

Highlights of U.S. Eighth-Grade Findings from TIMSS

THE THIRD INTERNATIONAL MATHEMATICS AND SCIENCE STUDY

Now Available



Pursuing Excellence

A Study of U.S. Eighth-Grade Mathematics and Science Teaching, Learning, Curriculum, and Achievement in International Context

Visit the NCES TIMSS web site at
<http://www.ed.gov/NCES/timss>
 which contains:

- Full text and graphics from *Pursuing Excellence*.
- Information about the TIMSS videotape study, including how to order the CD-ROM of sample lessons from the United States, Germany, and Japan.
- Executive summary of *Splintered Vision*, an National Science Foundation report analyzing TIMSS data on textbooks and curriculum in the United States and abroad.
- Links to other TIMSS-related web sites.

International comparative results in mathematics and science achievement for seventh- and eighth-grade students in 41 countries around the world can be found in two companion reports: *Mathematics Achievement in the Middle School Years: IEA's Third International Mathematics and Science Study* and *Science Achievement in the Middle School Years: IEA's Third International Mathematics and Science Study*.

These two international reports are available from the TIMSS International Study Center, Campion Hall 323, Boston College, Chestnut Hill, MA 02167, (617) 552-4521.

key findings

- Compared to their counterparts in the 41 TIMSS countries, U.S. eighth graders are somewhat below the international average in mathematics and somewhat above the international average in science.
- U.S. eighth-grade students receive more hours of classroom instruction in mathematics and science and are assigned more homework than their German and Japanese counterparts.
- The content of U.S. eighth-grade mathematics classes is not as challenging as that of other countries and the topic coverage is not as focused. In science, the degree of topic focus appears to be more similar to that of other countries.
- While most U.S. eighth-grade mathematics teachers report familiarity with reform recommendations, only a few actually practice the key points in their classrooms. By contrast, Japanese teachers widely practice what the U.S. mathematics reform recommends.
- In general, U.S. teachers do not receive as much practical training and daily support as their German and Japanese counterparts.

January 1997

Special Component

In mathematics, students in 20 countries outperform our eighth graders. Students in 13 countries are not significantly different than ours, and U.S. students outperform their counterparts in 7 nations.

In mathematical context areas, U.S. eighth graders are:

At the international average in:

- ☐ Algebra
- ☐ Data representation, analysis and probability
- ☐ Fractions and number sense

Below the international average in:

- ☐ Geometry
- ☐ Measurement
- ☐ Proportionality

To provide a context for understanding international differences in teaching and learning, the U.S. TIMSS project collected videotapes of eighth-grade mathematics classes and conducted observational studies in Germany and Japan as well as the United States. Results of these studies reveal that:

- U.S. mathematics lessons typically require students to study less challenging material than classes in Germany and Japan.
- The content taught in U.S. eighth grade math classes is at the seventh grade level compared to other countries, and
- In the United States and Germany, mathematics teachers' typical goal is to teach students how to do something, while the goal of Japanese teachers is to focus on understanding mathematical concepts.

TABLE 1: Average Mathematics Performance Compared to the U.S.*

NATIONS WITH AVERAGE SCORES SIGNIFICANTLY HIGHER THAN THE U.S.

NATION	AVERAGE
Singapore	643
Korea	607
Japan	605
Hong Kong	588
Belgium-Flemish	565
Czech Republic	564
Slovak Republic	547
Switzerland	545
(Netherlands)	541
(Slovenia)	541
(Bulgaria)	540
(Austria)	539
France	538
Hungary	537
Russian Federation	535
(Australia)	530
Ireland	527
Canada	527
(Belgium-French)	526
Sweden	519

NATIONS WITH AVERAGE SCORES NOT SIGNIFICANTLY DIFFERENT FROM THE U.S.

NATION	AVERAGE
(Thailand)	522
(Israel)	522
(Germany)	509
New Zealand	508
England	506
Norway	503
(Denmark)	502
United States	500
(Scotland)	498
Latvia (LSS)	493
Spain	487
Iceland	487
(Greece)	484
(Romania)	482

NATIONS WITH AVERAGE SCORES SIGNIFICANTLY LOWER THAN THE U.S.

NATION	AVERAGE
Lithuania	477
Cyprus	474
Portugal	454
Iran, Islamic Republic	428
(Kuwait)	392
(Colombia)	385
(South Africa)	354

INTERNATIONAL AVERAGE = 513

* Countries in parenthesis did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures. The report presents standard errors for all survey estimates.

nts of U.S. TIMSS

The emphasis on understanding is evident in the steps typical of Japanese eighth-grade mathematics lessons.

- 1 The teacher poses a complex, thought-provoking problem.
- 2 Students struggle with the problem.
- 3 Various students present ideas or solutions to the class.
- 4 The class discusses the various solutions.
- 5 The teacher summarizes the class' conclusions.
- 6 Students practice similar problems.

In contrast, the emphasis on skill acquisition is evident in the steps common to most U.S. and German math lessons.

- 1 The teacher instructs students in a concept or skill.
- 2 The teacher solves example problems with class.
- 3 Students practice on their own while the teacher assists individual students.

In science, students in 9 nations outperform U.S. eighth graders, performance in 16 other nations is not statistically different than ours, and our students outperform those in another 15 nations.

In science context areas, U.S. eighth graders are:

Above the international average in:

- Environmental issues & the nature of science
- Earth Science
- Life Science

At the international average in:

- Chemistry
- Physics

TABLE 2: Average Science Performance Compared to the U.S.*

NATIONS WITH AVERAGE SCORES SIGNIFICANTLY HIGHER THAN THE U.S.

NATION	AVERAGE
Singapore	607
Czech Republic	574
Japan	571
Korea	565
(Bulgaria)	565
(Netherlands)	560
(Slovenia)	560
(Austria)	558
Hungary	554

NATIONS WITH AVERAGE SCORES NOT SIGNIFICANTLY DIFFERENT FROM THE U.S.

NATION	AVERAGE
England	552
Belgium-Flemish	550
(Australia)	545
Slovak Republic	544
Russian Federation	538
Ireland	538
Sweden	535
United States	534
(Germany)	531
Canada	531
Norway	527
New Zealand	525
(Thailand)	525
(Israel)	524
Hong Kong	522
Switzerland	522
(Scotland)	517

NATIONS WITH AVERAGE SCORES SIGNIFICANTLY LOWER THAN THE U.S.

NATION	AVERAGE
Spain	517
France	498
(Greece)	497
Iceland	494
(Romania)	486
Latvia (LSS)	485
Portugal	480
(Denmark)	478
Lithuania	476
(Belgium-French)	471
Iran, Islamic Republic	470
Cyprus	463
(Kuwait)	430
(Colombia)	411
(South Africa)	326

INTERNATIONAL AVERAGE = 516

* Countries in parenthesis did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures. The report presents standard errors for all survey estimates.

A TIMSS Overview

The Third International Mathematics and Science Study is the largest and most comprehensive comparative international study of education that has ever been undertaken. One-half million students from 41 countries were tested in 30 different languages at 5 different grade levels to compare their mathematics and science achievement. Intensive studies of students, teachers, schools, curriculum, instruction, and policy issues were also carried out to understand the educational context in which learning takes place.

TIMSS is the third comparison of mathematics and science achievement carried out by the International Association for the Evaluation of Educational Achievement (IEA). Previous IEA studies of mathematics and science were conducted for each subject separately at various times during the 1960s, 1970s, and 1980s. This is the first time that IEA has assessed both mathematics and science in the same study. Comparative studies of other subjects, including reading literacy (1992) and computers in education (1993), have also been published by the IEA.

