NOTES FOR A TALK ON "HOW WILL WE KNOW IF WE'RE FIRST IN THE WORLD IN SCIENCE AND ENGINEERING BY THE YEAR 2000?"

We're already first in science and engineering. How will we know when we're no longer first?

o When our research in science and engineering declines from its current preeminance.

o When foreign students stop coming to the U.S. to study.

o When large numbers of U.S. students in science and engineering must go abroad to study.

o When our students no longer excel in competitions that reward excellence in independent research, such as the Westinghouse Science Talent Search.

o When our patents in high technology products fall.

o When the U.S. buys more licenses than it sells.

Will our test scores be the highest in the world by the year 2000?

Unlikely.

o The rankings of nations in international test comparisons are biased because it is not feasible to control for the major societal differences among nations. (See articles for more detail!)

o We have a higher proportion of students in poverty than many other industrialized countries. 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.

o There are curriculum differences from nation to nation. For example, advanced mathematics students in the United States are more likely to defer calculus until college than are their counterparts in many other countries. 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.

As a nation, what would we like to accomplish by the year 2000?

o Maintain our current preeminance in science and engineering.

o Improve international competitiveness. But these improvements will relate less to science education and international test

comparisons than to business practices and government policies.

o Provide a better education for non-college bound students in a world requiring ever-greater technological skills.

o Continue efforts to redesign science courses to give greater emphasis to major scientific concepts, scientific issues in the context of public policy, research methodology, and independent research projects.

o Provide incentives for increasing numbers of high-achieving young people to become science and mathematics teachers.

o Increase the representation of minorities and women in science and engineering.

o Encourage public policies that will decrease the proportion of our students who are in poverty, the disparities in educational expenditures between rich and poor school districts, the rising costs of higher education.

Will our current preoccupation with test scores help us accomplish these goals?

I am concerned that an emphasis on test comparisons may lead us to implement "solutions" that are counterproductive.

o Without improvements in underlying societal problems (for example, poverty and inadequate resources in low-income schools), increasing the emphasis on test scores has been shown to screen out precisely those students who already receive the lowest quality education. Average test scores may rise, but at great costs.

o Moreover, a reliance on standardized, multiple-choice tests--which has increased even apart from the international assessments--is likely to have a deleterious effect on the quality of teaching and on the curriculum. These tests, which generally deal with isolated facts, are inconsistent with the kind of curriculum changes that would increase students' knowledge of key issues and perhaps their motivation to study science and engineering. I suggest that curriculum changes that will increase the emphasis on key scientific concepts are highly unlikely until teachers are freed from the pressure of rote examinations on material so limited that it can be measured by multiple-choice items across countries.

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