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ABSTRACT

The state of education in the United States is examined by asking how much educational value schools add as children pass through them, and at what cost. This approach eases the problems that arise from differing background experiences as children start school. Issues related to academic achievement in the United States are studied through a comparison of school effects from members of the Organization for Economic Cooperation and Development. Data from the most recent international surveys of the International Association for the Evaluation of Educational Achievement and the Organization for Economic Cooperation and Development show that among schools in comparable countries, those in the United States on average make the smallest year-to-year gains in academic achievement. The longer American students spend in school, the farther behind they fall. Yet, per-pupil expenditures in the United States are among the world's highest. Because they make the poorest progress and rank in the highest category of spending, U.S. schools, by nationally agreed on standards, are least productive among those in comparably economically advanced countries. In reading, mathematics, and science through eighth grade, U.S. schools rank last in four of five comparisons of achievement progress. However, per-student expenditures on U.S. primary and secondary schools were third highest among more than 20 advanced countries. Today, unlike the past, more secondary school students in comparable countries on average remain in school than students in the United States do, so their superior achievement gains do not depend on student selectivity or higher dropout rates. An appendix discusses value-added achievement comparisons. (Contains two tables and seven charts.) (SLD)

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Spending more while Learning Less

by Herbert J. Walberg

JULY 1998

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U.S. School Productivity in International Perspective

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Foreword

A key mission of the Thomas B. Fordham Foundation is to supply education reformers with helpful, often actionable information that they might not otherwise see. In pursuit of that end, we sometimes ask experts—the kind whose writing is as clear as their analysis is careful—to distill significant research findings and explicate significant data.

No education data are more significant than those that place U.S. schools and students in an international context and enable us to compare the performance of our education system with that of other countries. Although such analyses are resisted by some in the education fraternity—they typically claim that comparisons are inherently illegitimate and that America's situation is unique—most policymakers welcome them. And nobody we know is more adept at this sophisticated form of scholarship than Herbert J. Walberg, whose brief biography appears below. Tireless, meticulous, and seemingly immune to conventional wisdom, Dr. Walberg was a natural choice to examine and summarize important findings—drawn from several recent studies—that illuminate the academic performance of U.S. schools and students, and to incorporate in this analysis some helpful comparisons supplied by the Organization for Economic Cooperation and Development (OECD).

The result is a vivid and unusual glimpse of the woeful productivity of U.S. schools in international perspective.

The question Walberg set out to answer is: How much educational value do schools add as children pass through them, and at what cost? This approach eases the problems that typically dog comparative research, such as the fact that differing home environments and pre-school experiences mean youngsters in various countries start their formal schooling at different levels of readiness. When one looks at "value added," however, this factor practically disappears, and actual "school effects" are clearly revealed.

The advanced countries that Walberg compared are all OECD members, found in North America, the Pacific Rim, and Western Europe. The OECD is a respected statistical and policy agency that obtains, analyzes, and reports uniform data on its member countries. Starting with economic statistics, the OECD added indicators and analyses of health, technology, and science. During the past decade, it launched an ambitious education indicator program embodied in its annual report, *Education at a Glance: OECD Indicators*. The

present report draws upon the latest three editions of that report, which include information on mathematics, reading, and science achievement.[1]

Dr. Walberg is Research Professor of Education and Psychology at the University of Illinois at Chicago. For a decade, he served on the Technical Committee of the International Association for the Evaluation of Educational Achievement (IEA), the multi-country agency that compares test scores of students in more than 25 countries. For the OECD, he chaired the technical advisory committee on education indicators. He also served as a founding member and chair of the Design and Analysis Committee of the National Assessment Governing Board. He is a member of the International Academy of Education and fellow of the American Association for the Advancement of Science, the American Psychological Association, the American Psychological Society, and the Royal Statistical Society (London). Readers wishing to contact him directly may write him at 180 East Pearson Street, Number 3607, Chicago, IL 60611-2107 or e-mail Hwalberg@uic.edu.

The Thomas B. Fordham Foundation is a private foundation that supports research, publications, and action projects in elementary/secondary education reform at the national level and in the vicinity of Dayton, Ohio. Further information can be obtained from our web site (http://www.edexcellence.net) or by writing us at 1015 18th Street, N.W., Suite 300, Washington, D.C. 20036. (We can also be e-mailed through our web site.) This report is available in full on the Foundation's web site and hard copies can be obtained by calling 1-888-TBF-7474 (single copies are free).

Chester E. Finn, Jr., President
Thomas B. Fordham Foundation
Washington, D.C.
July 1998

Executive Summary

Among schools in comparable countries, those in the U.S. on average make the smallest year-to-year gains in academic achievement. The longer American students are in school, the further they fall behind students in other lands. Yet per-pupil expenditures on U.S. schools are among the world's highest.

Because they made the poorest progress and ranked in the highest category of spending, U.S. schools, by internationally agreed upon standards, are least productive among those in comparable (i.e., economically advanced) countries.

More specifically:

1) In reading, science, and mathematics through eighth grade, U.S. schools ranked last in four of five comparisons of achievement progress. In the fifth case, they ranked second to last.

2) Between eighth grade and the final year of secondary school, U.S. schools slipped further behind those in other countries.

3) Because they made the least progress, U.S. secondary schools ranked last in mathematics attainment and second to last in science.

4) Per-student expenditures on U.S. primary and secondary schools were third highest among more than 20 advanced countries.

5) Today, unlike the past, more secondary school students in comparable countries on average remain in school than in the U.S. Thus, their superior achievement gains do not depend on student selectivity or higher dropout rates.

This report is based on the largest, most recent, and most rigorous international achievement surveys. These were carried out by the multi-national International Association for the Evaluation of Educational Achievement (IEA) and used by the Paris-based Organization for Economic Cooperation and Development (OECD) in its compilations of education indicators for economically advanced countries. This report makes use of the results for all age groups and employs measures of value-added progress made by schools rather than comparisons of students of a single age.