The IEA delegated responsibility for overall coordination and management of the TIMSS study to Professor Albert Beaton at the TIMSS International Study Center, located at Boston College. Each of the 41 IEA member nations that made the decision to participate in TIMSS paid for and carried out the data collection in its own country according to the international guidelines.

The costs of the international coordination were paid by the National Center for Education Statistics (NCES) of the U.S. Department of Education, the National Science Foundation (NSF), and the Canadian Government. TIMSS in the United States was also funded by NCES and NSF.

The national coordination of the U.S. portion of the study is managed by Professor William Schmidt of Michigan State University. Westat, Inc. developed the U.S. sample design; collected the information required from students, teachers, and schools; and is participating in the analysis and report writing of the U.S. data.

Third International Mathematics and Science Study Publications Order Form

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Third International Mathematics and Science Study (TIMSS)

Summary of Report Releases

October 15, 1996	November 20, 1996
Textbook and Curriculum Comparisons "Splintered Vision" and three other studies examining up to 50 countries. Analysis of textbooks and curriculum guides in mathematics and science. In-Depth Curriculum Study Examines six countries. Case studies of science and mathematics education.	Achievement of Middle School Students Examines 41 countries. US and international results for 7th and 8th grade mathematics and science. Summary of US Achievement/Schooling: 8th Grade "Pursuing Excellence" report examines 8th grade mathematics and science. Analyzes student performance, teaching, texts, curriculum, and student/teacher lifestyles. CD ROM: Typical Mathematics Classes in Three Countries A computer-based tool to compare teaching in 8th grade mathematics classes in Germany, Japan and the U.S.
Winter 1997	Spring 1997
US, Germany and Japan Comparisons Case studies examining education standards, adolescent life and working lives of teachers in three countries. Analysis of Instructional Practices Examines 8th grade mathematics and science in 41 countries. Special focus on US, Germany and Japan Analysis of 8th Grade Mathematics Teaching Videos Study presents complete results from analysis of 8th grade mathematics classes in Germany, Japan and US.	US Curriculum Analysis Examines 8th grade mathematics and science curriculum in 41 countries, with a special focus on the US, Germany and Japan.
Summer 1997	Winter 1997/1998
Achievement of Primary School Students: 4th Grade US and international results of student performance in 4th grade mathematics and science. State-by-State & International Comparisons Examines up to 41 countries and 44 US states. Experimental report links data from NAEP* and TIMSS in mathematics for grades four and eight; and in science, for grade eight.	Achievement of Secondary School Students US and international results in mathematics and science at end of secondary education. Five separate studies.

* NAEP is the National Assessment of Educational Progress.

Third International Mathematics and Science Study Release of Reports

October 15, 1996

Many Visions, Many Aims: A Cross-National Exploration of Curricular Intentions in School

Mathematics—An analysis of mathematics curriculum guides and textbooks in 50 countries. This report looks at the sequence and the topics covered from kindergarten through the end of secondary school, analyzed in a comparative framework.

To order: Kluwer Academic Publishers Group, Order Department, PO Box 322, 3300 AH Dordrecht, The Netherlands, Fax: 31 78 T654 6474, Telephone: 31 78 639 2392/ Email: services@wkap.nl

Many Visions, Many Aims: A Cross-National Exploration of Curricular Intentions in School Science

An analysis of science curriculum guides and textbooks in 50 countries. This report looks at the sequence and the topics covered from kindergarten through the end of secondary school, analyzed in a comparative framework.

To order: Kluwer Academic Publishers Group, Order Department, PO Box 322, 3300 AH Dordrecht, The Netherlands, Fax: 31 78 T654 6474, Telephone: 31 78 639 2392/ Email: services@wkap.nl

A Splintered Vision: An Analysis of U.S. Mathematics and Science Curricula—An in-depth look at a composite mathematics and science curricula and textbooks in the United States. The international analyses of mathematics and science curricula are used as a point of reference for the U.S. analysis.

To order: Kluwer Academic Publishers Group, Order Department, PO Box 322, 3300 AH Dordrecht, The Netherlands, Fax: 31 78 T654 6474, Telephone: 31 78 639 2392/ Email: services@wkap.nl

Characterizing Pedagogical Flow: An Investigation of Mathematics and Science Teaching in Six Countries—These are the results of the Study of Mathematics and Science Opportunity (SMSO) survey, which investigated the curriculum and pedagogy in France, Japan, Norway, Spain, Switzerland, and the United States. Analyses include in-depth looks at the content and methods of mathematics and science instruction in these six countries. These analyses are complemented by case studies in each participating country.

To order: Kluwer Academic Publishers Group, Order Department, PO Box 322, 3300 AH Dordrecht, The Netherlands, Fax: 31 78 T654 6474, Telephone: 31 78 639 2392/ Email: services@wkap.nl

November 20, 1996

Pursuing Excellence: U.S. Eight-Grade Mathematics and Science Achievement in International

Perspective—This report draws from the many reports and parts -- assessments, surveys, video, and case studies -- of TIMSS to summarize the most important findings concerning achievement and schooling in the eighth grade. It is part of the first of three waves of TIMSS reports on the eighth and fourth grades and the end of high school.

To order: The National Library of Education, 555 New Jersey Avenue, NW, 20208, Telephone: 1-800-424-1616 or in the DC metro area 202-219-1651

Splintered Vision: An Investigation of US Mathematics and Science Education Executive Summary

An executive summary of the analysis of U.S. mathematics and science curricula and textbooks.

To order: National Library of Education, 555 New Jersey Avenue, NW 20208, Telephone: 1-800-424-1616, in the DC metro area call 202-219-1651

CDROM: Typical 8th Grade Mathematics Classes in Germany, Japan and the U.S. The CD will feature excerpts from extensive video tape studies of teachers and students at work in mathematics classrooms in these three countries. A comprehensive written report, to be issued Winter 1997, provides more extensive analysis.

To order: National Education Data Resource Center, c/o Pinkerton Computer Consultants, Inc., 1900 North Beauregard Street, Suite 200, Alexandria, VA 22311-1722, Telephone: 703-845-3151, fax 703-820-7465, Email: nedrc@inet.ed.gov

Mathematics Achievement in the Middle School Years: IEA's Third International Mathematics and Science Study (TIMSS)—This report focuses on the mathematics achievement in the two grades with the largest proportion of 13 year-olds—the seventh and eighth grades in most countries. Special emphasis is placed on the eighth grade results, including selected information about students' background and classroom practices in teaching mathematics. Data for 41 countries are presented.

To order: CSTEOP, Campion Hall 323, Boston College, Chestnut Hill, MA 02167, Telephone: 617-552-4521, Fax: 617-552-8419, Email: <http://wwwwcsteop.bc.edu/timss>

Science Achievement in the Middle School Years: IEA's Third International Mathematics and Science Study (TIMSS)—This report focuses on the science achievement in the two grades with the largest proportion of 13 year-olds—the seventh and eighth grades in most countries. Special emphasis is placed on the eighth grade results, including selected information about students' background and classroom practices in teaching science. Data for 41 countries are presented.

To order: CSTEOP, Campion Hall 323, Boston College, Chestnut Hill, MA 02167, Telephone: 617-552-4521, Fax: 617-552-8419, Email: <http://wwwwcsteop.bc.edu/timss>

Third International Mathematics and Science Study: Quality Assurance in Data Collection—A report on the quality assurance program which ensured the comparability of results across participating countries. The program emphasized instrument translation and adaptation, sampling response rates, test administration and data collection, the reliability of the coding process, and the integrity of the database.

To order: CSTEOP, Campion Hall 323, Boston College, Chestnut Hill, MA 02167, Telephone: 617-552-4521, Fax: 617-552-8419, Email: <http://wwwwcsteop.bc.edu/timss>

Third International Mathematics and Science Study: Technical Report, Volume I Design and Development—This report serves as a record of actions and documentation of outcomes, to use both in interpreting results and as a reference for future endeavors. It documents the design and development of TIMSS.

