	77	7	99.0	216
Philippines	73.5	298	68	35	94.6	82
Romania	22.6	230	69	22	97.8	298
Russian Federation	147.3	16889	67	17	99.0	105
Singapore	3.1	1	76	4	91.4	324
Slovak Republic	5.4	48	73	9	99.0	184
Slovenia	2.0	20	75	5	99.0	199
South Africa	40.6	1221	65	48	84.0	34
Thailand	60.6	511	69	33	94.7	64
Tunisia	9.2	155	70	30	67.0	31
Turkey ¹³	62.5	815	69	40	83.2	110

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

¹ Estimates for 1997 based, in most cases, on a de facto definition. Refugees not permanently settled in the country of asylum are generally considered to be part of their country of origin. World Bank (1999) World Development Indicators, p. 42-44.
² Area is the total surface area in square kilometers, comprising all land area and inland waters. World Bank (1999) World Development Indicators, p. 120-122.
³ Number of years a newborn infant would live if prevailing patterns of mortality at its birth were to stay the same throughout its life. World Bank (1999) World Development Indicators, p. 110-112.
⁴ Infant mortality rate is the number of deaths of infants under one year of age during 1997 per 1,000 live births in the same year. World Bank (1999) World Development Indicators, p.16-18.
⁵ Population aged 15 years and over. UNDP (1999) Human Development Report 1999 (134-137).
⁶ A newspaper issued at least four times a week is considered to be a daily newspaper. Circulation figures show the average circulation. UNESCO (1999) Statistical Yearbook, IV (106-133).

⁷ Figures for Belgium (Flemish) are for the whole country of Belgium.
⁸ Data provided by Department of Statistics, Ministry of Interior, Republic of China.
⁹ Data for population, area, and infant mortality provided by Cypriot Government Statistics Department.
¹⁰ The Statesman's Yearbook, 1998-99. Edited by Barry Turner, p.1411.
¹¹ Data provided by Israel's Central Bureau of Statistics, publication no. 1133.
¹² Data provided by Ministère du plan et de l'initiation économique: Annuaire de Maroc, 1999.
¹³ Data provided by Turkey's State Institute of Statistics.
 A dash (–) indicates data are not available.

	Gross National Product per Capita (in US dollars) ¹	GNP per Capita (Purchasing Power Parity) ²	Expenditure on Education as % of Gross National Product ³	Expenditure on Research and Development as % of Gross National Product ⁴	Total Unemployment (% of total labor force) ⁵	Aid per Capita ⁶
United States	29080	29080	5.4	2.6	5.0	–
Australia	20650	19510	5.5	1.8	8.4	–
Belgium (Flemish) ⁷	26730	23090	3.1	1.6	12.7	–
Bulgaria	1170	3870	3.2	0.6	11.1	25
Canada	19640	21750	6.9	1.7	9.4	0
Chile	4820	12240	3.6	0.6	5.3	9
Chinese Taipei ⁸	13235	–	4.9	2.0	2.9	–
Cyprus	–	–	4.5	0.2	–	–
Czech Republic	5240	10380	5.1	1.2	3.1	10
England	–	–	–	–	–	–
Finland	24790	19660	7.5	2.8	14.7	–
Hong Kong	25200	24350	2.9	0.3	2.2	–
Hungary	4510	6970	4.6	0.7	10.5	16
Indonesia	1110	3390	1.4	0.1	–	4
Iran, Islamic Rep.	1780	5690	4.0	0.5	–	3
Israel ⁹	16180	17680	10.1	2.4	7.7	204
Italy	20170	20100	4.9	2.2	12.1	–
Japan	38160	24400	3.6	2.8	3.2	–
Jordan	1520	3350	7.9	0.3	–	104
Korea, Rep.	10550	13430	3.7	2.8	2.7	-3
Latvia	2430	3970	6.3	0.4	7.0	33
Lithuania	2260	4140	5.5	0.7	7.1	27
Macedonia	1100	3180	5.1	–	38.8	75
Malaysia	4530	7730	4.9	0.2	2.5	-11
Moldova	460	1450	10.6	0.9	1.6	15
Morocco	1260	3210	5.3	–	17.8	17
Netherlands	25830	21300	5.1	2.1	6.2	–
New Zealand	15830	15780	7.3	1.0	6.0	–
Philippines	1200	3670	3.4	0.2	7.9	9
Romania	1410	4270	3.6	0.7	6.3	9
Russian Federation	2680	4280	3.5	0.9	3.4	5
Singapore	32810	29230	3.0	1.1	2.4	0
Slovak Republic	3680	7860	5.0	1.1	12.6	13
Slovenia	9840	11880	5.7	1.5	13.9	49
South Africa	3210	7190	8.0	0.7	–	12
Thailand	2740	6490	4.8	0.1	0.9	10
Tunisia	2110	5050	7.7	0.3	–	21
Turkey	3130	6470	2.2	0.5	6.6	0

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

¹ World Bank (1999) World Development Indicators, p. 12-14.