Spending More While Learning Less

Reading Progress

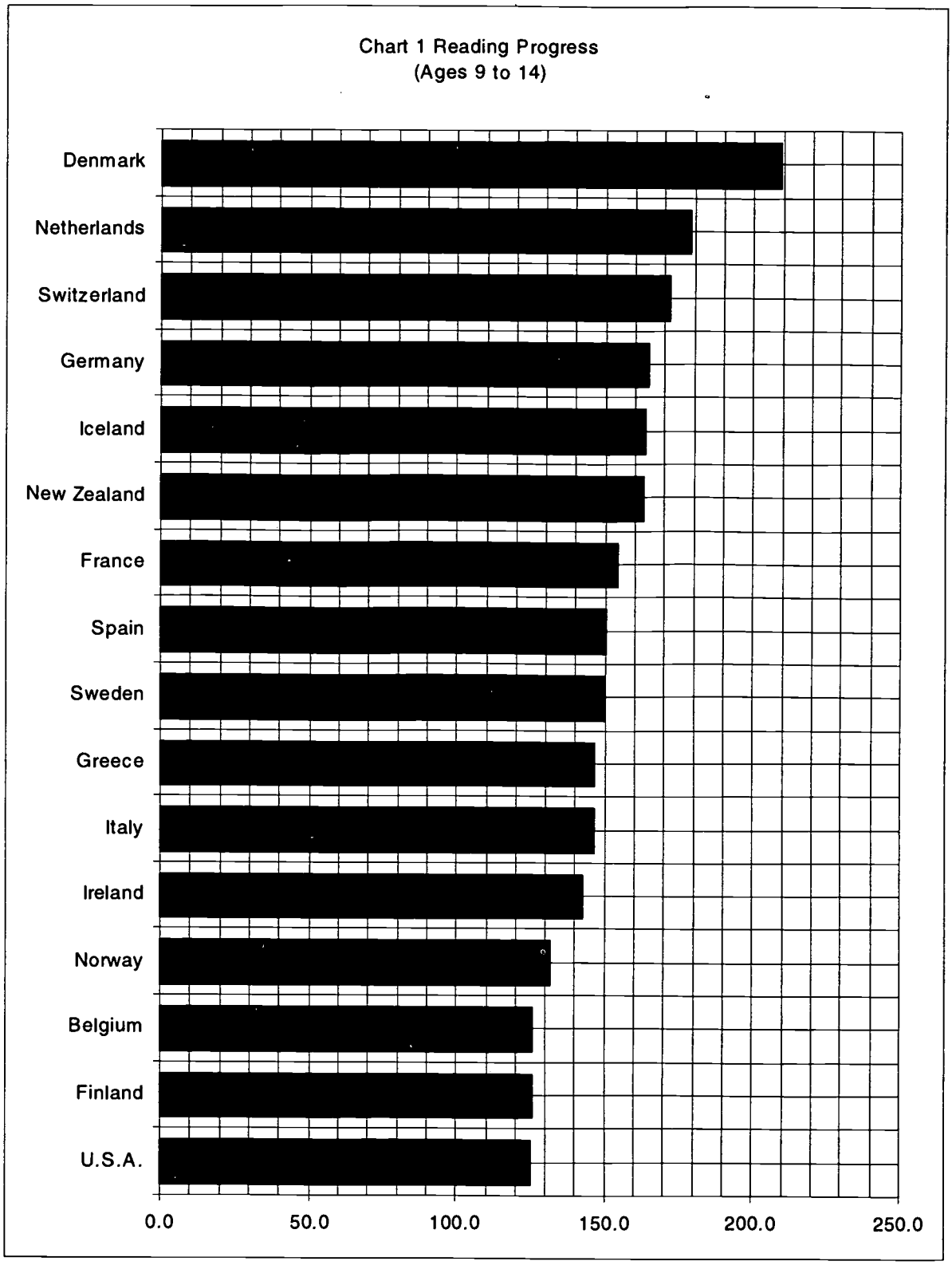
No skill is more fundamental to academic success than reading. Yet it is strongly influenced by socio-economic status, child rearing, and suchlike. Until children start school around the age of six, families, mass media, and other non-school factors are the chief sources of influence on their initial vocabulary and comprehension. Comparisons of schools that do not account for these factors would be unfair and incomplete. The big question about schools, then, is not how much students know at one point in time, especially early in their academic careers, but how much progress students make during the school years. In the case of reading, one recent measure of progress is available: gains made by students from ages 9 to 14.[2]

Among OECD countries, U.S. students made the least progress in reading.

As shown in Chart 1, among OECD countries, U.S. students made the least progress in reading.[3] The average progress (difference between 9- and 14-year-olds) for the 16 participating countries was 160 points.[4] U.S. students' progress was only 125 points, or 78 percent of the international average.[5]

Mathematics Progress

Perhaps the most comparable of all subjects, mathematics has long been a topic of international achievement surveys. U.S. student attainments have generally ranked poorly, especially in the upper grades. What about the value added by schools?



Note: The scale displayed here is a statistical construct, designed to illuminate the relative magnitude of achievement gain differences between age cohorts and among countries. These "points" cannot be calibrated directly to test scores or other "real-world" gauges. To grasp the order of magnitude shown in these achievement gains, it is helpful to note that in this case Denmark gained the most points, 209; the U.S. the least, 125.

