

April
2001



TIMSS
1999
Benchmarking

HighLights

A Bridge to School Improvement

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

Many states and school districts have been working on the arduous task of improving education in their jurisdictions. There has been concerted effort across the nation in writing and revising academic standards that has very much included attention to mathematics and science. Most states are in the process of implementing new content or curriculum standards or revising existing ones. Participation in the TIMSS 1999 Benchmarking Study provided an unprecedented opportunity for jurisdictions to assess the comparative international standing of their students' achievement and to evaluate their mathematics and science programs in an international context.

In 1999, the U.S. eighth graders performed significantly above the TIMSS international average in mathematics and science, but about in the middle of the achievement distribution of the 38 participating countries (above 17/18 countries, similar to 6/5, and below 14 in both subjects). In TIMSS 1999, the world class performance levels in mathematics were set essentially by five Asian countries – Singapore, the Republic of Korea, Chinese Taipei, Hong Kong SAR, and Japan. In science, four Asian countries and a central European one had the highest performance – Chinese Taipei, Singapore, Hungary, Japan, and the Republic of Korea.

Now Available...

**Comparative results for the
TIMSS 1999 Benchmarking
Study in mathematics and science
at the eighth grade are available
in two companion reports.**



Mathematics
Benchmarking
Report:
TIMSS 1999 – Eighth Grade



Science
Benchmarking
Report:
TIMSS 1999 – Eighth Grade

See back for more detailed information about reports from TIMSS 1999



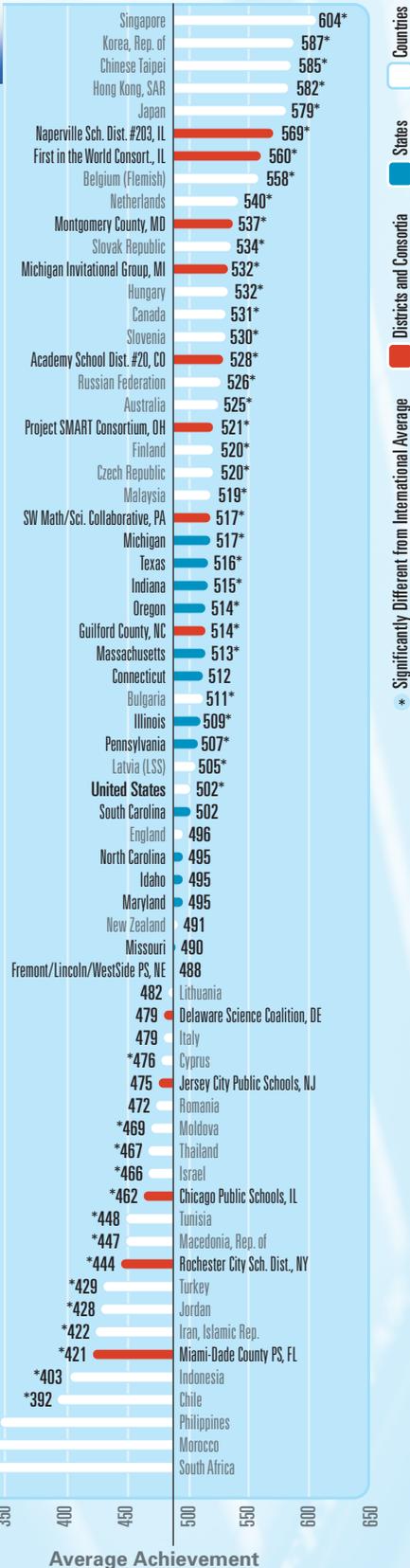


Major Findings From The TIMSS 1999 BENCHMARKING STUDY

- Average performance in mathematics for the 13 Benchmarking states was generally clustered in the middle of the international distribution of results for the 38 countries. In mathematics, all of the Benchmarking states performed either significantly above or similar to the international average, yet significantly below the five high-performing Asian countries.