To order: CSTEOP, Campion Hall 323, Boston College, Chestnut Hill, MA 02167, Telephone: 617-552-4521, Fax: 617-552-8419, Email: <http://wwwwcsteop.bc.edu/timss>

January 1997

Teaching Mathematics in the Eighth Grade: An Analysis of Videos from Japan, Germany, and the United States—Researchers taped classrooms from a half-sample of the eighth grade mathematics classrooms assessed in TIMSS in three countries. This report presents the results of the analysis of these videos with information on the content of the classes, sequence and method of presentation, flow of the lesson, and use of instructional materials.

Mathematics and Science in the Eighth Grade—This report presents a short overview of the TIMSS project and a summary of the results of the United States Survey of eighth grade mathematics and science achievement. It also presents contextual information collected from students, teachers, and schools.

NOTE: The next three reports are based on data collected in the Case Studies carried out in Japan, Germany, and the United States. Four topics areas, ability differences, standards, teachers' working lives, and adolescents' lives were the focus of these case studies.

- ***Education Standards in Japan, Germany, and the United States***—This report examines educational standards in Japan and Germany, two countries with a reputation for high standards, and compares them with those in the United States. It examines two types of standards, content standards, and performance standards. In addition, it looks at how the education systems in Germany and Japan view and deal with students who do not meet the standards.
- ***Adolescent Life in Japan, Germany and the United States***—This report provides an overview of the lives of adolescents in the three countries, both in and out of school. It also examines how the forces—internal, schools, families, or society in general—motivate students. Finally, the report looks at the types of support provided to adolescents and at the obstacles to their success.
- ***Working Lives of Teachers in Japan, Germany and the United States***—This report compares policies regarding teachers and their overall working conditions in order to inform policy discussions in the United States. It compares all three countries in terms of certification and training requirements, teachers' roles in school and in the lives of their students, their general working conditions, and the school environment are provided. Other issues such as teacher preparation, improvement, level of autonomy, and types of support are also explored.

Spring/Summer 1997

NAEP/TIMSS Link in Mathematics and Science. This experimental report will link the achievement of U.S. eighth grade mathematics students in the states who took the Trial State Assessment in 1996 with students from 41 countries who took the eighth grade mathematics assessments in TIMSS in 1995. The report will also link NAEP/TIMSS performance of fourth grade students in both mathematics and science.

Other Reports To Be Released Include:

IEA International Mathematics Assessment Results Report—Primary School

IEA International Science Assessment Results Report—Primary School

U.S. Report of 4th Grade TIMSS Results

Winter 1997/98

IEA International Mathematics Assessment Results—End of Secondary Education

IEA International Science Assessment Results—End of Secondary Education

U.S. Report of 12th Grade Results

IEA International Performance Assessment Report

U.S. Report on Performance Assessment



FOR EMBARGOED RELEASE: 11 a.m.
November 20, 1996

Contact: David Thomas
(202) 401-1579

**INTERNATIONAL MATH-SCIENCE COMPARISON FINDS
U.S. BETTER IN SCIENCE, BUT IN THE MIDDLE OVERALL;
NOT GOOD ENOUGH, RILEY SAYS**

According to the most thorough international study of math and science education ever conducted, U.S. students are above average in science and below in math.

Pursuing Excellence: A Study of U.S. Eighth-Grade Mathematics and Science Teaching, Learning, Curriculum and Achievement in International Context, released today by the U.S. Education Department's National Center for Education Statistics, reports U.S. scores in both math and science as not significantly different from those of England or Germany. In science, among participating G-7 countries -- America's major economic and political allies -- only Japan scored significantly higher than the U.S. [G-7 countries include the United Kingdom, Canada, France, Germany, Japan and Italy. Italy did not participate in the test.]

Overall, American students are above average in life sciences and environmental issues, average in fractions, algebra and physics, but struggle with measurement and geometry.

"If we see the news in the report as simply a horse race story of who finished first and who finished second we miss the point," said U.S. Secretary of Education Richard W. Riley. "The issues are much deeper -- the content and rigor of what we are teaching -- how we go about teaching -- the fact that we continue to shortchange America's teachers by not giving them the preparation and help they need to do the best job possible in the classroom. One of the clear messages of this report is that we need to take a good, hard look at what we teach and how we teach math."

Among the findings drawn from the Third International Mathematics and Science Study (TIMSS):

- o eighth-grade mathematics classes in the U.S. are not as advanced and not as focused as those in Japan and Germany;

- o topics taught in U.S. eighth-grade mathematics classrooms are at a seventh-grade level by international standards;
- o the content of U.S. mathematics classes requires less high-level thought than classes in Germany and Japan;
- o U.S. mathematics teachers' typical goal is to teach students how to do something, while Japanese teachers' goal is to help them understand mathematical concepts.

The international comparison suggests a general improvement in U.S. science from a 1991 assessment that placed American students below average, though the tests and the set of participating nations have changed. U.S. mathematics performance, however, remains slightly below the international average.

"Our own National Assessments of Educational Progress show our students have improved in math since the early '80s," Riley said, "but it appears students in other nations are moving up, too. For U.S. students, average is just not good enough."

Riley said states and local school districts should review and toughen their academic standards, and cited materials prepared by the National Council of Teachers of Mathematics as an example of how to improve the teaching of math.

According to the report, U.S. teachers are generally familiar with the tougher standards suggested by the council, but it appears that other nations, notably Japan, are doing a better job of actually teaching tougher material. Based on videotapes of actual classroom instruction, the researchers found that U.S. math classes still largely focus on how to solve problems, while Japanese teachers do a much better job at helping students understand the concepts behind the solutions.

Riley said the department will sponsor a series of regional and state workshops on the results of the study, with an emphasis on successful practices that illustrate more rigorous content and teaching methods. Riley also said the department will prepare and send a summary of the report to business and education leaders and the nation's local PTA chapters. The department

also will work with communities and states, as well as the National Science Foundation, the National Academy of Sciences, and the nation's math and science teachers to share what works to boost achievement.

The study found that common culprits such as television watching and lack of time devoted to study could not account for the below average U.S. math scores. Heavy TV watching was found to be about as common in Japan -- one of the highest scorers -- and U.S. students actually spend more classroom time on math and science than students in both Japan and Germany.

"The data appear to be telling us that we need to examine what's actually going on in the school and the classroom," Riley said. "We have bright, dedicated, well-educated teachers, but compared to Japan and Germany, they get little practical training or mentoring, and little opportunity to work closely with other teachers to improve teaching."

Riley said colleges and universities should examine how teachers are prepared and suggested that guidelines from the National Commission on Teaching and America's Future be considered as a "blueprint" of how to proceed. The commission has called for high standards, more opportunities for apprenticeships, mentoring by master teachers and work schedules that permit ongoing professional development.

Riley also stressed that improving how we train teachers "will be of little use if teachers are forced to teach using textbooks that are outdated, lack focus, and do not reflect the tougher standards."

"Every student should enter middle school and junior high school with a firm grasp of arithmetic," Riley said, "but clearly employers want problem solvers, people who have mastered the basics and can apply that knowledge to new situations. Our math curriculum in middle schools and junior high schools lacks focus and too much class time is spent memorizing formulas at the expense of understanding useful concepts.

"Many of our students have not even been exposed to the material on this test, for example basic geometry and physics, by the eighth grade. Rather, they see the same content over and over again, year after year. It's time to re-examine what we ask of students and raise the bar -- do away with dead-end, general math classes. We can do better."