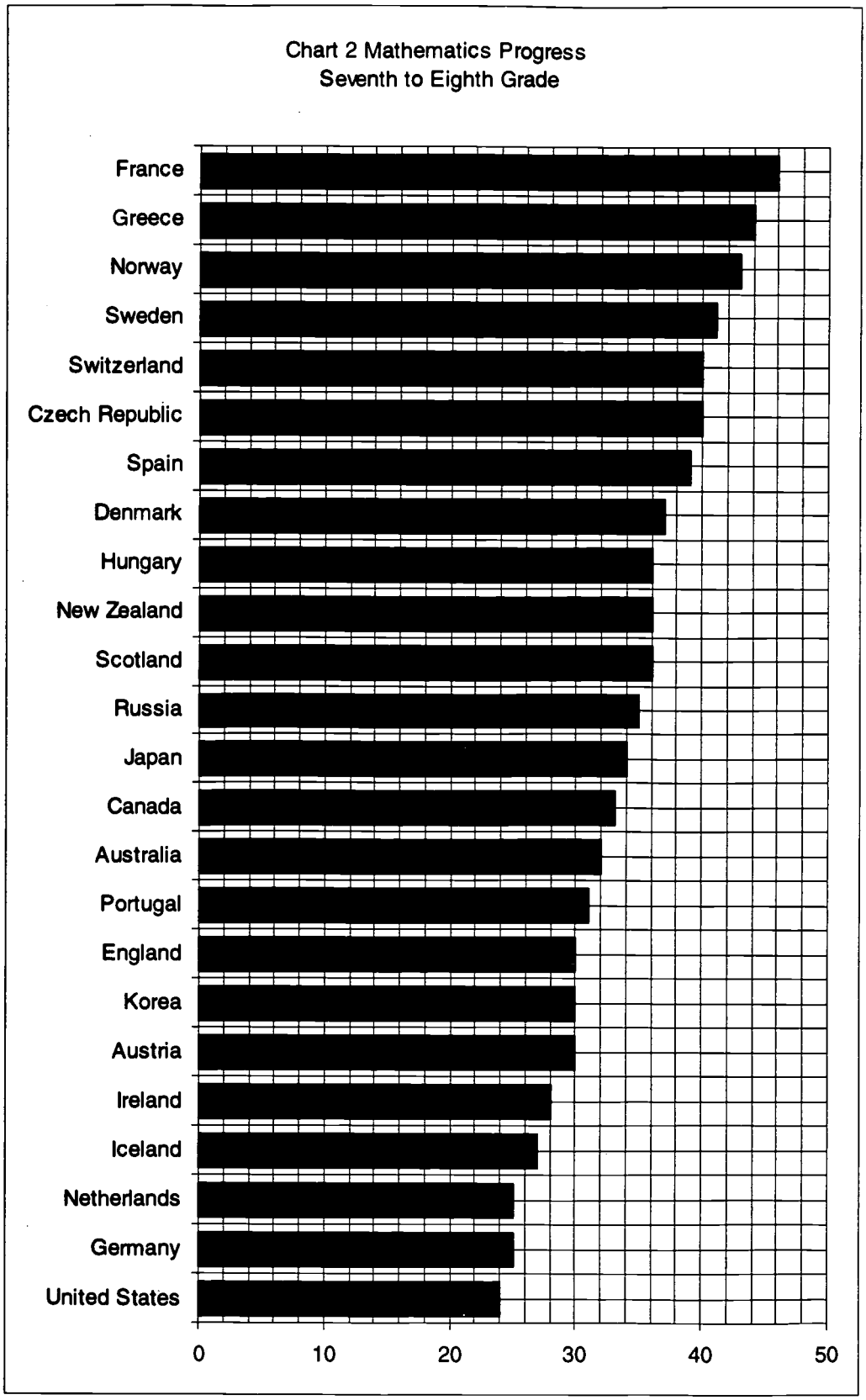
In the 1996 and 1997 *Education at a Glance* editions, the OECD reported analyses of data from the Third International Mathematics and Science Study. As shown in Chart 2, U.S. students made the least progress between grades seven and eight among 24 countries.[6] The average gain of all countries was 33. U.S. students gained only 24 points, or 73 percent of the international average.

U.S. students made the least progress between grades seven and eight among 24 countries.

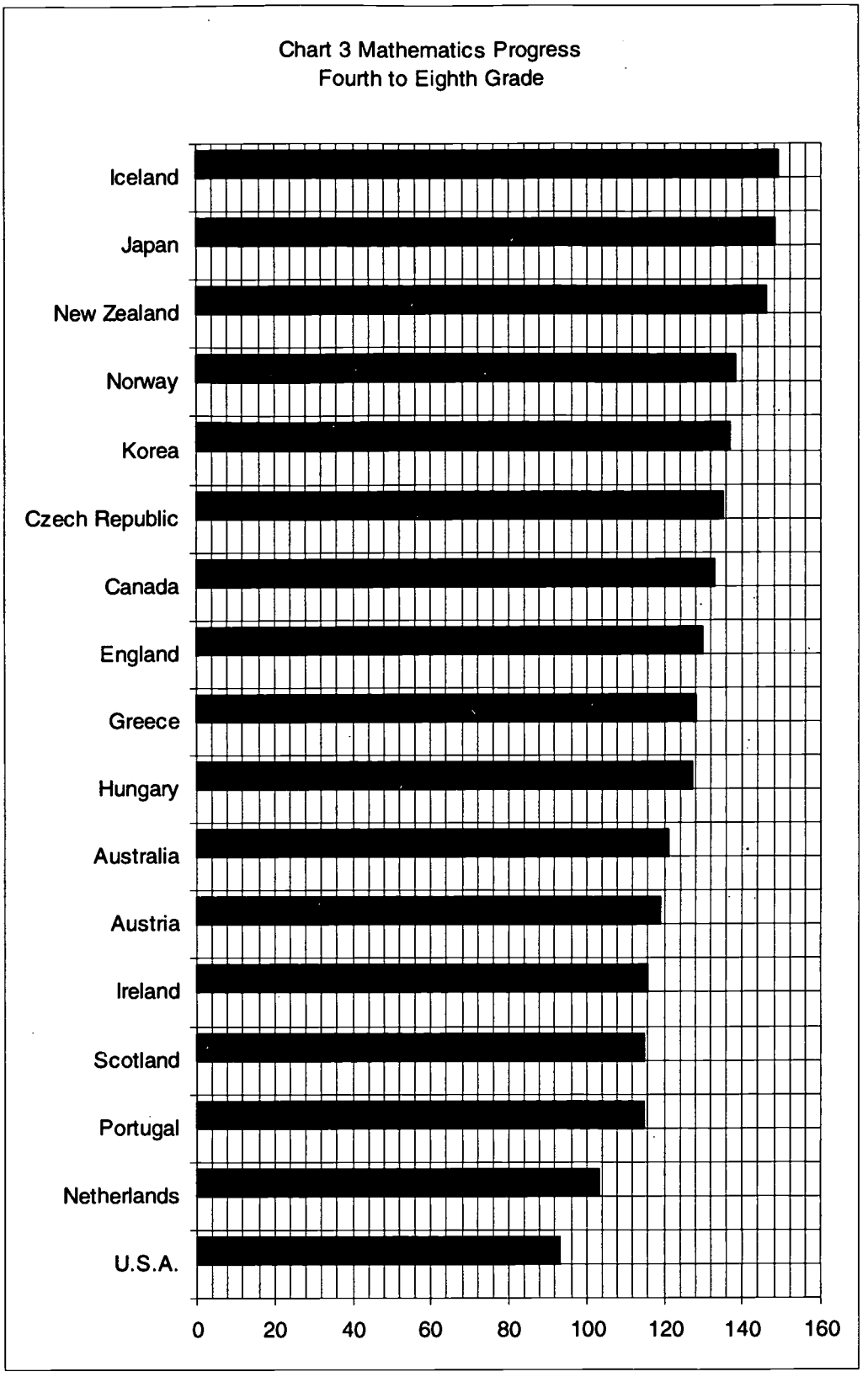
Chart 3 shows fourth to eighth grade math gains of the 17 participating OECD-selected countries. U.S. schools rank last, gaining 93 points, which is 73 percent of the 127 points gained by the average country.[7]

The latest report of the Third International Mathematics and Science Study (TIMSS) presents math and science data for eighth grade and the final year of secondary school for 16 OECD countries. Since different and uncalibrated tests were employed at the two grade levels, no direct comparison can be made between the performance of the upper secondary school students and that of eighth-graders.[8] This means that gains cannot be calculated without elaborate and possibly controversial test equating. The TIMSS team could, however, calculate the country averages and display their rank order as shown in Table I. From these data, the changes in rank order can readily be calculated and are shown in the last column of Table I.