- In science, performance for the 13 states was relatively better than in mathematics, with performance clustered in the upper half of the international distribution. All but 3 states performed significantly above the international average.
- The Benchmarking Study underscores the extreme importance of looking beyond the averages to the range of academic achievement found across the United States. Performance across the participating school districts and consortia reflected nearly the full range of achievement internationally.
 - ▶ At the high end of the continuum in mathematics, although achievement was not as high as Singapore, Korea, and Chinese Taipei, the Naperville School District and the First in the World Consortium (both in Illinois) performed similarly to Hong Kong, Japan, Belgium (Flemish), and the Netherlands. In science, the Naperville School District and the First in the World Consortium, the Michigan Invitational Group, and the Academy School District (in Colorado) all had average achievement comparable to Chinese Taipei and Singapore.
 - ▶ At the other end of the continuum in both mathematics and science, urban districts with high percentages of students from low-income families and minorities performed similarly to lower-performing countries in TIMSS 1999, but significantly higher than the lowest-scoring countries.
- In mathematics, students in the Benchmarking jurisdictions generally followed the national pattern of doing relatively less well in measurement and geometry than in fractions and number sense, data representation, and algebra. Similarly, they tended to perform relatively less well in physics than in the other science content areas.



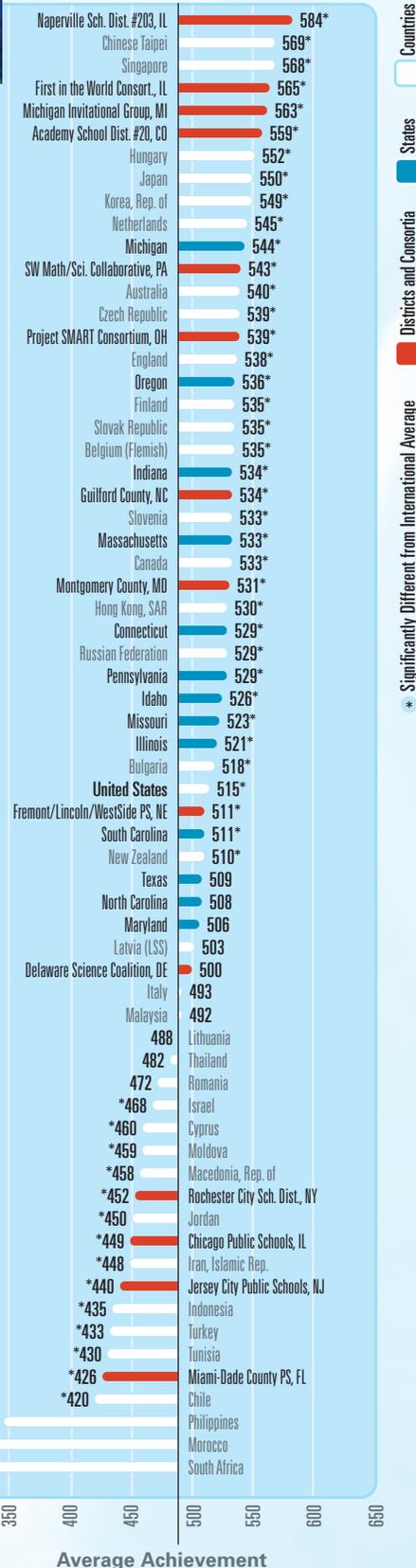
Mathematics Achievement



International Average: 487



Science Achievement



International Average: 488





Improving students' opportunities to learn requires examining every aspect of the educational system, including the curriculum, teacher quality, availability and appropriateness of resources, students' motivation, instructional effectiveness, parental support, and school safety. There is no "magic bullet" or single factor that is the answer to higher achievement in mathematics or science. Raising achievement involves improvements in a number of important areas related to educational quality.