Other findings in the TIMSS report include:

- o There was little difference in how U.S. boys and girls scored in both math and science;
- o Japanese teachers have more opportunities to discuss teaching-related issues with their colleagues than do U.S. teachers;
- o U.S. teachers assign more homework and spend more class time discussing it than teachers in Germany and Japan. U.S. students report about the same amount of out-of-school math and science study as their Japanese and German counterparts;
- o U.S. teachers generally receive more formal education, but not as much hands-on training and daily support for quality teaching as their Japanese colleagues;
- o Although most U.S. math teachers report familiarity with reform recommendations, few apply the key points in their classrooms.

Additional TIMSS reports, examining the math and science achievement of fourth- and 12-grade students, are being prepared. In all, nearly 500,000 students participated in TIMSS -- 40,000 in the U.S.

The report is available on the department's web site at www.ed.gov/NCES/timss. Printed copies are available while they last from the National Library of Education at 1-800-424-1616 (in D.C., 219-1651). The report also will be available from the U.S. Government Printing Office.

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Third International Mathematics and Science Study

What is TIMSS?

TIMSS - the Third International Mathematics and Science Study - is a study of classrooms across the country and around the world. It is the largest international comparative study of educational achievement to date. The National Center for Education Statistics (NCES) of the U.S. Department of Education, the National Science Foundation (NSF), and the Canadian Government are funding the international TIMSS project to assess school achievement in mathematics and science in nearly 50 countries. TIMSS will study student outcomes, instructional practices, curricula, and cultural context. The international coordination of TIMSS activities is centered at Boston College under the direction of Professor Albert Beaton. One of the driving forces behind TIMSS is the recognition by policymakers that mathematical and scientific literacy affect economic productivity. World-class competence in math and science is essential to compete successfully in today's interdependent global marketplace. TIMSS will provide a comparative international assessment of educational achievement in those two subjects and the factors that contribute to it.

Components of TIMSS

TIMSS has many parts. All countries participating in the study are included in the student assessments, questionnaires, and curriculum analysis. Approximately half of the countries also participated in the performance assessments. To acquire a better understanding of contextual factors contributing to achievement, NCES designed two unique additions to the TIMSS project to be carried out in Japan, Germany, and the United States. These two additions are videotape observations of mathematics instruction, and ethnographic case studies of key policy topics. Finally, states and districts in the U.S. are being offered the opportunity to participate in TIMSS as if they were nations to understand how their students compare to those of countries throughout the world.

Student Assessments. Assessments booklets contain multiple-choice and free-response items. Students across the nations in three distinct target populations are assessed:

- ☐ Population 1: students in the two adjacent grades containing most 9-year-olds (U.S. grades 3 and 4);
- ☐ Population 2: students in the two adjacent grades containing most 13-year-olds (U.S. grades 7 and 8); and
- ☐ Population 3: students enrolled in the final year of secondary school, regardless of their program of study (U.S. grade 12), as well as a special sample of calculus and physics students.

Performance Assessments. A random subsample of students in Populations 1 and 2 who took the main assessment are selected for an additional series of hands-on mathematics and science tasks.

Questionnaires. Students fill out questionnaires about background factors related to achievement, including their opinions about mathematics and science. Teachers answer questions about lesson structure and context, as well as beliefs about teaching math and science. School administrators answer questions about the implemented curriculum, staffing levels, availability of resources, in-service education, and retention rates.

Curriculum Analysis. A content analysis of science and mathematics textbooks and curriculum guides from the participating countries was begun prior to the assessments. The curriculum analysis studied materials for their topic content and sequencing. The materials were divided into comparable units and coded for analysis. Dr. William Schmidt of Michigan State University manages this segment of the study.

Videotape Observations. Teachers from Grade 8 mathematics classes are videotaped to study what typically happens in the classroom. Observations are analyzed and a database is created for subsequent comparative analysis. This segment of the study is performed only in the United States, Japan, and Germany. Dr. James Stigler of the University of California-Los Angeles is directing this segment of the study.

Case Studies. Researchers observe and conduct in-depth interviews with a small sample of students, teachers, and administrators. Topics of study include implementation of national standards, methods of dealing with ability differences, adolescents' attitudes toward school, and the daily lives and working environment of teachers. Dr. Harold Stevenson of the University of Michigan directs this component of the study.

U.S. TIMSS National Sample

	Participating Students	Participating Schools
3rd-4th grade	11,114	189
7th-8th grade	11,110	185
12th grade	11,115	211

NOTE: In April - May 1995, 33,339 students from 585 public and private schools across the U.S. participated in the TIMSS assessments. Scientific sampling procedures were used to ensure reliable national, regional, and state samples.

State TIMSS

States were offered the opportunity to assess a state-representative sample of their students at the same time as the U.S. National TIMSS study. Colorado, Illinois, and Minnesota joined in this program. Individual states were responsible for all costs associated with State TIMSS.

District TIMSS

Some districts expressed an interest in receiving district-level data. Districts are being offered the opportunity to participate as the states did, paying all costs and receiving district-representative data. District TIMSS will occur in April-May 1996. TIMSS Research Questions How do teachers in different countries teach? How do their instructional practices differ? How do these differences affect learning? What can we learn from this? What are the different social and cultural contexts with which this learning takes place? How do these affect learning? What lessons can we learn?

Who is Conducting TIMSS?

TIMSS is being coordinated by the International Association for the Evaluation of Educational Achievement (IEA), an independent international cooperative of research centers and departments of

education in more than 50 countries. TIMSS has the largest complement of participants of any of IEA's international studies.

TIMSS was designed by task forces that included members from the many participating countries. Those groups were involved in item development and review for assessment instruments, questionnaires, and sampling and test rotation schemes. IEA monitors the sampling process, quality control, scaling of tests, and training. In addition, an International Steering Committee is in place to monitor the activities and progress of the study, and a U.S. Steering Committee has been established to give advice on the implementation of the study in the United States.

Each participating country provides for its own data collection and analysis.

U.S. participation in TIMSS is funded by NCES and NSF. NCES oversees the collection, analysis, and reporting of the U.S. data, through a contract with Westat, Inc. Professor William Schmidt of Michigan University is the U.S. national research coordinator.

TIMSS Schedule

1991-1994

Study Planning and Field Test

Spring 1995

Main Assessment

Winter 1996-97

Reports

Other TIMSS sites:

IEA Clearinghouse

Minnesota Faces the World: TIMSS

Department of Educational Measurement at Umeå University

For questions about the content of this document, please contact Lois Peak at Lois_Peak@ed.gov
-###-



Projects with Partners

Last update May 14, 1996 (TAC)

Statement of
Richard W. Riley
U. S. Secretary of Education

On Release of the Third International Mathematics and Science Study
November 20, 1996
Washington, D. C.

This important report is timely and I welcome the findings. Some of the news is good. Some of the news is disappointing. This report is an eye-opener and it should encourage all of us to pick up the pace in our efforts to improve student achievement. We now have a very solid international benchmark of what it means to pursue excellence. American education must take it seriously.

These scores are not what they should be. They underscore precisely the issues and challenges raised in the recent election. Reform of our K-12 system by lifting standards is what we expect of our teachers, schools, and students. I assure you that the President is fully committed to the improvement of our schools -- to lift test scores for all of our students so that they can compete and win in the new global economy. I know this President well. We have worked together on education matters for years. He is as education-minded as you can be.

I personally gave the President an overview of these findings before he left for Asia. The Administration has every intention of meeting the challenges that come with this report. These findings reinforce what the President has been saying for some time now -- that higher standards, better teaching, and tougher testing, all the elements that push people to make an extra effort, have to be in place if we want to move American education into the 21st century.

Here I want to stress something very important -- if we see the news in this report as simply a horse race story of which country finished first and who finished second, we miss the point. This report gives us a great insight into what needs improving and suggests how to go about making those improvements.