Among the 16 countries, those in Northern Europe gained the most ranks, while those in Eastern Europe lost the most. U.S. schools declined from fourteenth to last place. As shown in Table I, they dropped two ranks: from third last to last place. They could, of course, drop no further (unless the non-OECD participating countries of Cyprus, Lithuania, and South Africa were included).[9]



Note: The scale displayed here is a statistical construct, designed to illuminate the relative magnitude of achievement gain differences between age cohorts and among countries. These "points" cannot be calibrated directly to test scores or other "real-world" gauges. To grasp the order of magnitude shown in these achievement gains, it is helpful to note that in this case France gained the most points, 46; the U.S., the least, 24.



Note: The scale displayed here is a statistical construct, designed to illuminate the relative magnitude of achievement gain differences between age cohorts and among countries. These "points" cannot be calibrated directly to test scores or other "real-world" gauges. To grasp the order of magnitude shown in these achievement gains, it is helpful to note that in this case Iceland gained the most points, 149; the U.S., the least, 93.

Table I: Changes in Rank in Mathematics Among 16 Countries

Country	Eighth Grade	Final Year	Change in Rank
Iceland	16	5	+11
Denmark	13	3	+10
Norway	15	6	+9
Sweden	10	2	+8
New Zealand	12	8	+4
Netherlands	3	1	+2
Canada	9	9	0
Germany	11	12	-1
Switzerland	2	4	-2
U.S.A.	14	16	-2
France	5	7	-2
Australia	8	11	-3
Austria	4	10	-6
Hungary	6	14	-8
Russia	7	15	-8
Czech Republic	1	13	-12

Science Progress

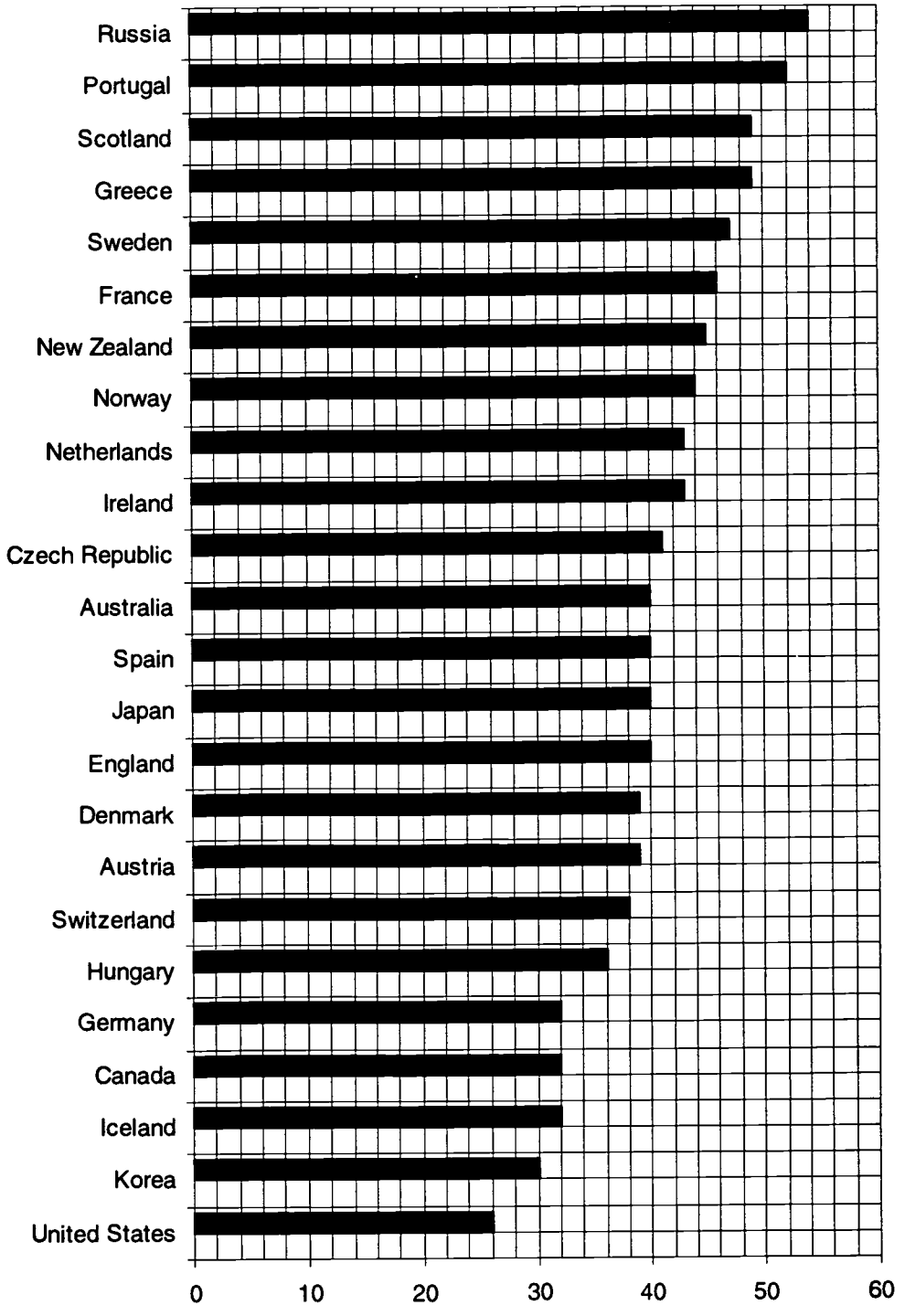
Twenty-four OECD countries participated in the seventh- to eighth-grade science portion of TIMSS. Shown in Chart 4, U.S. schools ranked last in value-added gains from seventh to eighth grade. The average country's schools gained 41 points; U.S. schools gained 26 points or 63 percent of the international average.