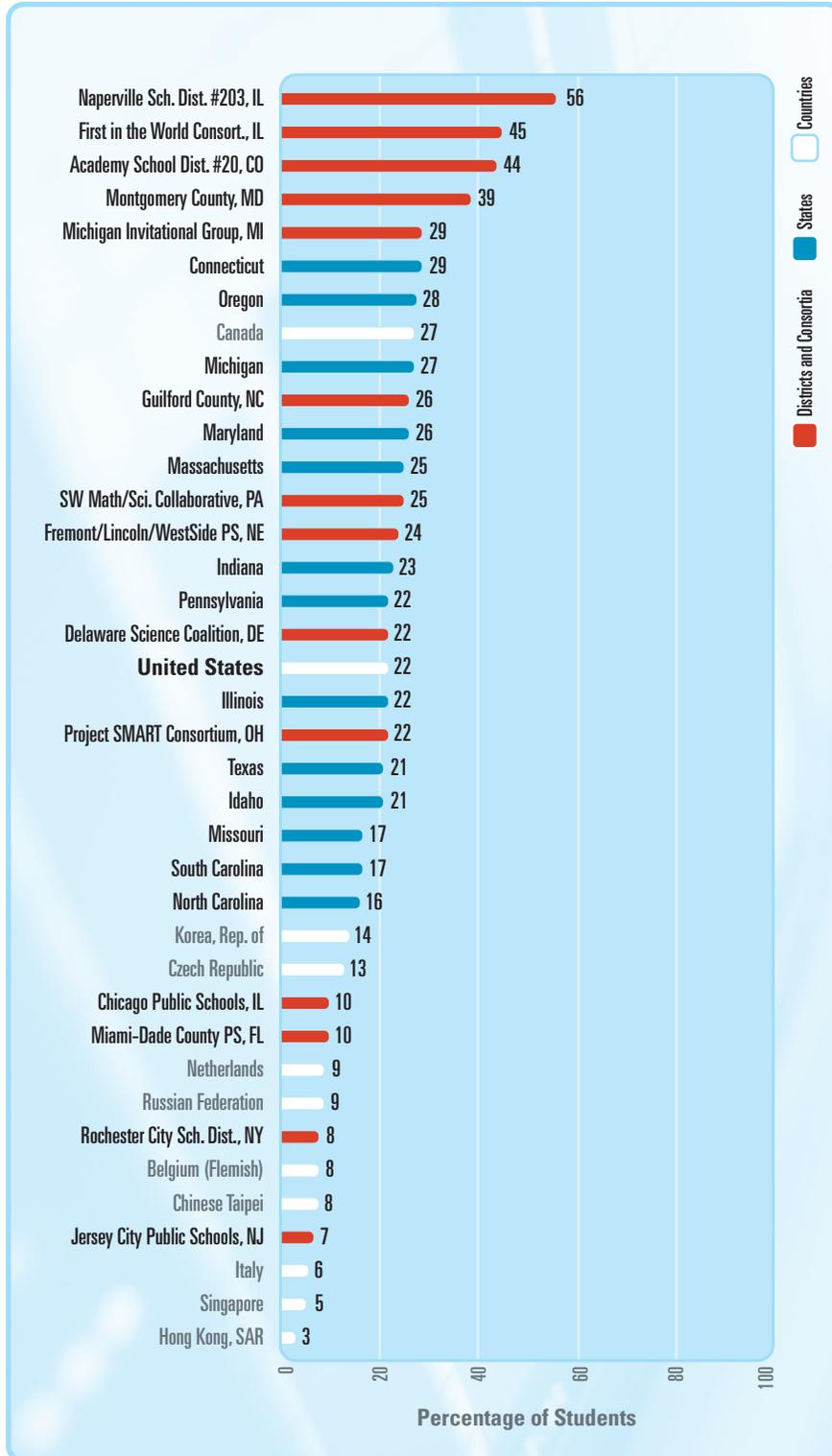


■ Disparities in Opportunities to Learn at Home and at School

- The TIMSS 1999 Benchmarking Study provides evidence that some schools in the U.S. are among the best in world, but that a world-class education is not available to all children. Students with fewer educational resources at home also often have fewer opportunities at school.
 - ▶ Benchmarking jurisdictions with more students from homes with high levels of educational resources were among the top-achievers in TIMSS 1999, and those with the lowest achievement were four urban districts that also had the lowest percentages of students with high levels of home educational resources (see opposite).
 - ▶ The results also support extensive research showing that students in urban districts often attend schools with fewer resources than in non-urban districts, including a less challenging curriculum and an atmosphere less conducive to learning.