This report tells us many things. It tells us the issue is not simply class time, or the amount of homework, or too much television, as important as these things are. The issues are much deeper -- the content and rigor of what we are teaching -- how we go about teaching -- the fact that we continue to shortchange America's teachers by not giving them the preparation and help that they need to do the best job possible in the classroom. More than anything else, this report reinforces my conviction that the push we have been making for high standards is the right way to go.

As a nation we are not where we want to be. Being above average in science is encouraging. Our investment in science education appears to be paying off. Our students performed as well as all students in the G-7 countries in science, other than Japan. But we can still do better, and being below average in math doesn't sit well with me. Our students are on par with students in Germany and England when it comes to math. But one of the clear messages of this report is that we need to re-examine what we teach and how we teach mathematics.

The President gave a speech last March at the Education Summit attended by the nation's governors and business leaders that bears repeating. In that speech the President said, "I believe that the most important thing you can do is to have high expectations for students -- to make them believe they can learn, to tell them they're going to have to learn really difficult challenging things, to assess whether they're learning or not, and to hold them accountable as well as to reward them."

I believe this statement is a road map that the President will follow in his second term. This report gives us a wealth of data to encourage improvement and we will do a lot of encouraging. The President is a leader when it comes to education. But he will lead from the vital center and in a bipartisan spirit of pursuing excellence.

We also need to recognize that we are educating a much more diverse student population. America more than any other country in the world has been successful in meeting this challenge. But we have to work a little harder at understanding how to make it happen as we go through a great deal of social and economic transition. So how do we begin to address the findings of this very important report. Let me make some preliminary suggestions.

First, the American people need to understand as clearly as possible the link between their children getting good paying jobs in the future and our need to raise standards. I can't say it enough. All of our research tells us that an education of high standards for all of our children -- and I stress all of our children -- is the very foundation for our nation's future economic success.

American business leaders have been telling us for some time now that our schools have to do a better job of preparing our young people to be part of a knowledge based economy. What does that mean? It means simply this -- children always need to learn that $2+2=4$ and gain a sure foundation in the basics. That's not going to change.

But we also need to recognize that our children can learn much more. This report suggests that what most of the world considers the basics in 8th grade we consider advanced instruction. We need to set higher expectations for our children.

Parents, teachers and educators at the local level need to fully understand the importance of these findings. They are going to be the people who will make change happen. My Department will sponsor a series of regional and state workshops on the results of TIMSS, and also use these meetings to illustrate more rigorous content and good teaching.

All this information will of course be up on the Internet. We will also prepare and send to university presidents, educators, business leaders and our nation's 40,000 local PTA's a summary of the findings. We also have had some success in developing guides that help parents make decisions at the local level.

So we will create a guide called "World Class Math and Science Education." Parents need to

know what we mean when we talk about world class when it comes to teaching practices and student work. Improving math and science instruction should develop around a coherent vision of what we expect our children to learn.

This should encourage a second step. State and local school districts should review and toughen their standards. One way to improve is right here in my hand. (hold up). This is a copy of the voluntary math standards put out by the National Council of Teachers of Mathematics. These are good standards. The voluntary national science standards are first rate as well. States and local citizens need to make sure that they are getting standards as demanding as these into the classroom.

I encourage states to align their student achievement tests in math and science against these international standards of excellence. States have much to gain by taking a second look at their current assessments, and investing in assessments that will allow them to improve teaching in the class room.

In Illinois, for example, twenty school districts have banded together to form a "First in the World" consortium. The 8th graders in these school districts have already taken the TIMSS test. This consortium working with local business partners will use the results to re-examine their curriculum and teaching methods to find better ways to go about teaching. This is one way to raise standards.

Third, this report should give our colleges and universities the incentive to re-examine how we are preparing our nation's teachers. America has a smart and dedicated teaching force. This study shows that our teachers work harder and longer than their counterparts in other countries. We are asking a great deal of these teachers and giving them little in the way of support.

I am particularly concerned that we are not giving new teachers the skills and support they need to enter this demanding profession. This is a problem we can fix. And we have a blueprint of how it can be done -- the recent report of the National Commission on Teaching and America's Future, chaired by Gov. Jim Hunt of North Carolina.

Many of the recommendations of the Commission need to be taken to heart including: organizing teacher education and development around high standards; creating year long internships and/or apprenticeships; and establishing mentoring programs with master teachers during the first two years of a teacher's career in the classroom.

I also encourage states to thoroughly review licensing procedures for teachers, and make it their goal that future teachers get licensed based on whether they can teach to higher standards. This process should also include performance assessments for new teachers.

Fourth, we need to do much more to support today's working teachers. Many math teachers

are trying on their own and without sufficient help to put the math standards into practice in the classroom. That shows good initiative. But too many of these teachers still do not have a full understanding of how to teach to the higher standards. The solution is not to blame teachers. We simply need to give our teachers more of an opportunity to advance their skills so they can do a better job.

I would like to find a way beginning this summer to help many more teachers advance their skills in teaching math and science. The National Science Foundation has a record that we can build on. I hope to work with the National Council of Teachers of Mathematics and our nation's higher education community to make this happen.

In the long term we need to push harder to make that we pursue excellence for all of our teachers. So I endorse today the goal set by the Commission that 100,000 teachers go through the demanding process of being certified by the National Board of Professional Teaching Standards in the next decade.

My fifth point is that nothing will be accomplished unless we link reforms of teacher training to changes in curriculum development, textbooks and testing. Reform of the teaching profession will be of little use if our teachers continue to use outdated and topic-heavy text books. I want to encourage educators and state education officials to sit down with textbook publishers to fully understand these findings.

We also need to place much more of an emphasis on better and stronger assessments. I intend to invest more of our energy in strengthening the assessment process. We simply have to make better connections all across the line from teacher training to how we test our young people. This does not mean that we need a national curriculum.

It does mean, however, that America's education community has to get on with the job of putting all the elements together. The American people are tuned into education. They have made it their first priority. Within the framework of a balanced budget, it will be one of the President's top priorities. Our people expect results. This is no time to dilly-dally.

Finally, we should eliminate dead-end math courses and set higher expectations for 8th grade achievement. One of the most important findings of TIMSS is that other countries set higher expectations for their middle school students and their students meet those high standards. We need to expose many more of our young people are to a more challenging curricula including algebra, geometry and measurement by the end of the 8th grade.

Raising standards and getting students to achieve more is not an insurmountable task. It does not require another blue ribbon commission and more study. In New York City, test scores in math have gone up for the second year in a row in all 32 elementary districts where they are placing a stronger emphasis on high standards.

5

Real progress can and should occur in today's class rooms. We can't wait another five or six years. The American people expect and deserve a first class -- indeed -- a world class education for all of their children. I urge everyone to bend to the task at hand and pick up the pace of reform. Our children deserve the very best when it comes to preparing them for the 21st century.

Thank you.

Visit the NCES TIMSS Web Site

<http://www.ed.gov/NCES/timss>

- ***Full text and graphics from “Pursuing Excellence,” a synthesis of TIMSS data on US eighth-grade mathematics and science teaching, learning and curriculum in an international context.***
- ***Executive summary of “Splintered Vision,” an NSF report analyzing TIMSS data on textbooks and curriculum in the US and abroad.***
- ***Links to other TIMSS-related Web sites.***
- ***Download and print-out TIMSS information.***

***For more information on TIMSS,
please call 202-219-1395.***



U.S. DEPARTMENT OF EDUCATION
OFFICE OF EDUCATIONAL RESEARCH AND IMPROVEMENT

NATIONAL CENTER FOR EDUCATION STATISTICS

Hold For Release Until:
November 20, 1996 at 11:00 a.m. EDT

Contacts: Kerri Morgan 202-667-0901 and
Suellen Mauchamer 202-219-1329

**NCES Commissioner Looks "Beyond The Horse Race" in
Third International Mathematics and Science Study**

REPORT SHATTERS PREVAILING MYTHS ABOUT US EDUCATION

National Center of Education Statistics Commissioner Pat Forgione today presided over release of *Pursuing Excellence*, a report of initial findings from the Third International Mathematics and Science Study (TIMSS) prepared by Lois Peak and Eugene Owen. The following excerpts are from the commissioner's statement.

