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REVISIONS TO ALBERT SHANKER'S REMARKS AT THE MATH/SCIENCE EDUCATION ACTION CONFERENCE IN BERKELEY, CALIFORNIA

October 1989

**MR. SHANKER:** Thank you very much.

It's a pleasure to be here and to offer some suggestions for dealing with this most urgent task.

I would like to start with a warning that we should not isolate the problem of getting large numbers of youngsters to learn mathematics and science from the problem of student achievement in other areas. If we do, we'll tend to look exclusively for math and science solutions. But if we recognize that our students aren't learning much of anything, we'll see the problem -- correctly -- as a general one that is related to school organization and environment.

I won't cite all of the figures in other fields except to say that we should familiarize ourselves with the results of the National Assessment of Educational Progress (NAEP). NAEP assesses student achievement in a number of fields: writing, reading, mathematics, science, social studies and others.

A number of levels of achievement have been established for NAEP assessments -- either four or five for each subject. The first level is what you might consider illiteracy or innumeracy in the absolute sense. The next is barely above illiteracy or innumeracy. Then, there's another step where people can perform with a minimal competency. A student who reaches the top level in a subject can function pretty well. In writing, that would be somebody who can write a good letter or essay. In reading, it would be a person who can read a college-level textbook or an article or

editorial in a newspaper that uses some complicated concepts and sentence construction. In mathematics and science, the person is able to solve two-step problems of some difficulty and in science, to understand and apply general concepts.

How many students achieve at the top level in reading, writing, science, math and social studies? The percentages are about the same for all these subject areas, and they're not very high. Of the 71 percent of students who are still in school by age 17, three, four, five, six percent reach the top levels. Three, four, five or six percent.

So the problems we have are not limited to mathematics and science. If you were to look at the results in writing and reading, they would tell you that only about four percent of our 17-year-olds can write a decent essay or letter or can read anything that's worth reading.

We can see the broader implications of this problem by looking at the entrance examinations to colleges and universities in Great Britain, France, Germany or most other industrialized countries. They show that, unless an American student were in that top category, he or she would not be admitted to a college or a university in any other country. So we produce three to six percent in our top category while other countries produce 16 to 28 percent who pass the rigorous national or provincial examinations in their countries. To put it in a slightly different way, 90 to 95 percent of the kids who go to college in the United States would not be admitted to a college or university in any other country in the world. Except for students who go to the elite institutions where there's a good deal of selectivity, our youngsters are getting their high school education in college.

How can we fix this? Well, the usual answers won't work. We can't say

"hire more teachers" because education is very labor-intensive. It will take the equivalent of about 23 percent of all the college graduates in the United States each year merely to replace the people who leave teaching because of resignation, death, retirement, et cetera.

And when you talk about getting the equivalent of 23 percent of all college graduates, what kind of quality can you expect? It might be easy enough to get the bottom 23 percent because the competition for them is not very keen -- although with the growing labor shortage, the competition for that group will be intensifying, too. And if you were to say that we should expect our teachers to come from the top half of all college graduates -- a not unreasonable standard -- you'd be asking that we get one-half of all the top talent in the country for our elementary and secondary schools. This is something that will not happen.

The conclusion here is unavoidable. There is no way we can get teachers of the quality we need in math, science, English, reading, writing, social studies and other subjects. We can't get 2.5 million of these people, one for each individual classroom. It cannot be done, especially now that numbers of college graduates entering the workforce will be decreasing and competition for available graduates will be increasing.

Maybe 10 or 15 years ago, during the baby boom -- when there were all kinds of people lined up, waiting for a given job -- it would have been possible to set our requirements high and still pick and choose. But we're getting to the point where there won't be anybody in line who meets our requirements. So we need to ask ourselves the same questions that people in business, industry, government and other institutions are asking. Do we hire some people and retrain them or rethink a job so two, three, four or

five people can do it in different ways and without the qualifications we now require? Are there things we can do with technology?

As long as we think of self-contained classrooms with 2.5 million individuals in those classrooms responsible for delivering instruction, there is no way, over the next 10, 15 or 20 years, that we're going to be able to improve student outcomes in mathematics, science or any other field.