High Level of Home Educational Resources



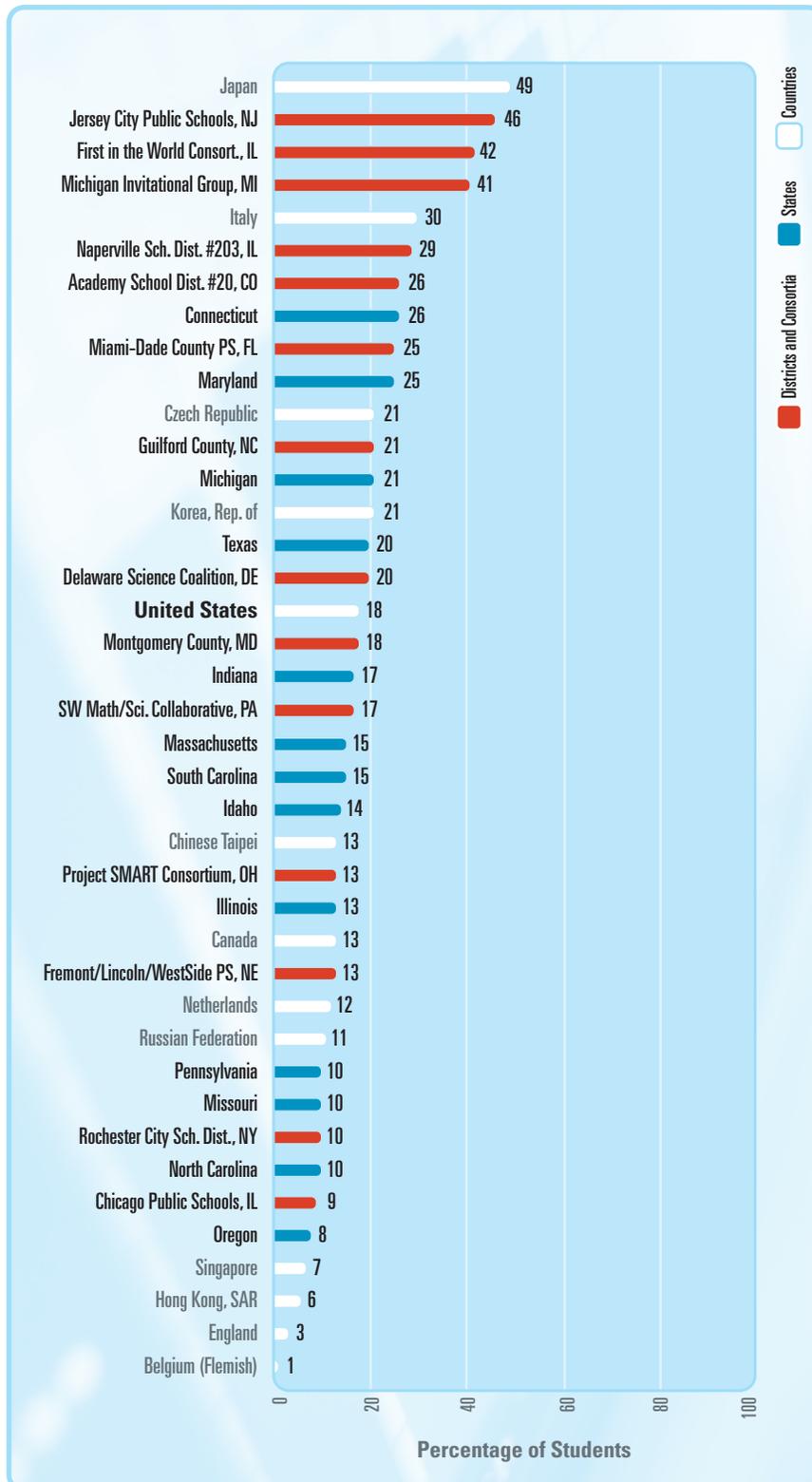


Results About Teaching and Learning

- Research shows higher student achievement in mathematics and science is associated with teachers having a university degree in the subject. Results varied dramatically across the Benchmarking entities. In the United States, however, students were more likely than students internationally to be taught by teachers with degrees in education or “other.”
- In general, teachers in many Benchmarking entities and in the United States overall may be overconfident about their preparation to teach eighth-grade mathematics. Across the Benchmarking entities, the smallest percentage of students with teachers who felt “very well prepared” to teach mathematics was 75 percent – compared to the international average of 63 percent. The comparable figure for the U.S. was 87 percent. Teachers were less confident in their preparation to teach science. Just 27 percent in the U.S. felt “very well prepared,” with a range across Benchmarking jurisdictions from 56 percent to 14 percent.
- The TIMSS data show that the instructional time for learning mathematics and science included considerable focus on lecture-style demonstrations by teachers and practice for students working on worksheets or textbooks. Instructional time is further eroded by interruptions. In Japan and Korea, more than half the students were in classes that never had interruptions for announcements or administrative tasks. Among the Benchmarking participants, the results ranged from 22 percent of the eighth graders in such classes in Naperville to only 5 percent in the Jersey City Public Schools.