² An international dollar has the same purchasing power over GNP as a U.S. dollar in the United States. World Bank (1999) World Development Indicators, p. 12-14.

³ UNESCO (1999) Statistical Yearbook, p.II-(490-513); Belgium figure is for the Flemish community only; Cyprus is for Greek section only.

⁴ UNESCO (1999) Statistical Yearbook, p.III-(6-17); Belgium figure is for the Flemish community only; Cyprus is for Greek section only.

⁵ Unemployment is the share of the labor force that is without work but available for and seeking employment. Definitions of labor force and unemployment differ by country. World Bank (1999) World Development Indicators, p. 58-60.

⁶ World Bank (1999) World Development Indicators, p. 352-355. Aid per capita includes official development assistance, which consists of disbursement of loans and grants, and official aid, which consists of capital projects, budget and balance of payments support, food and other commodity services, technical co-operation and emergency relief. A negative value indicates repayments exceed aid payments.

⁷ Figures for Belgium (Flemish) are for the whole country of Belgium.

⁸ Data provided by Department of Statistics, Ministry of Interior, Republic of China.

⁹ Data Provided by Israel's Central Bureau of Statistics, publication no. 1133.

A dash (–) indicates data are not available or that aggregates cannot be calculated because of missing data in year shown.

How Do the Benchmarking Jurisdictions Compare on Demographic Indicators?

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

As illustrated previously in Exhibit 9, the characteristics of the states, districts, and consortia that took part in the TIMSS 1999 Benchmarking Study are diverse.

These four districts also had very high percentages of students from low-income families. In comparison, Naperville and the Academy School District had less than one-fifth minority students and less than five percent of their students from low-income families.

Research on disparities between urban and non-urban schools reveals a combination of factors, often interrelated, that all mesh to lessen students' opportunities to learn in urban schools. Students in urban districts with high percentages of low-income families and minorities often attend schools with higher proportions of inexperienced teachers.¹² Urban schools also have fewer qualified teachers than non-urban schools. In reviewing the U.S. Department of Education's 1994 Schools and Staffing Survey, *Education Week* prepared a 1998 study on urban education that found that urban school districts experience greater difficulty filling teacher vacancies, particularly for certain fields including science, and that they are more likely than non-urban schools to hire teachers who have an emergency or temporary license.¹³ Studies of under-prepared teachers indicate that such teachers have more difficulty with classroom management, teaching strategies, curriculum development, and student motivation.¹⁴ Teacher absenteeism is also a more serious problem in urban districts. An NCES report on urban schools found they have fewer resources, such as textbooks, supplies, and copy machines, available for their classrooms.¹⁵ It also found that urban students had less access to gifted and talented programs than suburban students. Additionally, several large studies have found urban school facilities to be functionally older and in worse condition than non-urban ones.¹⁶

¹² 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.

¹³ *Quality Counts 1998, The Urban Challenge: Public Education in the 50 States*, Education Week, 17(17).

¹⁴ Darling-Hammond, L. and Post, L. (2000), "Inequality in Teaching and Schooling: Supporting High Quality Teaching and Leadership in Low-Income Schools" in R. Kahlenberg (ed.), *A Notion at Risk: Preserving Public Education as an Engine for Social Mobility*, Century Foundation Press.

¹⁵ Lippman, L., Burns, S., and McArthur, E. (1996), *Urban Schools: The Challenge of Location and Poverty*, NCES 96-184, Washington, DC: National Center for Education Statistics.

¹⁶ Lewis, L., Snow, K., Farris, E., Smerdon, B., Cronen, S., Kaplan, J., and Greene, B. (2000), *Condition of America's Public School Facilities: 1999*, NCES 2000-032, Washington, DC: National Center for Education Statistics; *School Facilities: America's Schools Report Differing Conditions* (1996), GAO/HEHS-96-103, Washington, DC: U.S. General Accounting Office.