On the Breadth and Scope of the Study...

"TIMSS is the world's largest, most comprehensive and rigorous international comparison of teaching, learning and achievement—with data on half a million students, in three grade levels, in the US and 40 other countries. Today's report, *Pursuing Excellence* is a snapshot of US of eighth grade mathematics and science. It is the first of many NCES investigations into TIMSS data that provides our country with invaluable international benchmarks defining world-class performance in education."

"*Pursuing Excellence* is the most complete and accurate picture of how eighth grade mathematics and science education in the US differs from other nations. The report looks beyond horse race comparisons of student test scores to explore rich information on the practices that shape education and achievement around the world."

"*Pursuing Excellence* combines a variety of innovative research techniques to shed new light on US education through the prism of other countries. NCES examined information on textbooks and curricula, analyzed case studies, and surveyed teachers, students and school administrators. We looked how well our students did on international assessments compared to randomly selected international peers. Researchers even compared video tape from typical eighth grade mathematics classes in the US, Germany and Japan."

On Student Achievement...

"The achievement of US eighth graders is above the 41-country average in science and below average in mathematics. We perform noticeably above the international average in some sub-fields, such as life science and environmental issues; about average in others, such as algebra and physics; and far below average in subjects such as geometry and measurement. With the notable exception of Japan, we perform comparably with many of our major economic competitors. And in a world-wide talent search for the top ten percent of eighth-graders in the 41 TIMSS countries, 13 percent of our science students and five percent of our mathematics students would make it into the 'talented tenth'."

-- more --

Tempting as it may be, it is not correct to report test scores by rank. Given the margins of error, NCES grouped countries into bands of performance – according to whether their students performed above, below, or at the same level as ours. It is an irresponsible use of statistics to portray one country as performing better than another country in the same band.”

On Exposing Education Myths...

“Data in this report expose myths that surround educational achievement. Contrary to popular opinion, US eighth-graders have more hours of instruction in mathematics and science than those in Germany and Japan. Our eighth-graders do as much homework as the Japanese and Germans, and heavy TV watching is as common among US students as it is among their Japanese counterparts. We also cover more topics in our mathematics and science classes than most other nations. Clearly US performance is not due to how much time we spend, but rather, how we spend it. More of the same is not the answer.”

On Teaching and Learning...

“Much of the data in TIMSS underscore the importance of rigor. This study shows that we expect less from our children and they meet our expectations. What we teach in eighth grade mathematics, classes overseas typically cover in the seventh grade. Our curriculum, teaching and textbooks are less focused and challenging than that of other countries. Despite reform recommendations and standards that call for students to apply mathematical thinking, the study shows we teach students procedures --how to do something, not how to understand mathematical concepts. We require less high-level thought of our students in eighth grade mathematics classes than do the Germans and Japanese.”

“The findings also suggest that US mathematics teachers are not yet carrying out many reform recommendations. For example, 95 percent of math teachers studied in 1995 reported familiarity with the education standards developed by the National Council of Teachers of Mathematics. Seventy-five percent said their lessons reflect these recommendations. Yet analysis of videotaped lessons show that only a few apply the key points in their classrooms. Ironically, the data show that Japanese teachers, whose students outperform ours, widely practice what the US mathematics standards recommend.”

On Next Steps...

“There is much left to discover from TIMSS. In 1997, NCES will release a state-by-state comparison of student performance in the US and other TIMSS countries. We'll also release data on teaching, learning and achievement in grade four and at the end of high school.”

“TIMSS is truly a treasure trove of information that will inform efforts to improve teaching and learning for decades to come. NCES plans to make TIMSS the most accessible study ever. Information is being released on CD ROM, video tape and on the World Wide Web. The reports start anew the national conversation about what we want our schools to accomplish and how close we are to achieving our goals.”

**Full text and graphics from the TIMSS reports are available on the World Wide Web at:
<http://www.ed.gov/NCES/timss>**

Third International Mathematics and Science Study (TIMSS)

Summary of Report Releases

October 15, 1996	November 20, 1996
Textbook and Curriculum Comparisons “Splintered Vision” and three other studies examining up to 50 countries. Analysis of textbooks and curriculum guides in mathematics and science. In-Depth Curriculum Study Examines six countries. Case studies of science and mathematics education.	Achievement of Middle School Students Examines 41 countries. US and international results for 7th and 8th grade mathematics and science. Summary of US Achievement/Schooling: 8th Grade “Pursuing Excellence” report examines 8th grade mathematics and science. Analyzes student performance, teaching, texts, curriculum, and student/teacher lifestyles. CD ROM: Typical Mathematics Classes in Three Countries A computer-based tool to compare teaching in 8th grade mathematics classes in Germany, Japan and the U.S.
Winter 1997	Spring 1997
US, Germany and Japan Comparisons Case studies examining education standards, adolescent life and working lives of teachers in three countries. Analysis of Instructional Practices Examines 8th grade mathematics and science in 41 countries. Special focus on US, Germany and Japan Analysis of 8th Grade Mathematics Teaching Videos Study presents complete results from analysis of 8th grade mathematics classes in Germany, Japan and US.	US Curriculum Analysis Examines 8th grade mathematics and science curriculum in 41 countries, with a special focus on the US, Germany and Japan.
Summer 1997	Winter 1997/1998
Achievement of Primary School Students: 4th Grade US and international results of student performance in 4th grade mathematics and science. State-by-State & International Comparisons Examines up to 41 countries and 44 US states. Experimental report links data from NAEP* and TIMSS in mathematics for grades four and eight; and in science, for grade eight.	Achievement of Secondary School Students US and international results in mathematics and science at end of secondary education. Five separate studies.

* NAEP is the National Assessment of Educational Progress.

Third International Mathematics and Science Study

Release of Reports

October 15, 1996

Many Visions, Many Aims: A Cross-National Exploration of Curricular Intentions in School

Mathematics—An analysis of mathematics curriculum guides and textbooks in 50 countries. This report looks at the sequence and the topics covered from kindergarten through the end of secondary school, analyzed in a comparative framework.

To order: Kluwer Academic Publishers Group, Order Department, PO Box 322, 3300 AH Dordrecht, The Netherlands, Fax: 31 78 T654 6474, Telephone: 31 78 639 2392/ Email: services@wkap.nl

Many Visions, Many Aims: A Cross-National Exploration of Curricular Intentions in School Science

An analysis of science curriculum guides and textbooks in 50 countries. This report looks at the sequence and the topics covered from kindergarten through the end of secondary school, analyzed in a comparative framework.

To order: Kluwer Academic Publishers Group, Order Department, PO Box 322, 3300 AH Dordrecht, The Netherlands, Fax: 31 78 T654 6474, Telephone: 31 78 639 2392/ Email: services@wkap.nl

A Splintered Vision: An Analysis of U.S. Mathematics and Science Curricula—An in-depth look at a composite mathematics and science curricula and textbooks in the United States. The international analyses of mathematics and science curricula are used as a point of reference for the U.S. analysis.