- The choices teachers make determine, to a large extent, what students learn.
 - ▶ The TIMSS Benchmarking data show higher mathematics achievement when teachers emphasize reasoning and problem solving activities. About half the Japanese students had teachers who reported a high degree of emphasis on reasoning activities in their mathematics classes, more than in any other country. The emphasis on problem-solving varied dramatically across Benchmarking participants. At the top end, between 41 and 46 percent of the students in Jersey City, the First in the World Consortium, and the Michigan Invitational Group had teachers who reported a high degree of emphasis (see opposite).
 - ▶ Higher science achievement was related to the emphasis that teachers place on experiments or practical investigations. There also was great variation among the Benchmarking participants in the percent of students in science classes with a high degree of emphasis on scientific investigation, from 79 percent in Naperville, more than in any TIMSS 1999 country, to 17 percent in the Delaware Science Coalition.



High Emphasis on Reasoning and Problem Solving in Math Class





Mathematics: Example Item 1

Percent Correct



Chris plans to order 24 issues of a magazine. He reads the following advertisements for two magazines. *Ceds* are the units of currency in Chris' country.

Teen Life Magazine

24 issues
 First four issues FREE
 The rest
 3 *ceds* each.

Teen News Magazine

24 issues
 First six issues FREE
 The rest
 3.5 *ceds* each.

Which magazine is the least expensive for 24 issues? How much less expensive? Show your work.

$$\begin{array}{r} \text{Teen Life} = 20 \\ \times 3 \\ \hline 60 \text{ ceds} \\ 24 = 60 \text{ ceds} \end{array}$$

