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ABSTRACT

International comparisons show that U.S. students perform well in reading, less well in science, and more poorly still in mathematics. Researchers have found that several factors in combination appear responsible for the complex pattern of achievement, and no quick fix appears available for problem areas. Research suggests that it is quality and content of instruction, rather than mere time, that is important in performance. The evidence is mixed about the relationship between television viewing and academic achievement, and no clear conclusions are possible at present. The average time spent on homework is apparently not a deciding factor, as comparisons with other countries indicate. More important is the rigor of the curriculum. The curriculum offered in the United States is apparently less rigorous than that of other countries, and students are less likely to take advanced mathematics and science courses. Effort, and the emphasis teachers put on effort, along with their beliefs about the importance of ability, may contribute to the differences. The importance of international studies is not in their ranking of countries, but in the information they provide about why other countries are successful. (Contains 7 references.) (SLD)

# EDUCATION POLICY ISSUES: STATISTICAL PERSPECTIVES

# UNDERSTANDING THE PERFORMANCE OF U.S. STUDENTS ON INTERNATIONAL ASSESSMENTS

U.S. Department of Education
Office of Educational Research & Improvement
National Center for Education Statistics

NATIONAL CENTER FOR EDUCATION STATISTICS

EDUCATION POLICY ISSUES: STATISTICAL PERSPECTIVES

February 1994

# Understanding the Performance of U.S. Students on International Assessments

*This new series of Statistical Perspectives from NCES is designed to provide the best statistical information available on important education policy questions. The series primarily provides information grounded in statistical findings, but also, as appropriate, provides some information based on smaller-scale research and case studies.*

The academic performance of U.S. elementary and secondary students relative to students in other countries is not consistent. International comparisons show that U.S. students perform well in reading, less well in science, and more poorly still in mathematics.[1, 2] Younger U.S. students generally perform comparatively better than older ones.

What factors are associated with the differences in the relative performance of U.S. students? A number of factors are frequently cited as *the* explanation for our students' relative performance, such as time in school, television watching, homework, effort, curriculum content, and instructional practices. Some factors, although very often mentioned, do not easily explain the complex pattern of differential performance, while others pose important challenges to American education policy. Researchers have found that several factors in combination appear to be important, suggesting that there is no "quick fix."

**Does time spent in school make a difference?**

Although students in some countries spend more days in school than U.S. students, they do not necessarily receive more hours of instruction (table 1). Research suggests the need to look more carefully at the *quality* and *content* of instructional time, rather than its *quantity*.

**Table 1.— Annual school days and instructional hours for 13-year-olds[3]: 1991**

| Country | Days in school | Instructional hours |
|---|---|---|
| Korea | 222 | 977 |
| Japan | 220 | 875 |
| Canada | 188 | 953 |
| **United States** | **180** | **1,003** |
| France | 174 | 1,073 |

**Table 2.— Percent of items correct in mathematics assessment and time spent on math homework and on television watching for 13-year-olds[3]: 1991**

| Country | Percent items correct | Percent 5 or more hours of TV each day | Percent 4 or more hours on math homework each week |
|---|---|---|---|
| Switzerland | 71 | 7 | 15 |
| Soviet Union (former) | 70 | 17 | 33 |
| France | 64 | 5 | 17 |
| Israel | 63 | 20 | 17 |
| **United States** | **55** | **20** | **15** |
| Spain | 55 | 10 | 22 |

This is a global measure of instructional time, covering all subjects, so it cannot explain why, in comparison to others, American students perform differently in different subjects. For example, Japanese seventh graders receive less math instructional time than do their U.S. peers, yet they significantly outperform American students in math. Japanese teachers cover more material in less time.[4] Increasing overall time in school without other instructional changes will not necessarily improve American math scores.

**Would our students do better if they watched less TV?**

The evidence is mixed about the relationship between television viewing and academic performance. U.S. students do watch a lot of television, and their performance in mathematics and science is relatively poor . There are other countries where children watch as much television (e.g., the former Soviet Union and Israel), but whose average performance is higher (table 2). In contrast, French students watch less TV than Soviet students, but have lower average math scores. Finnish students watch large amounts of television, yet perform the highest on a test of reading literacy among 9-year-olds.[1] Researchers have hypothesized that countries such as Israel and Finland may have more educational content in their television programming than others.