To order: Kluwer Academic Publishers Group, Order Department, PO Box 322, 3300 AH Dordrecht, The Netherlands, Fax: 31 78 T654 6474, Telephone: 31 78 639 2392/ Email: services@wkap.nl

Characterizing Pedagogical Flow: An Investigation of Mathematics and Science Teaching in Six Countries—These are the results of the Study of Mathematics and Science Opportunity (SMSO) survey, which investigated the curriculum and pedagogy in France, Japan, Norway, Spain, Switzerland, and the United States. Analyses include in-depth looks at the content and methods of mathematics and science instruction in these six countries. These analyses are complemented by case studies in each participating country.

To order: Kluwer Academic Publishers Group, Order Department, PO Box 322, 3300 AH Dordrecht, The Netherlands, Fax: 31 78 T654 6474, Telephone: 31 78 639 2392/ Email: services@wkap.nl

November 20, 1996

Pursuing Excellence: U.S. Eight-Grade Mathematics and Science Achievement in International

Perspective—This report draws from the many reports and parts -- assessments, surveys, video, and case studies -- of TIMSS to summarize the most important findings concerning achievement and schooling in the eighth grade. It is part of the first of three waves of TIMSS reports on the eighth and fourth grades and the end of high school.

To order: The National Library of Education, 555 New Jersey Avenue, NW, 20208, Telephone: 1-800-424-1616 or in the DC metro area 202-219-1651

Splintered Vision: An Investigation of US Mathematics and Science Education Executive Summary

An executive summary of the analysis of U.S. mathematics and science curricula and textbooks.

To order: National Library of Education, 555 New Jersey Avenue, NW 20208, Telephone: 1-800-424-1616, in the DC metro area call 202-219-1651

CDROM: Typical 8th Grade Mathematics Classes in Germany, Japan and the U.S. The CD will feature excerpts from extensive video tape studies of teachers and students at work in mathematics classrooms in these three countries. A comprehensive written report, to be issued Winter 1997, provides more extensive analysis.

To order: National Education Data Resource Center, c/o Pinkerton Computer Consultants, Inc., 1900 North Beauregard Street, Suite 200, Alexandria, VA 22311-1722, Telephone: 703-845-3151, fax 703-820-7465, Email: nedrc@inet.ed.gov

Mathematics Achievement in the Middle School Years: IEA's Third International Mathematics and Science Study (TIMSS)—This report focuses on the mathematics achievement in the two grades with the largest proportion of 13 year-olds—the seventh and eighth grades in most countries. Special emphasis is placed on the eighth grade results, including selected information about students' background and classroom practices in teaching mathematics. Data for 41 countries are presented.

To order: CSTEPP, Campion Hall 323, Boston College, Chestnut Hill, MA 02167, Telephone: 617-552-4521, Fax: 617-552-8419, Email: <http://wwwwcsteep.bc.edu/timss>

Science Achievement in the Middle School Years: IEA's Third International Mathematics and Science Study (TIMSS)—This report focuses on the science achievement in the two grades with the largest proportion of 13 year-olds—the seventh and eighth grades in most countries. Special emphasis is placed on the eighth grade results, including selected information about students' background and classroom practices in teaching science. Data for 41 countries are presented.

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Third International Mathematics and Science Study: Quality Assurance in Data Collection—A report on the quality assurance program which ensured the comparability of results across participating countries. The program emphasized instrument translation and adaptation, sampling response rates, test administration and data collection, the reliability of the coding process, and the integrity of the database.

To order: CSTEPP, Campion Hall 323, Boston College, Chestnut Hill, MA 02167, Telephone: 617-552-4521, Fax: 617-552-8419, Email: <http://wwwwcsteep.bc.edu/timss>

Third International Mathematics and Science Study: Technical Report, Volume 1 Design and Development—This report serves as a record of actions and documentation of outcomes, to use both in interpreting results and as a reference for future endeavors. It documents the design and development of TIMSS.

To order: CSTEPP, Campion Hall 323, Boston College, Chestnut Hill, MA 02167, Telephone: 617-552-4521, Fax: 617-552-8419, Email: <http://wwwwcsteep.bc.edu/timss>

January 1997

Teaching Mathematics in the Eighth Grade: An Analysis of Videos from Japan, Germany, and the United States—Researchers taped classrooms from a half-sample of the eighth grade mathematics classrooms assessed in TIMSS in three countries. This report presents the results of the analysis of these videos with information on the content of the classes, sequence and method of presentation, flow of the lesson, and use of instructional materials.

Mathematics and Science in the Eighth Grade—This report presents a short overview of the TIMSS project and a summary of the results of the United States Survey of eighth grade mathematics and science achievement. It also presents contextual information collected from students, teachers, and schools.

NOTE: The next three reports are based on data collected in the Case Studies carried out in Japan, Germany, and the United States. Four topics areas, ability differences, standards, teachers' working lives, and adolescents' lives were the focus of these case studies.

- ***Education Standards in Japan, Germany, and the United States***—This report examines educational standards in Japan and Germany, two countries with a reputation for high standards, and compares them with those in the United States. It examines two types of standards, content standards, and performance standards. In addition, it looks at how the education systems in Germany and Japan view and deal with students who do not meet the standards.
- ***Adolescent Life in Japan, Germany and the United States***—This report provides an overview of the lives of adolescents in the three countries, both in and out of school. It also examines how the forces—internal, schools, families, or society in general—motivate students. Finally, the report looks at the types of support provided to adolescents and at the obstacles to their success.
- ***Working Lives of Teachers in Japan, Germany and the United States***—This report compares policies regarding teachers and their overall working conditions in order to inform policy discussions in the United States. It compares all three countries in terms of certification and training requirements, teachers' roles in school and in the lives of their students, their general working conditions, and the school environment are provided. Other issues such as teacher preparation, improvement, level of autonomy, and types of support are also explored.

Spring/Summer 1997

NAEP/TIMSS Link in Mathematics and Science. This experimental report will link the achievement of U.S. eighth grade mathematics students in the states who took the Trial State Assessment in 1996 with students from 41 countries who took the eighth grade mathematics assessments in TIMSS in 1995. The report will also link NAEP/TIMSS performance of fourth grade students in both mathematics and science.

Other Reports To Be Released Include:

IEA International Mathematics Assessment Results Report—Primary School

IEA International Science Assessment Results Report—Primary School

U.S. Report of 4th Grade TIMSS Results

Winter 1997/98

IEA International Mathematics Assessment Results—End of Secondary Education

IEA International Science Assessment Results—End of Secondary Education

U.S. Report of 12th Grade Results

IEA International Performance Assessment Report

U.S. Report on Performance Assessment



TIMSS Classroom Videotape Study and CD-ROM

The National Center for Education Statistics of the U.S. Department of Education added two research studies to TIMSS in the United States, Japan, and Germany to gather more information about the context in which learning takes place. These are videotaped observations of classrooms and ethnographic case studies. This bulletin describes the classroom videotape study.

Dr. James Stigler of the Department of Psychology at the University of California in Los Angeles directed the classroom videotape study. The primary goal of the study was to collect, organize, and analyze videotaped observational data about how teachers in different countries teach grade 8 mathematics. Topics of interest include how teachers organize their lessons, interact with students, talk about mathematics, and use materials to explain mathematical concepts. Another goal of the study was to compare actual teaching practice, as captured on the videotapes, with recommendations in current reform documents and with teacher perceptions of these recommendations.

Design of the Study

From the sample of grade 8 mathematics classrooms participating in the main TIMSS assessment, a random subsample – 100 in the United States, 100 in Germany, and 50 in Japan – was selected for the videotape study. Videographers, native to the country in which they were videotaping, traveled from school to school throughout a 7-month period filming a “typical” lesson in each of the selected classrooms. Teachers were told that it was important that they conduct the day’s lesson exactly as they would have had the videotaping not been done on that day. Teachers were also asked to fill out a short questionnaire about the purposes of the lesson that was videotaped and to provide copies of their lesson plan and any materials (such as worksheets) used in the lesson.