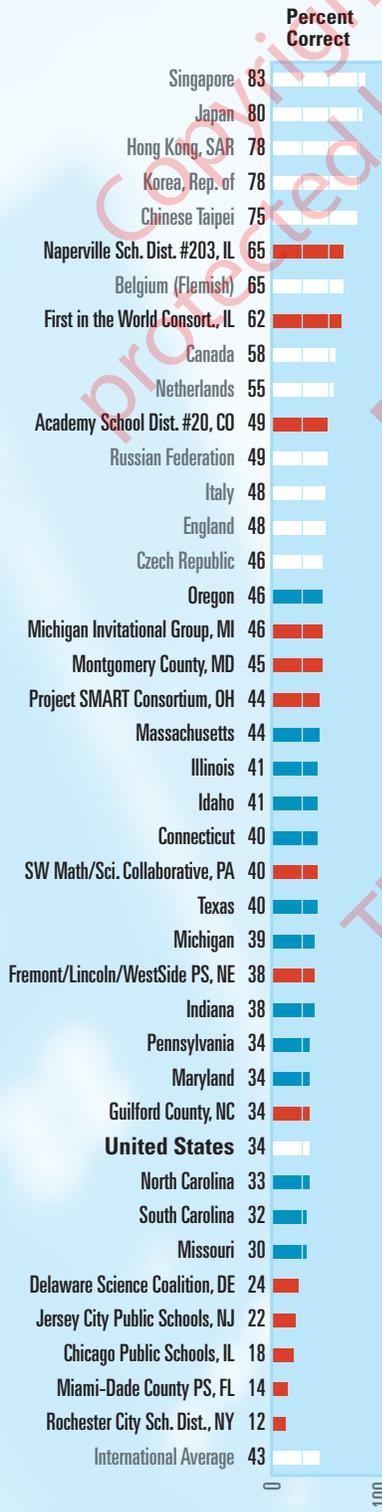
$$\begin{array}{r} \text{Teen News} = 18 \\ \times 3.5 \\ \hline 90 \\ 540 \\ \hline 63.0 \\ \text{ceds} \\ 24 = 63 \text{ ceds} \end{array}$$

Teen Life is less expensive by 3 *ceds*.

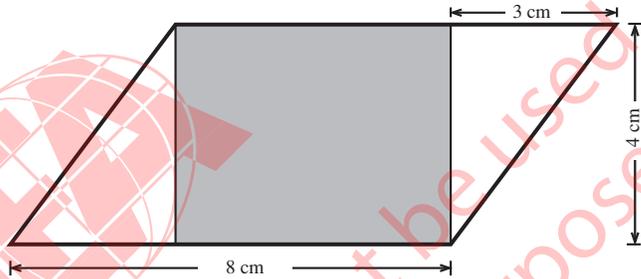
Legend: ■ Districts and Consortia ■ States ■ Countries



Mathematics: Example Item 2



The figure shows a shaded rectangle inside a parallelogram.



What is the area of the shaded rectangle?