Now, I think it's quite true that the battle is mostly lost in elementary school or shortly thereafter. If you take a look at some of the state examinations that prospective elementary school teachers are required to take, I think you'll have to conclude that one-half to three-quarters of our elementary school teachers feel uncomfortable with arithmetic and with science. But there's no point in saying we should get rid of them and replace them because we don't have any replacements who can do better. Therefore, we need to ask ourselves how we get to where we want to go with what we have.

If one-half to three-quarters of the teachers are uncomfortable teaching in these fields, how about developing teacher teams with clusters of youngsters, so that teachers who are strong in math and science can share what they have with all the youngsters and not just with those who are in their own rooms? Is there a way of creatively using technology? Can we use the current systems of incentives to encourage teachers to go back and get 30 to 60 credits beyond their baccalaureate in areas where we have some need? Is there a way of enticing teachers who are now in other fields but were interested in math and science and who may have a minor there to go into either of these areas? Can we get school boards to consider market-sensitive salaries for subjects where there is a shortage

of qualified teachers?

You might be surprised to find that the American Federation of Teachers has supported market-sensitive salaries in shortage areas for the last five years. But we have not heard of a single school board across the country that has proposed this.

Another extremely important issue is how we assess our students. The United States is the only country that bases most of its student assessments on standardized tests, and as long as we depend on these standardized tests, I think we'll continue to get some of the poor results we are worrying about.

It is not true that standardized tests never require you to think. Some do, but they all create a certain habit of mind in students and a certain way of teaching. Students who know that questions on the final test will offer them a choice of four or five answers, and all they'll have to do is pick out the "correct" answer, will study and learn in a very different way from students who know they will have to carry out a procedure or write an essay.

The same thing goes for teachers. Preparing students to select answers from lists of five calls for a different kind of teaching from the kind that prepares students to stand up and talk about something or write several pages of discussion and analysis -- very different. If we want to improve student outcomes, we must stop relying almost entirely on standardized tests and move towards assessments that allow students to demonstrate what they know and can do.

We must also begin to think more carefully about student incentives. In most countries, the courses students take, they grades they get on exams count in the world outside school. The incentives are lined up correctly,

so students are able to see a relationship between what they do in school and getting a good job or getting into college. In the U.S., kids know they don't need to achieve much -- all they need to do is graduate. So, we've got a nation of kids asking, "What's the least I need to do to get out of here?"

Take high school students who work after school. Very few employers ask for transcripts. Very few employers look at what courses a high school student takes. Does McDonald's ask, "Are you taking math and science?" and "How well are you doing?" and "What is your attendance record?" before hiring someone? Do they check with the school at all? Does Pizza Hut?

Our businesses can improve student performance by telling students that the courses they take, their grades, their attendance records are going to count in getting an after-school job. And after graduation they will count in how quickly kids get a job and what their entry-salary level is.

College standards are important, too. I'm not in favor of going back to the time when five or ten percent of our youngsters went on to college, but kids who are college bound would take more work in science and math -- and they would do better overall -- if there were requirements in these areas. I don't think there's any question about that, and it is closely related to the whole question of student incentives and teacher incentives.

Finally, we must stop considering the school as an institution that might be improved but is not to be changed in any basic respect. If the figures I have cited are correct -- and I believe they are because NAEP does these assessments every couple of years and the results are quite consistent -- they show us that the problem is not poor student achievement in math or science alone. Our system of public education as a whole is not producing. Therefore, it's not enough for us to figure out how we can

improve math and science within the framework of the existing institution. We need to rethink the entire institution. We need to ask ourselves how our schools can be redesigned or reconfigured to produce the student outcomes we want.

As we undertake this enormous task, we need to be careful about promising results that we don't know we can achieve. Scientists are a good model here. If someone asks a group of scientists when there'll be a cure for the common cold or AIDS or cancer, the scientists say, "We don't know. It's very complicated. We're trying as hard as we can." They don't overpromise, and, as a result, they retain the public's faith in their efforts.

We need to do the same. We shouldn't come out of this meeting or any other and announce that we can now fix the problems in our schools. What we need to tell people is that we're plugging away and using all our ingenuity and intelligence to find an answer. And when we come up with a set of reasonable hypotheses, let's not oversell them as miracle cures. If we do, we're not only likely to fail but also to forfeit the public's confidence.

Thank you.