Chart 5 shows the science gains of 17 countries from fourth to eighth grade. U.S. schools ranked second to last. They gained 113 points or 78 percent of the 144 point average country-gain.

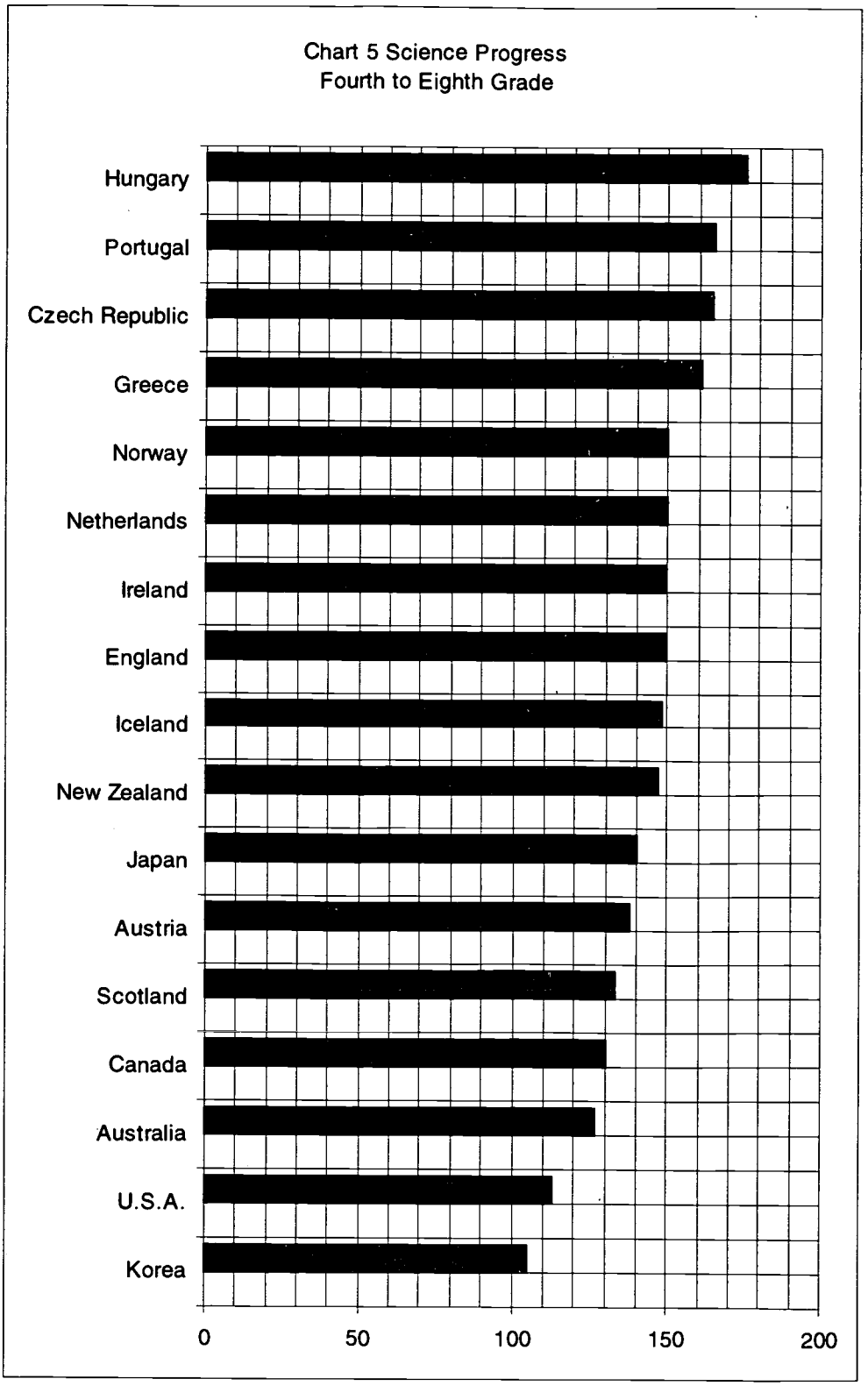
From eighth to twelfth grade, U.S. schools declined from eighth to fifteenth place, which means second from the bottom.

As in the mathematics part of TIMSS, the tests for the eighth grade and final year of secondary school were not calibrated with one another. Therefore, TIMSS published the achievement ranks rather than the value-added gains for the two groups in the 16 participating countries. These and the changes in ranks are shown in Table II.

Chart 4 Science Progress
Seventh to Eighth Grade



Note: The scale displayed here is a statistical construct, designed to illuminate the relative magnitude of achievement gain differences between age cohorts and among countries. These "points" cannot be calibrated directly to test scores or other "real-world" gauges. To grasp the order of magnitude shown in these achievement gains, it is helpful to note that in this case Russia gained the most points, 54; the U.S., the least, 26.



Note: The scale displayed here is a statistical construct, designed to illuminate the relative magnitude of achievement gain differences between age cohorts and among countries. These "points" cannot be calibrated directly to test scores or other "real-world" gauges. To grasp the order of magnitude shown in these achievement gains, it is helpful to note that in this case Hungary gained the most points, 175; Korea, the least, 105; the U.S., second least, 113.

Again, the schools in Northern Europe generally attained the most by the final year and gained the most ranks. These countries generally also tested the largest proportions of students. Eastern European and U.S. schools not only attained the least but also lost the most ranks. U.S. schools declined from eighth to fifteenth place, which means second from the bottom. Since U.S. schools tested a smaller percentage of the school-leaving age cohort than most countries, its scores are probably overestimated.

Table II: Changes in Rank in Science Among 16 Countries

Country	Eighth Grade	Final Year	Change in Rank
Iceland	15	3	12
Norway	11	4	7
Sweden	7	1	6
New Zealand	12	6	6
Switzerland	13	7	6
Denmark	16	10	6
Canada	10	5	5
France	14	12	2
Netherlands	2	2	0
Germany	9	11	-2
Australia	5	9	-4
Austria	3	8	-5
U.S.A.	8	15	-7
Russia	6	14	-8
Czech Republic	1	13	-12
Hungary	4	16	-12

School Expenditures

An ideal analysis of value added would measure both benefits and expenditures in monetary terms. Unfortunately, analysts cannot yet measure the dollar value of a point or rank gain on academic achievement tests. Nonetheless, for a more complete picture of value added, expenditures on schools can be reviewed in relation to achievement gains. The figures reported here are the OECD-calculated per-student expenditures for primary/secondary (public and private) schools in 1994.[10] These 1994 expenditures are the latest available and correspond to the years for which the achievement scores were obtained.