	Total Public Enrollment (All Grades)	Percentage of Students				Per Pupil Expenditure ³
		Special Needs	Limited English Proficient	Minority ¹	Low Income ²	
States						
Connecticut	544698	14	4	26	20	8827
Idaho	244722	11	7	17	37	4808
Illinois	2011530	14	6	35	31	6481
Indiana	988094	15	3	17	25	6420
Maryland	841671	13	2	45	28	7412
Massachusetts	962317	18	13	26	28	8064
Michigan	1720266	5	–	18	17	7330
Missouri	912445	14	1	22	34	5663
North Carolina	1254821	13	2	38	44	5367
Oregon	542809	11	7	20	33	6920
Pennsylvania	1816414	11	–	22	30	7409
South Carolina	664592	13	0	37	45	5204
Texas	3945367	12	14	53	48	5567
Districts and Consortia						
Academy School Dist. #20, CO	15821	7	–	18	4	4767
Chicago Public Schools, IL	430914	12	16	89	71	5784
Delaware Science Coalition, DE ⁴	19830			37	40	
First in the World Consort., IL	35802	13	8	26	14	8924
Fremont/Lincoln/WestSide PS, NE	40769	15	2	17	23	5915
Guilford County, NC	61154	14	3	43	37	5431
Jersey City Public Schools, NJ	32505	9	–	93	89	9653
Miami-Dade County PS, FL	352536	11	14	93	59	5845
Michigan Invitational Group, MI ⁴	10947			12	22	
Montgomery County, MD	127933	12	6	50	25	8223
Naperville Sch. Dist. #203, IL	18473	11	1	18	2	5988
Project SMART Consortium, OH ⁴	15266			21	22	
Rochester City Sch. Dist., NY	38121	17	–	84	73	8490
SW Math/Sci. Collaborative, PA ⁵	403347	11	–	13	33	6858

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

* All data except percent minority and percent low income are from the Common Core of Data (CCD) published by the National Center for Education Statistics (NCES) of the U.S. Department of Education. The nonfiscal data are from School Year 1998-99; the state fiscal data are from Fiscal Year 1997-98, and the district/consortium fiscal data are from Fiscal Year 1996-97. A dash (–) indicates data were not reported to NCES; a blank indicates data are not available for a consortium. All percentages are rounded to the nearest whole number.

¹ Percent minority is the percentage of non-white students as reported by participating schools (also shown in Exhibit 4.4, which provides the breakdown by race/ethnicity).

² Percent low income is the percentage of students eligible to receive free or reduced-price lunch through the National School Lunch Program as of October 1, 1998, as reported by participating schools (also shown in Exhibit 7.1). Because school response data were available for less than 50% of students in Miami-Dade, its low-income figure shown is that reported by the Florida Department of Education's Bureau of Education Information and Accountability Services.

³ Per pupil expenditure is net current expenditures as defined by Hawkins-Stafford Education Amendments of 1988 (P.L. 100-297), divided by average daily attendance for states and by total enrollment for districts/consortia.

⁴ Data shown are for participating schools only.

⁵ Enrollment includes students attending private schools that are part of the consortium.

How Is the Report Organized?

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

The report is in two sections. Chapters 1 through 3 present the achievement results. Chapter 1 presents overall achievement results. Chapter 2 shows international benchmarks of science achievement illustrated by results for individual science questions. Chapter 3 gives results for the six science content areas. Chapters 4 through 7 focus on the contextual factors related to teaching and learning science. Chapter 4 examines student factors including the availability of educational resources in the home, how much time they spend studying science outside of school, and their attitudes towards science. Chapter 5 provides information about the curriculum, such as the science included in participants’ content standards and curriculum frameworks as well as the topics covered and emphasized by teachers in science lessons. Chapter 6 presents information on science teacher preparation and professional development activities as well as on classroom practices. Chapter 7 focuses on school factors, including the availability of resources for teaching science and school safety.

Each of chapters 4 through 7 is accompanied by a set of reference exhibits in the reference section of the report, following the main chapters. Appendices at the end of the report summarize the procedures used in the Benchmarking Study, present the multiple comparisons for the science content areas, provide the achievement percentiles, list the topics and processes measured by each item in the assessment, and acknowledge the numerous individuals responsible for implementing the TIMSS 1999 Benchmarking Study.