The success of the videotape study hinged largely on the quality and comparability of the tapes collected. What could be analyzed from the videotapes was dependent not only on what actually happened in the classroom but also on how the camera captured what happened. Therefore, it was essential to develop standardized rules for using the camera in the classroom and to train the videographers to follow these rules carefully.

Organizing the Data

This study collected data in a wide variety of formats – videotaped images, questionnaires, lesson plans, and instructional materials – and in three languages. The first task in preparing the data for analysis was to develop a system for combining these various materials into an integrated multimedia database in English.

The classroom videotapes and supplementary materials were digitized, compressed, and stored on CD-ROM. The videotaped images were stored in digital form because digital data can be accessed randomly without having to rewind a tape and because data in digital form is less likely to degrade over time and with use.

The videotapes were transcribed, and all German and Japanese materials were translated into English. Using software specifically designed for this project, the videotapes were marked with timecodes and the transcripts and video images were linked in a multimedia database.

Coding and Analysis

In order to summarize in tabular form what the videotapes captured as visual images, a coding scheme was developed by the research team at UCLA. A preliminary coding scheme was developed from the literature on how students learn from mathematics, reform documents proposing how mathematics should be taught, the TIMSS mathematics assessment framework, and recommendations from experts in mathematics and instruction from the three countries. The coding scheme was refined through an iterative process of coding and recoding the videotapes that had been collected. From time to time, a panel of mathematics educators from the three countries was convened to participate in revising the coding scheme and to examine the cross-cultural differences in instruction as captured on the videotapes.

Codes were developed to describe the following general aspects of the lessons that were videotaped:

- The classroom environment (e.g., number of students, materials available and in use);
- Characteristics of the lesson (e.g., goal, organization, and mathematical content of the lesson);
- How mathematics is studied during seatwork; and
- How mathematics is studied during classwork.

The codes assigned by the coders were included in the database, making it easy for researchers to search the database for exemplars of each coded item. Statistical analyses of each of the codes could be conducted, thus quantifying different types of student and teacher behavior and classroom activities.

Reporting Results

The CD-ROM is being released at a news event on November 20th, in Washington, D.C. A report describing the differences in teaching practices observed in the three countries will be released in the winter of 1997, along with the reports on the other components of the study.

Schools, teachers, parents, and students were promised that the videotaped images of students and teachers would remain confidential. This means that the data from the study will be summarized and reported as averages across a large number of classrooms;

information about a single classroom will not be released, nor will the videotapes themselves be released to the public. However, because much of the excitement of this study comes from watching the videotapes themselves, five public use videotapes have been made with the signed consent of all of the participants.

The transcripts of the study videotapes from each country and the videotapes themselves will be made available by NCES under a licensing agreement to members of the scientific community who promise to maintain confidentiality for research purposes.

Some TIMSS Questions

How do teachers in the three countries teach?

How do their instructional practices differ?

How are lessons organized and presented in each of the three countries?

What are the cultural scripts for the lessons in the three countries?

What is the role of the teacher and of the students during seatwork?

During classwork?

Are the students passive or active learners?

What proportion of class time is spent in instructionally relevant activities? In social or "housekeeping" activities?

Are teachers aware of reform standards regarding the teaching of mathematics? Do teachers who think they are following the standards seem to be implementing the standards in their classrooms?

**FOR MORE INFORMATION ON THE TIMSS STUDY IN THE U.S.,
PLEASE CALL: 202-219-1395.**



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"TIMSS is the world's largest, most comprehensive and rigorous international comparison of teaching, learning and achievement—with data on half a million students, in three grade levels, in the US and 40 other countries. Today's report, *Pursuing Excellence* is a snapshot of US of eighth grade mathematics and science. It is the first of many NCES investigations into TIMSS data that provides our country with invaluable international benchmarks defining world-class performance in education."

"*Pursuing Excellence* is the most complete and accurate picture of how eighth grade mathematics and science education in the US differs from other nations. The report looks beyond horse race comparisons of student test scores to explore rich information on the practices that shape education and achievement around the world."

"*Pursuing Excellence* combines a variety of innovative research techniques to shed new light on US education through the prism of other countries. NCES examined information on textbooks and curricula, analyzed case studies, and surveyed teachers, students and school administrators. We looked how well our students did on international assessments compared to randomly selected international peers. Researchers even compared video tape from typical eighth grade mathematics classes in the US, Germany and Japan."

On Student Achievement...

"The achievement of US eighth graders is above the 41-country average in science and below average in mathematics. We perform noticeably above the international average in some sub-fields, such as life science and environmental issues; about average in others, such as algebra and physics; and far below average in subjects such as geometry and measurement. With the notable exception of Japan, we perform comparably with many of our major economic competitors. And in a world-wide talent search for the top ten percent of eighth-graders in the 41 TIMSS countries, 13 percent of our science students and five percent of our mathematics students would make it into the 'talented tenth'."

-- more --

Tempting as it may be, it is not correct to report test scores by rank. Given the margins of error, NCES grouped countries into bands of performance – according to whether their students performed above, below, or at the same level as ours. It is an irresponsible use of statistics to portray one country as performing better than another country in the same band.”

On Exposing Education Myths...

“Data in this report expose myths that surround educational achievement. Contrary to popular opinion, US eighth-graders have more hours of instruction in mathematics and science than those in Germany and Japan. Our eighth-graders do as much homework as the Japanese and Germans, and heavy TV watching is as common among US students as it is among their Japanese counterparts. We also cover more topics in our mathematics and science classes than most other nations. Clearly US performance is not due to how much time we spend, but rather, how we spend it. More of the same is not the answer.”

On Teaching and Learning...

“Much of the data in TIMSS underscore the importance of rigor. This study shows that we expect less from our children and they meet our expectations. What we teach in eighth grade mathematics, classes overseas typically cover in the seventh grade. Our curriculum, teaching and textbooks are less focused and challenging than that of other countries. Despite reform recommendations and standards that call for students to apply mathematical thinking, the study shows we teach students procedures --how to do something, not how to understand mathematical concepts. We require less high-level thought of our students in eighth grade mathematics classes than do the Germans and Japanese.”

“The findings also suggest that US mathematics teachers are not yet carrying out many reform recommendations. For example, 95 percent of math teachers studied in 1995 reported familiarity with the education standards developed by the National Council of Teachers of Mathematics. Seventy-five percent said their lessons reflect these recommendations. Yet analysis of videotaped lessons show that only a few apply the key points in their classrooms. Ironically, the data show that Japanese teachers, whose students outperform ours, widely practice what the US mathematics standards recommend.”

On Next Steps...

“There is much left to discover from TIMSS. In 1997, NCES will release a state-by-state comparison of student performance in the US and other TIMSS countries. We'll also release data on teaching, learning and achievement in grade four and at the end of high school.”

“TIMSS is truly a treasure trove of information that will inform efforts to improve teaching and learning for decades to come. NCES plans to make TIMSS the most accessible study ever. Information is being released on CD ROM, video tape and on the World Wide Web. The reports start anew the national conversation about what we want our schools to accomplish and how close we are to achieving our goals.”

**Full text and graphics from the TIMSS reports are available on the World Wide Web at:
<http://www.ed.gov/NCES/timss>**

Visit the NCES TIMSS Web Site

<http://www.ed.gov/NCES/timss>

- ***Full text and graphics from “Pursuing Excellence,” a synthesis of TIMSS data on US eighth-grade mathematics and science teaching, learning and curriculum in an international context.***
- ***Executive summary of “Splintered Vision,” an NSF report analyzing TIMSS data on textbooks and curriculum in the US and abroad.***
- ***Links to other TIMSS-related Web sites.***
- ***Download and print-out TIMSS information.***

***For more information on TIMSS,
please call 202-219-1395.***