Answer: 20

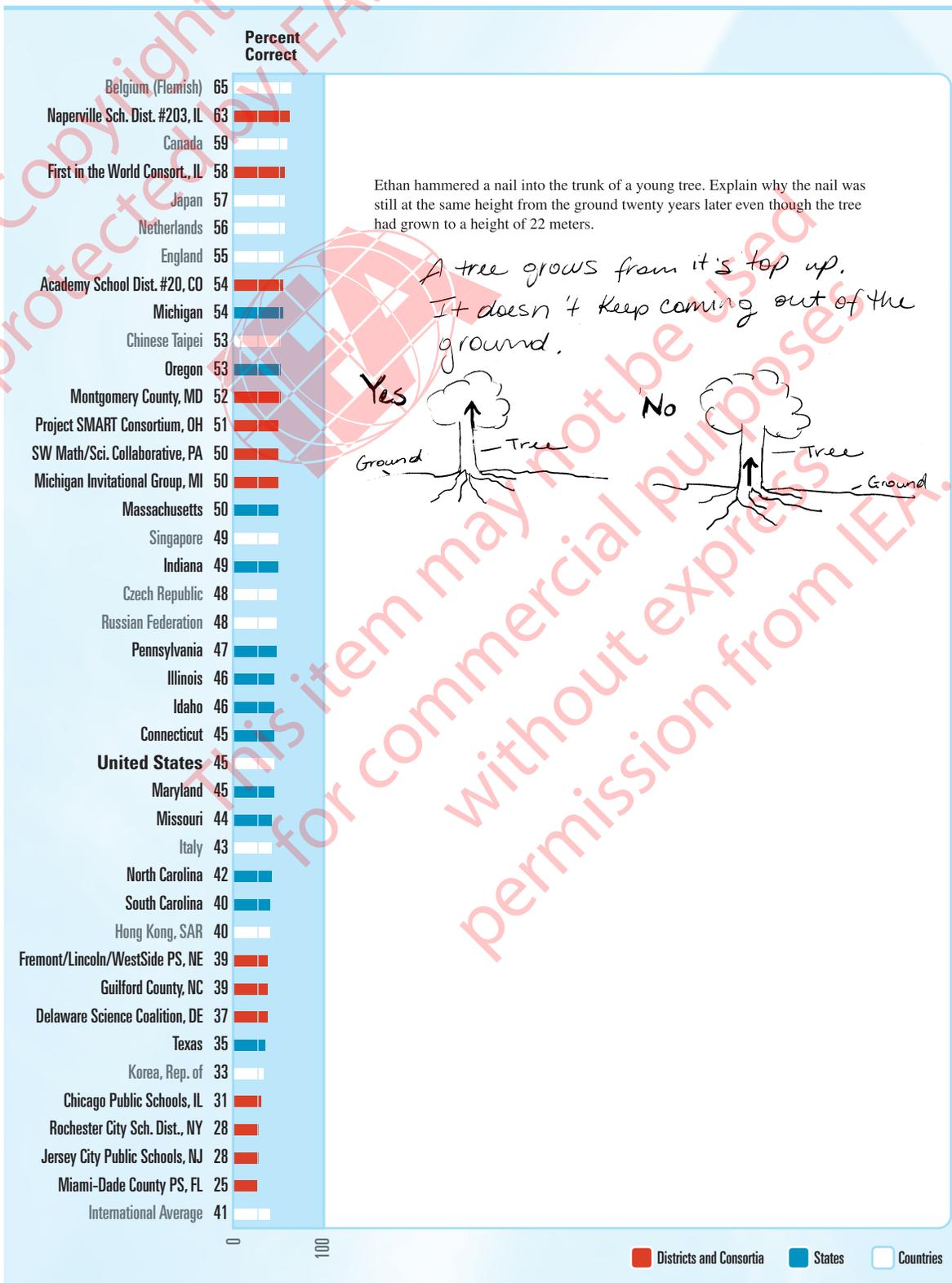
$$8 - 3 = 5$$

$$\begin{array}{r} 5 \\ \times 4 \\ \hline 20 \end{array}$$



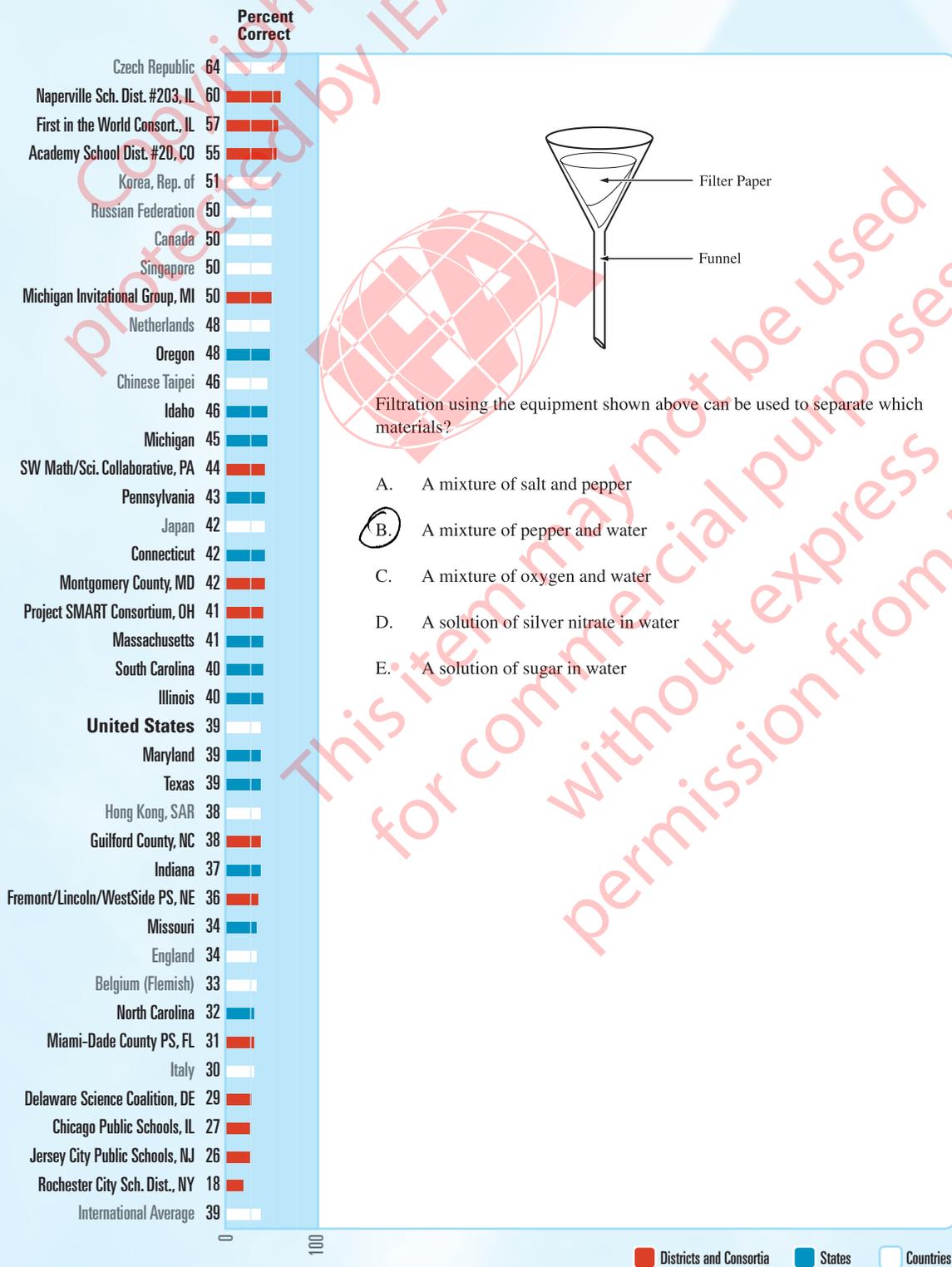


Science: Example Item 3





Science: Example Item 4





The TIMSS studies are projects of the International Association for the Evaluation of Educational Achievement (IEA). The IEA is an independent international cooperative of national research institutions and government agencies. Since its inception in 1959, the IEA has conducted more than 15 studies of cross-national achievement.



The International Study Center at Boston College is dedicated to conducting comparative studies in educational achievement. Principally, it serves as the International Study Center for IEA's studies in mathematics, science, and reading - the Trends in Mathematics and Science Study (TIMSS) and the Progress in International Reading Literacy Study (PIRLS).



Support for the overall design, administration, data management, and quality assurance activities of the TIMSS Benchmarking Study was provided by the National Center for Education Statistics (NCES) in the U.S. Department of Education, the U.S. National Science Foundation (NSF), and the Office of Educational Research and Improvement (OERI) in the U.S. Department of Education. Each Benchmarking participant contracted directly with Boston College to fund data-collection activities in its own jurisdiction. Funding for the international coordination of TIMSS 1999 was provided by NCES, NSF, the World Bank, and participating countries. Each participating country was responsible for funding local project costs and implementing TIMSS 1999 in accordance with the international procedures.

TIMSS REPORTS 2000 - 2001



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