U.S. schools ranked third highest among 22 countries in per-student expenditures on primary schools and third highest among 23 countries on secondary schools.

Chart 6 shows that U.S. schools ranked third highest among 22 countries in per-student expenditures on primary schools. At $5300, U.S. primary schools expended 75 percent more than the $3033 international average. Chart 7 shows that U.S. schools also ranked third on secondary school expenditures among 23 countries. At $6680, U.S. primary schools spent 54 percent more than the $4335 average of all countries.

Chart 6 Per-Student Expenditures on
Primary Schools in Dollars

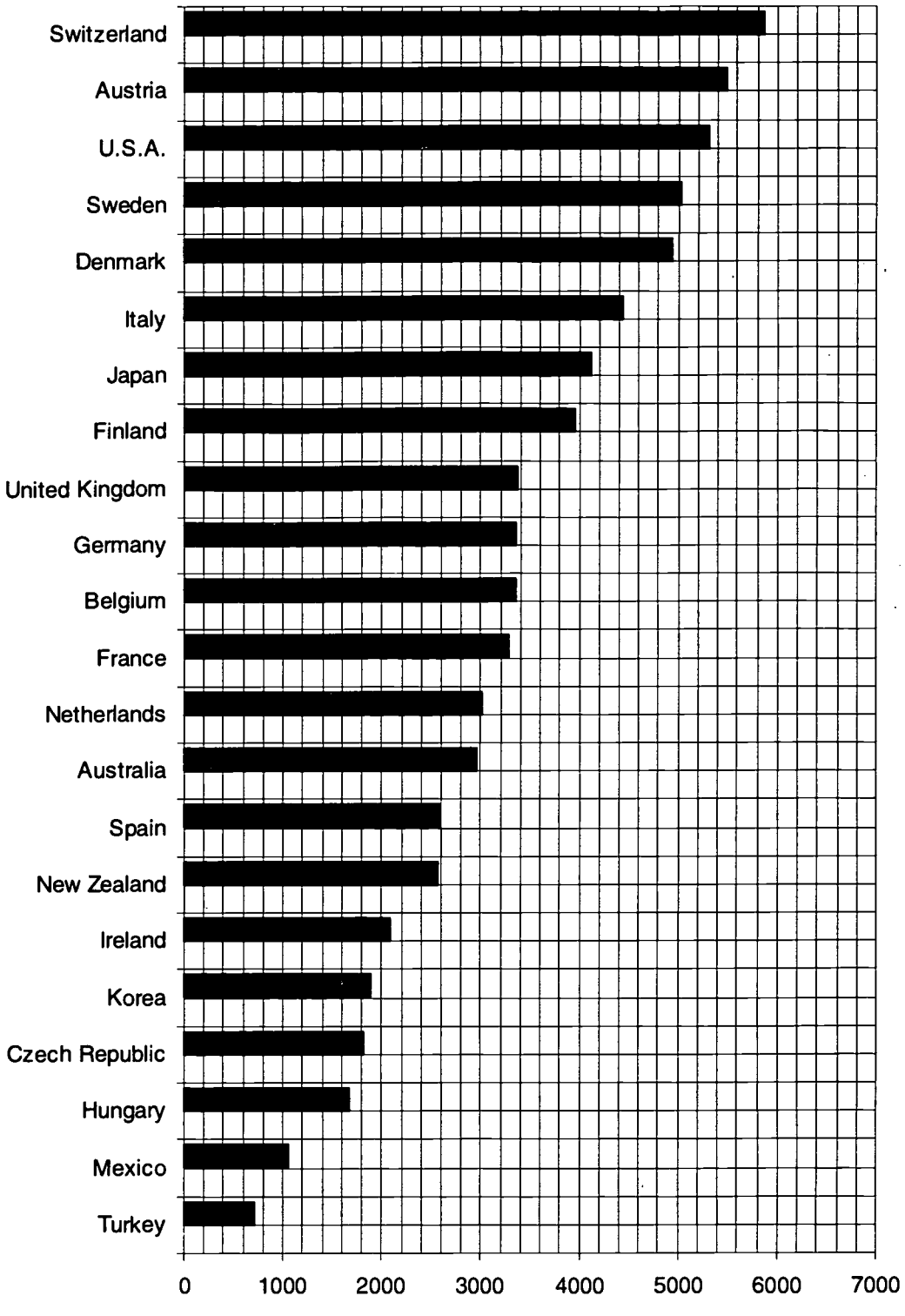
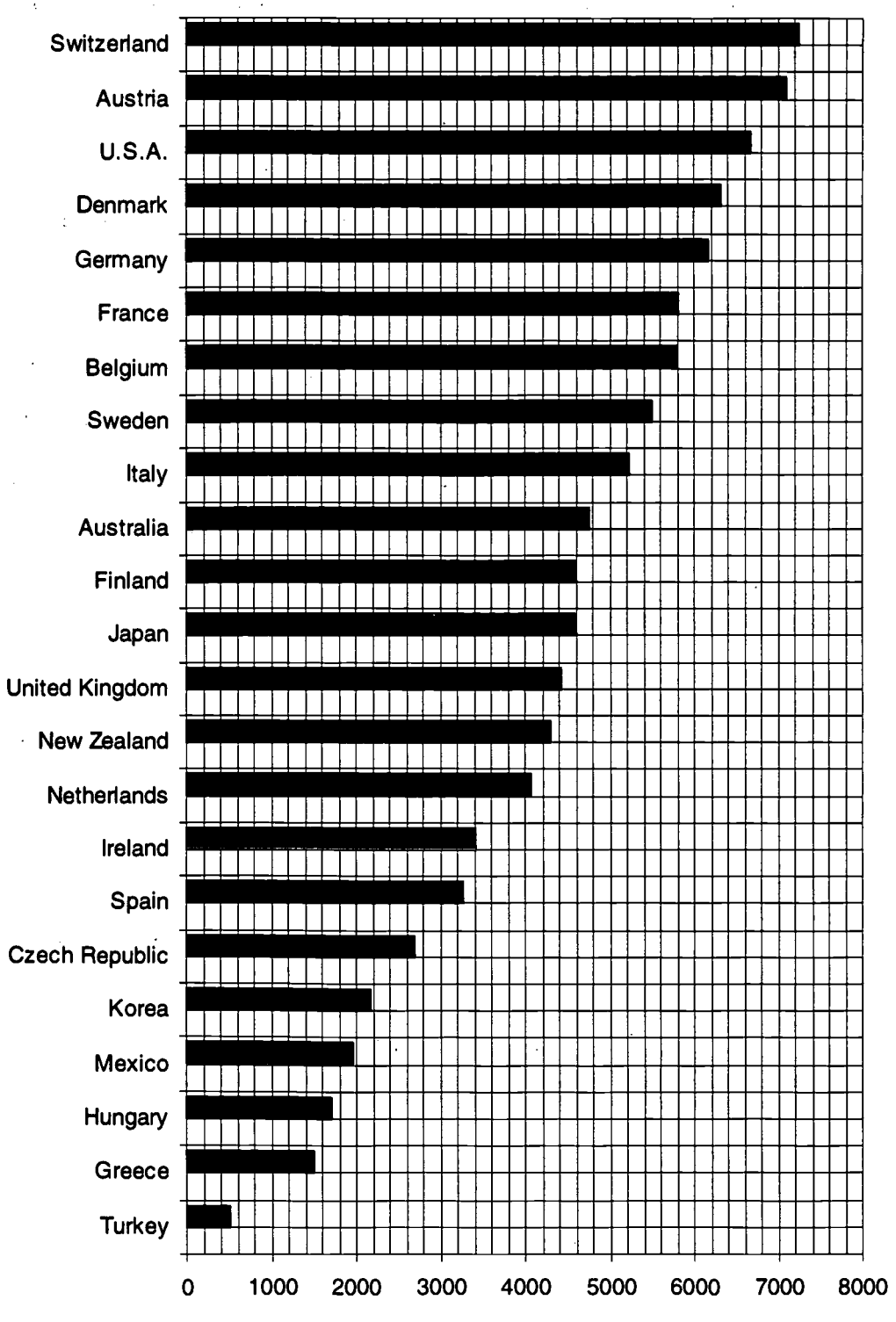