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Individual student performance *within* countries also varies. In many countries, including the U.S., 13-year-olds who watch more television perform worse in mathematics, science, and reading literacy assessments. But among 9-year-olds, there is no clear relationship between amount of television watching and individual student performance.[1, 3]

**Is the average time a country's students spend on homework related to their achievement?**

Apparently not. At age 13, students in France, Israel, Switzerland, and the U.S. were equally likely to spend substantial time on math homework (table 2), yet the average performance in these countries ranged from high (Switzerland) to low (U.S.). Students in the former Soviet Union were twice as likely as Swiss students to do a lot of math homework, but their average performance was similar. Findings were similar in science.[3]

Within countries, the results are mixed: in most countries, including the U.S., 13-year-olds who do more homework achieve higher mathematics scores. At age 9, however, there was far less relationship between homework and performance. In science, there was no clear relationship between hours spent on homework and student performance at either age 9 or 13 in many countries.[3] The content of homework and teacher feedback may be more important than how much time is spent doing it.

**Are U.S. students being exposed to as rigorous a curriculum as students in other countries?**

International studies in the 1980s found that in some countries that performed substantially better than the U.S., students were exposed to relatively complex topics and concepts at much earlier ages. When students were taught a more demanding curriculum, they learned more in the discipline and more advanced skills at earlier ages.

For example, the American mathematics curriculum for 13-year-olds in the early 1980s more closely resembled elementary school curriculum of better performing countries and it was much more disorganized and repetitive than the curricula in many other countries. On average, U.S. 8th graders spent 20 percent of their time on algebra, compared to 37 percent for similar Japanese students. In secondary school, the U.S. curriculum concentrated more on algebra, whereas many other countries taught calculus and the curriculum resembled early collegiate mathematics in the U.S.[5]

International studies demonstrate important differences in the introduction of particular subjects to the curriculum. In countries where students received instruction in particular science fields (e.g. biology or chemistry), students performed better in those fields.[2]

The curriculum offered in the U.S. is apparently less rigorous than in other countries; U.S. students are also less likely to take advanced mathematics and science courses, as these are not required for graduation. In 1990, fewer than 10 percent of U.S. students enrolled in the most advanced mathematics courses, a much lower proportion than in other industrialized nations.[6] By contrast, U.S. 9-year-olds spent as much or more time reading and studying language as students in any other country. Reading instruction is the focus of considerable attention in American elementary schools, and students perform very well relative to their international peers.[1]

**Does effort make a difference?**

Researchers suggest that the Japanese stress effort as the path to succeeding in math and science, while Americans, in general, tend to believe that ability, not hard work, is more important. Most U.S. teachers seem to believe that all students can and must learn to read to benefit from elementary education, but they think that advanced mathematics and science are for only a few.[7]

## Conclusion

Factors related to our relatively poor performance in some subjects and better performance in others are very complex. Curriculum, student effort, beliefs about the relative importance of effort and ability, and instructional practices are all related to performance. Total instructional time and television watching, while important, are not subject-specific and so they cannot explain why U.S. students perform relatively well in some subjects but poorly in others. The *quality* and *content* of the time spent are as important as the *quantity*. The value of international studies of student performance is not to rank countries. Instead we can use them best to learn *how* different societies and educational systems educate their youth and to gain new insights into how we educate our own children. While international studies are frequently critiqued on technical grounds and further research is clearly needed, the results are consistent enough to support these general findings.

[1]Lundberg, I. and P. Linnakyla, *Teaching Reading Around the World*, and Elley, W.B., *How in the World Do Students Read?* International Association for the Evaluation of Educational Achievement, 1992.

[2]Medrich, E. A. and J.E. Griffith, *International Mathematics and Science Assessments: What Have We Learned?* National Center for Education Statistics, 1992.

[3]Educational Testing Service, *Learning Mathematics* and *Learning Science*, The International Assessment of Educational Progress, 1992.

[4]Schaub, M. and D. Baker, *Solving the Math Problem: Exploring Mathematics Achievement in Japanese and American Middle Grades*, University of Chicago, 1991.

[5]McKnight, C., et al., *The Underachieving Curriculum: Assessing U.S. School Mathematics from an International Perspective*, International Association for the Evaluation of Education Achievement, 1987.

[6]U.S. Department of Education, National Center for Education Statistics, *The 1990 High School Transcript Study Tabulations*, 1993.

[7]Peak, L., "Academic Effort in International Perspective," in *Motivating Students to Learn*, T.M. Tomlinson, ed., McCutchan Publishing Company, 1993 and Stevenson, H. and J. Stigler, *The Learning Gap*, Summit Books, 1992.

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