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QUESTIONING THE INTERNATIONAL COMPARISONS

Iris C. Rotberg

The international comparisons of science and mathematics achievement are reported to show that the U.S. education system is failing. That conclusion, which I believe is based on studies that are seriously flawed, has deflected our attention from real and difficult problems. So too has the rhetoric about U.S. competitiveness which is assumed to be a deficiency attributed primarily to the quality of science, engineering, and technology education. I also question the assumption that our education problems can be resolved without attention to the underlying conditions of poverty. These myths, while rhetorically satisfying, inevitably lead us to recommend solutions that are irrelevant at best and often are counterproductive to resolving or even addressing our most important problems. My conclusions are perhaps best presented by posing a set of questions that I am frequently asked about these issues.

1. Since the international test score comparisons all seem to produce similar negative findings, doesn't that mean that there must be some underlying validity to them?

No, it means that they all have the same shortcomings. It is simply not feasible to control for the major societal differences among nations. First, the students represented in the test comparisons are much more highly selected in some countries than in others. Second, some countries, like the United States, have a relatively high proportion of low-income students who are in school and taking the test. Countries with substantial proportions of low-income students taking the test tend to score lower than countries with less poverty or than those whose low-income students are not tested simply because they are not in school. Third, there are differences in curriculum emphases among nations that contribute to the relative rankings. If students have never studied calculus, we can be sure they will not do well on a calculus test. We don't need to administer an international test to tell us that. While there is room for debate about whether a higher proportion of U.S. high school students <u>should</u> take calculus, this issue cannot be resolved on the basis of test scores of students who have never taken the subject.

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2. What made you question the findings of the international comparisons in the first place?

The test score results could not be explained by differences in the quality of education. For example, there were major reversals of rankings between higher and lower grades in Hungary, England/Wales, British Columbia, Japan, Hong Kong, the former Soviet Union, Slovenia, and the United States. Consider the results of a recent assessment of mathematics students in Hungary and England. Hungary ranks near the top in the eighth-grade comparisons. Not surprisingly, by the 12th grade, when Hungary retains more students in mathematics than any other country, Hungary ranks among the bottom countries. Have Hungary's schools gone downhill between the eighth and the 12th grades, or is it simply a matter of more students, lower scores? England, by contrast, scores in the bottom half in most of the eighth-grade comparisons, but ranks among the top countries by the 12th grade, when only a highly select group of students there takes the test. Of course, this type of sampling problem is not limited to international comparisons. Within the United States, the relative rankings of states on average SAT scores are also a reflection of the proportion of students who take the test. The states with the highest proportions of students taking the SAT tend to have the lowest average SAT scores.

3. With all our expertise in statistics and sampling design, can't we simply improve the validity of the international comparisons?

No, the fact is that we have had expert statisticians working on the problems for the past 30 years. The difficulty is not in devising elegant statistical designs, but in carrying them out in the real world. The problems in making these comparisons are endemic to all of the studies, including the most recent ETS study which went out of its way to point out these problems and strongly advised in its press release against ranking the countries. But more important, would our children's education improve if we established rigid international controls on each nation's sampling design, located out-of-school (or homeless) children and tested them on science and mathematics, or controlled for tracking or relative socioeconomic status? And even if we did so, what is the chance that the test score differences could be attributed to the quality of each nation's education system?

4. Does it matter if we exaggerate the problem in the United States when we all agree that science education can be better than it is?

Yes, it does matter. The rhetoric is not supported by the facts. We incorrectly assume that adverse test score differences mean that our schools, or our parents, or our students, or our scientists, or our research institutions have failed. I am

particularly concerned about proposed remedies based on misleading test score differences--for example, raising course and graduation requirements--without doing anything about the vast financial differences between rich and poor school districts. Those requirements will do more harm than good. We are likely to screen out of the education system precisely those students who already receive the lowest quality education. Certainly, we will reduce their graduation rates, and subsequent employability and earnings. We will end up with a so-called meaningful high school certificate, but fewer students will receive it. What will the others do for a living? Moreover, for all students, we are in danger of placing increased emphasis on rote learning, measured by multiple choice tests, and less emphasis on the type of curriculum changes and teaching practices that would focus on an understanding of basic scientific and engineering concepts and research methods. It is unlikely that memorizing facts that can be readily assessed on standardized tests will encourage greater numbers of high-achieving students to become scientists and mathematicians or give young people who do not attend college the skills they will need to compete in a world requiring ever-greater technological skills.

5. Do you believe that we can learn something from other nations' education systems or teaching practices?

Of course. However, the challenge is to identify those practices that realistically can be replicated in the United States. While comparative international studies may provide some insights, relatively few produce findings that can be readily transferred from one nation to another. In most cases, it would involve a basic restructuring of a nation's social, cultural, and political institutions. It would involve changes in some rather fundamental aspects of our society ranging from the respective roles of national and local governments in education, the role of the teacher in society, teachers' salaries, competitive sports in schools, summer vacations, our value system with respect to pluralism, open access to higher education across socioeconomic groups, the role of industry in vocational education and apprenticeship programs, and similar issues that each country looks at differently. The fact is we cannot--nor would it be wise to--superimpose changes in education outside the context of a country's cultural and political environment. That is not a problem limited to education. For example, comparisons of industrial policy in the United States and Japan are just as complex. Government/industrial links differ so fundamentally between the two countries that, as a practical matter, it is not likely that the "lessons" learned in Japan can or should be transferred to the United States.