Chart 7 Per-Student Expenditures on Secondary Schools in Dollars



Conclusions

The largest and most rigorous international achievement surveys ever conducted serve as the basis of the foregoing conclusions. For the first time, this report arrays in one place the rankings of the progress of economically advanced countries for all ages and school subjects recently surveyed.

The rankings show that in the subjects surveyed—reading, science, and mathematics—U.S. schools ranked last in four of five comparisons of achievement progress. In the fifth case, they ranked second to last. Between eighth grade and the final year of high school, the U.S. slipped further behind other countries. Because they made generally the poorest progress, at the end of secondary school U.S. students ranked last in mathematics and second to last in science among those in advanced industrial countries. Nonetheless, U.S. expenditures on primary and secondary schools were third highest among more than 20 countries.

U.S. schools can fairly be termed the least productive among those in economically advanced countries.

In short, U.S. schools are near the top in spending but last or near last in achievement progress. For these reasons, as measured by these internationally agreed upon standards, U.S. schools can fairly be termed the least productive among those in economically advanced countries.

Appendix

Value-Added Comparisons

International achievement comparisons reveal important facts about students and schools. Policymakers especially want to know how students at the end of secondary school compare since it reveals their preparedness for higher education and the workforce. For this reason, nearly all previous reports have focused on comparisons of students of the same age or with the same number of years of schooling.

In recent years, however, policymakers in the U.S. and elsewhere have become more concerned about the effectiveness of schools in inducing greater levels of learning. Static comparisons of primary schools—the kind typically made in the past—are less useful for this purpose because students' scores are partly determined by their experiences before they begin school, experiences heavily influenced by socioeconomic status and other external factors. Thus, gains in achievement during the school years are better gauges of schools' contributions to learning than are scores at a single point in time.

Gains, progress, and value added—terms used synonymously here—are particularly important for policy because they allow predictions of eventual attainments. Policies that do not add sufficient value may be revised. Units of the system such as primary and secondary schools may be separately evaluated by measuring students' progress while under their jurisdiction. In addition, many experts (and laymen) believe that incentives influence performance. For this reason, managers give merit raises for recent progress rather than work-life attainments. If carrots and sticks were employed in education, value added rather than cumulative attainment would be the most reasonable indicator.

Education policymakers increasingly recognize the usefulness of value-added indicators. Internationally, the OECD pioneered the use of value-added indicators in the 1995 edition of *Education at a Glance* and has employed them in subsequent reports. Similarly, Dallas, Texas and the state of Tennessee are employing value-added indicators and incentives to increase school productivity.[11] Other cities and states such as Chicago and Virginia employ attainment indicators to assign schools to probation. Such systems tend to include schools that serve poor children but are not necessarily ineffective as schools. A fairer and more efficient evaluation system would employ value-added indicators as at least one consideration in evaluating schools.

Reports sponsored by the U.S. National Academy of Sciences and the Brookings Institution recommend value-added indicators and incentives to boost the productivity of American schools.[12] A United Kingdom report to the Secretary of State for Education advises "that it is possible and desirable to set up a national system to provide schools with value-added indicators of their performance." According to the report, a national value-added system would be cost effective, readily understandable, and statistically valid. Value-added indictors can be easily calculated from standardized test scores and do not require changes in tests or testing procedures.[13]

For all these reasons, the present report compiles the value-added school achievement indicators in the most recent three (1995-1997) editions of the OECD's *Education at a Glance*. This report also includes a subsequent survey of secondary school students by the staff of the Third International Mathematics and Science Study. These information sources include indicators of reading, mathematics, and science achievement progress during the primary and secondary school years.[14]

An Example

Value-Added Reading Programs

Reading may be the most fundamental skill for acquiring knowledge in schools. Reading vocabulary and comprehension scores predict not only listening, writing, and speaking skills, but also achievement in mathematics, science, social studies, foreign languages, and other school subjects. Though policymakers and scholars emphasize math and science in international comparisons, reading seems at least as important.

Reading proficiency, moreover, is also of huge economic and social significance. Bormuth's 1970's survey[15] of about five-thousand people aged 16 and over showed that 87 percent of those employed reported that they had to read as part of their jobs. Typical working people read for 141 minutes per day as part of their jobs, or about 29 percent of the workday. Since the national wage bill in 1971 was $859 billion, Bormuth estimated that U.S. workers earned $253 billion for on-the-job reading. Because there are more workers today, because they undoubtedly read even more, and because their hourly wages have increased, the amount paid for on-the-job reading is substantially greater today. Arguably, U.S. citizens are paid more for reading than for any other single activity.

Bormuth's survey also showed that much leisure time is spent reading. Seventy-three percent of the sample, for example, reported having read a newspaper the previous day (similar to recent surveys); the mean reading time for this activity was 33 minutes. It appears that average adults spend at least three hours a day reading.

Perhaps better than any other subject or skill, reading also illustrates the need for value-added indicators when evaluating schools. National comparisons of attainment scores for a given age group could be misleading measures of school effects. Countries

vary substantially in determinants of reading skills, for example, due to differences in preschool and child-care policies, family practices, the extent of bilingualism, age of starting school, family income, and cultural cohesion. Since countries vary in these respects, the OECD devised an index of progress during the school years as a way of producing valid cross-national comparisons.

In its 1995 report, *Education at a Glance*, the OECD raised the following policy questions: How much does reading literacy improve between the ages of 9 and 14? If progress is insufficient, what factors are at work? Is education policy one of them? So that national policymakers could answer such questions for themselves, the OECD devised the indicator, "progress in reading achievement." It is the difference in the reading achievement of 9- and 14-year-old students measured in nationally representative random samples obtained by the IEA between October 1990 and April 1991.[16]

This value-added indicator is well suited for measuring school progress. By age 9, children in all OECD countries have several years of primary school under their belts. By age 14, almost none have dropped out of secondary school. Differences between age groups' scores remove early differences in readiness, socioeconomic status, and other conditions as much as education research allows.

Notes

1. *Education at a Glance: OECD Indicators*. (Paris, France: Organization for Economic Cooperation and Development, 1995, 1996, and 1997).

2. As has been widely reported, U.S. 9-year-olds scored well in reading. In fact, they were second only to Finland's students.

3. Strictly speaking, a few countries, such as Korea, were candidates rather than members of the OECD during the periods the reports were being prepared and published. They were included in the OECD reports and in the present report.

4. As in the case of the Scholastic Aptitude Test and other common tests, the points on the scale referred to here—and displayed in Chart 1—are a statistical construct, designed to illuminate the magnitude of differences between age cohorts and among countries. They cannot be calibrated to the percentage or number of points correct on tests with a fixed number of items. To convey the relative magnitude of achievement gains, a note beneath the chart states the greatest gain, the least gain, and the U.S. gain.

5. It might be thought that the reading test was insufficiently challenging for U.S. students to show gains. Five of the 16 countries, however, had higher scores for 14-year-olds than the U.S.

6. For seventh to eighth grade gains in mathematics and science, see *Education at a Glance*, 1996, pp. 212-213. The average standard error for the means is about five.

7. For fourth to eighth grade gains in mathematics and science, see *Education at a Glance*, 1997, pp. 306-307. The average standard errors are 9 for mathematics and 14 for science. Eight countries (including the U.S.) did not meet or partially met the sampling standards. The U.S. success at meeting inclusion standards at fourth grade and not at eighth grade would tend to lead to overestimates of U.S. gains.

8. Ina V. S. Mullis, Michael O. Martin, Albert E. Beaton, Eugenio J. Gonzalez, Dana L. Kelly, and Teresa A. Smith, *Mathematics and Science Achievement in the Final Year of Secondary School*. (Chestnut Hill, Mass.: Boston College, TIMSS International Study Center, February 1998, pp. 53-54).

9. U.S. schools' poor attainment and drop in ranks cannot be attributed to testing less elite students. TIMSS researchers calculated the proportion of the entire age cohort tested by each country. Twelve of the 16 countries tested a greater proportion than the U.S. The country average tested was 70 percent; the U.S. percentage was 63 percent. So, the U.S. estimates are probably biased upward more than the average of all other countries. Unlike the past, moreover, other comparable OECD countries now retain on

average higher percentages of 17- and 20-year-olds in school and postsecondary education (OECD, *Education Policy Analysis*. Paris: OECD, 1997, p. 98).

10. *Education at a Glance*, 1997, pp. 92-101. The OECD adjusted the expenditure estimates for the purchasing power of each country's currency.

11. See, for example, Jason Millman (Ed.), *Grading Teachers, Grading Schools*. (Thousand Oaks, Calif.: Corwin Press, 1997).

12. Eric A. Hanushek and Dale W. Jorgenson (Eds.), *Improving America's Schools: The Role of Incentives*. (Washington, DC: National Research Council, 1966) and Brookings Institution panel of 13 economists, *Making Schools Work: Improving Performance and Controlling Costs*. (Washington, DC: 1994).

13. *Qualifications and Curriculum Authority, The Value Added National Project: Report to the Secretary of State*. (London, Eng.: June 1997). The Authority recommended the simple difference between scores of older and younger students rather than more elaborate calculations recommended by some authorities. Simple gains are more readily understandable and produce very similar results as elaborate, time consuming, and debatable formulas. Advised by international authorities, the OECD employs simple differences.

14. As the term is used internationally, the term primary schools refers to what many Americans call elementary or grade schools. Secondary schools refers to what Americans call high schools.

15. John R. Bormuth, "Value and Volume of Literacy." *Visible Language*, 1978, 12, 118-61.

16. See footnote 1, *Education at a Glance*, 1995, pp. 207-208. Called "synthetic cohort gains," these indicators are not gains of the same students at two time points but the (cross-sectional) differences between younger and older students at a single time point. For technical details about the reading test, see the OECD report and Warwick B. Elley (1992*), How in the World do Students Read?* (Amsterdam, The Netherlands: The International Association for the Evaluation of Educational Achievement, 1992) and the OECD reports cited in forgoing sections.

    Because the standard errors in the reading chart average about five points, countries whose average scores are close to one another may not differ significantly. The same principle applies to other comparisons in this report. It suggests that, if the surveys were repeated, countries that scored similarly in one survey could change rank order with one another. With variations in subjects and ages, the progress surveys were in fact repeated five times. U.S. schools came in last in four instances and second last in one, which is highly unlikely to have occurred by chance.

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