6. Aren't you too complacent about the problems in American science and mathematics education?

No, I just don't believe that the data support a conclusion that our schools have failed. However, I do think that we are far too complacent about the large proportion of our children who live in poverty, about the vast differences in educational resources between rich and poor school districts, about the rising costs of

higher education, about reductions in the real value of student financial aid for low-income students, and about decreasing state expenditures for higher education--and what that does to student motivation. Unfortunately, we assume that schools can be improved with little attention to the underlying conditions of poverty and often hold schools accountable for "fixing" the fundamental problems in our society. My concern is that a focus on test scores deflects attention from what we can do to solve our real problems.

7. You talk about financial resources--isn't that throwing money at the problem?

Not at all. We know that low-income and minority students, on average, have less opportunity to study science and mathematics than do other students. They also have less access to the most qualified teachers, to science laboratories, and even to up-to-date textbooks. We also know that there are large disparities in education spending between rich and poor school districts. In many states, per-pupil expenditures in affluent districts can be as much as two and a half to three times as high as expenditures in the lowest-income districts. (1) If the amount of money spent on schools really doesn't make a difference, affluent parents haven't yet heard the message. If poor districts had as much funding as rich districts, they could reduce class size substantially, provide greater opportunities for individualized instruction, train teachers in new educational practices, incorporate technology into the instructional program, and still have enough left over to finance decent science laboratories.

8. Don't you believe that national testing would improve education for the students you are most concerned about?

To the contrary, I am concerned that there would be serious, negative consequences. Harold Howe II, a former Commissioner of Education, has described the potential impact of testing on students from low-income backgrounds who have major problems to overcome both outside <u>and</u> inside their schools. He puts it this way: "Inside their schools, they are subjected to the effects of lower educational expenditures per student--larger classes, limited special services, decaying and inadequate facilities, higher levels of teacher turnover and teacher absence, and numerous other signals that they are second-class citizens of the education system. To remind them with a new national test of these discouraging facts is not the best route to building their morale or their performance." (2) And, of course, for <u>all</u> students there is the problem I referred to earlier about increasing the emphasis on multiple choice tests of highly selected pieces of information. Nor is the answer to national testing to develop innovative new examinations--performance assessments, essay exams, portfolio assessments. In how many years? At what cost? In recent testimony before the House Committee on Education and Labor, several researchers estimated the cost of administering tests nationally in <u>five</u> subject matters in only <u>three</u> grades at more than $3 billion per year. (3) By comparison, the entire Chapter 1 program, the largest

federal program for elementary and secondary education, spends $6.1 billion. I question whether test administration is the best use of scarce education resources.

9. What about American competitiveness? How can we compete in the global marketplace with the Japanese (the Koreans...the Germans...) if our students don't do better in these test comparisons?

Our problems in international competitiveness have little to do with the quality of science and engineering education. Rather, they are related to business practices, government policies, and the realities of a global economy--for example, exchange rates, the lack of incentives for industry to invest in long-term product development, the financial incentives that lead to off-shore manufacturing, differential wage rates among countries, differential government subsidies among countries, licensing practices, antitrust concerns, and the emphasis placed on military at the expense of civilian research. In the U.S., approximately one-third of total expenditures (and two-thirds of federal expenditures) for research and development go to defense. These are far more important explanations of the status of U.S. competitiveness than are rankings on international test comparisons.

10. A concluding question: Will we be first in the world in science and mathematics by the year 2000?

It all depends on the measure. If we choose our sample carefully, for example, only from the students attending the Bronx High School of Science, we will be first! More seriously, if we somehow measured our students' expertise in designing independent research projects, as demonstrated by the Westinghouse Science Talent Search, we would do quite well. The fact is our basic scientific research output is highly competitive right now--Nobel prizes, scientific publications, high quality scientists and engineers. However, if we measure ourselves by international test scores, we will be far from first place. Far more important are other measures--those I just mentioned and others such as the vitality of our labor force, the employability and wages of those who do not attend college, and the quality of our workplace training in high-technology and information industries. Yes, our schools can be strengthened, but our success in doing so will require us to focus on a number of difficult public policy issues rather than on test scores and rankings that tell us little about how to resolve or even identify the most serious problems.

FOOTNOTES

1. William L. Taylor and Dianne M. Piche, Shortchanging Children: the Impact of Fiscal Inequity on the Education of Students at Risk, report prepared for the Committee on Education and Labor, U.S. House of Representatives, December 1991.

2. Harold Howe, II, letter to Jack Jennings, April 29, 1991, pp. 4-5.

3. Daniel M. Koretz, George F. Madaus, Edward Haertel, and Albert E. Beaton, Testimony before the Subcommittee on Elementary, Secondary, and Vocational Education, Committee on Education and Labor, U.S. House of Representatives, February 19, 1992.