Remarks Delivered to the American Vocational Association Board of Director's Meeting, Alexandria, VA, July 12, 1984

It is a pleasure to participate today in your consideration of issues related to public education in the United States.

I think it might be useful if I directed my remarks to those issues which are now receiving widespread public attention as a result of recent reports on the state of our educational system, particularly math and science education. As you know, the conclusions of many of these reports are quite grim. One report concludes:

> "Our nation is at risk. Our once unchallenged preeminence in commerce, industry, science and technological innovation is being overtaken by competitors throughout the world."

Not all observers, however, have been quite so pessimistic. A.Bartlett Giamatti, President of Yale and a member of one of the most publicized recent education commissions, recently wrote that he considered making the following remarks to Yale's entering freshman class:

> "Ladies and gentlemen of the class of 1987: I am delighted to see you all here. After all the critiques and debate about the American high school this summer, I did not know if anyone could or would show up this fall. You are a very strong group, as strong a freshman class as we have ever had. Your presence here argues for the health of American secondary education...you have come here not despite but because of school systems and teachers who have taken a battering recently, a battering all out of proportion to their responsibility... ."

(Note Japanese critique of their education system - N.Y. Times magazine - 7/8/84, p. 18ff)

Today I will discuss several conclusions from recent reports in the area of math and science education and assess the extent to which they are supported by research findings.

First, reports contend that the American system of education is not producing enough scientists, mathematicians, engineers, or computer specialists to meet demands.

The facts are quite different:

- Not only are there enough scientists and mathematicians, but by 1990, the number of science and math graduates is expected to exceed the number of jobs in these fields.

- Projections also show an overall balance between supply and demand for engineers for the rest of the decade.

- While the current demand for computer scientists exceeds the supply, the number of students receiving computer science degrees is rapidly increasing. By the end of the 1980s, even these shortages should be over.

Second, the reports contend that technological advances will increase future demand for highly trained and computer literate personnel.

- It's true that computer and engineering fields will have a high growth rate, but they will not create the greatest number of new jobs. The fact is that not one of the 19 occupations expected to produce the largest numbers of new jobs between 1982 and 1995 will be in high technology. Some comparisons are helpful.

- The Bureau of Labor Statistics projects 779,000 new jobs for building custodians, 217,000 new openings for computer systems analysts, and 205,000 new openings for computer programmers.

- The number of new kindergarten and elementary teaching positions-- 511,000-- are expected to be greater than the number of positions for computer systems analysts and computer programmers combined (422,000).

- The number of new openings for engineers--584,000-- will not be substantially greater than the 511,000 new openings projected for kindergarten and elementary teachers.

- It's interesting ~~and a little troublesome~~ to compare these figures with the occupational choices of the 1983 freshman class. Almost 20% of these students said they planned to be engineers or computer specialists compared to only 3% who planned to become elementary school teachers.

Third, American students are considered less well trained, as measured by test scores, than students in other industrialized countries.

- It is true that the average high school student in the United States scores lower in international comparisons than the average high school student in other industrialized countries.

- But these results do not compare equal proportions of high school age groups. Only about 20% of the age group in Europe attend upper-secondary school--the highest-achieving 20%--compared to 80% of the age group in the United States.

- When the top students are compared, American students score at about the same level as their counterparts in many industrialized countries--a particularly strong result considering American high schools include virtually the entire age group, typically working together in the same classroom.

Fourth, it has been widely reported that American students today are less well trained in math and science than were students in previous years.

- In fact, high school students took more mathematics in 1980 than they did in 1972 and about the same amount of science.

- And achievement scores of students likely to major in science and math are as high or higher than they were in previous years. (These findings are based on college board and graduate record achievement tests and on advanced placement tests.)

- Declines that do occur (and results are mixed) are on tests assessing the basic scientific and mathematical knowledge of the general population.

- But even these declines are partially explained by increases in the numbers, and changes in the socioeconomic characteristics, of students taking the test--certainly not a reflection on the quality of education.

Why does all this matter? Does it make a difference if we overstate ~~or inadequately define~~ the problems in math and science education? I have several concerns.

- First, I do not think that simply increasing requirements in science and math will improve the education of the large majority of students who might benefit more from courses which are not designed along narrow disciplinary lines. As we all remember from our own experience or that of our children, most students learn these traditional math and science courses by rote. It's unlikely that requiring more of these courses will increase knowledge about scientific issues in the context of public policy or about how to apply mathematics--but this is where ~~many observers think~~ the emphasis is needed.

- Second, increasing course and graduation requirements are likely to increase problems in another widely publicized area--shortages of math and science teachers. In fact, the whole issue of teacher shortages needs clarification. The public debate rarely mentions, for example, that

--~~As you well know,~~ There are also shortages in vocational/technical fields -- a fact that is well known to all of you.

--Reported teacher shortages result from ~~financial problems~~ budget constraints and from surpluses of teachers in other fields, as well as from the simple unavailability of "qualified" math and science teachers. Shortages of math and science teachers do not necessarily mean that these teachers can find jobs.

--In addition, increased requirements may actually lower the quality of science and math instruction if--for whatever reason-- qualified teachers cannot be hired to teach these courses.

• Third, the emphasis on math and science may reduce resources for other parts of the curriculum which are in need of improvement as least as much as math and science. For example, SAT scores have shown greater declines in verbal than in math scores. The quality of students' writing leaves much to be desired. Students don't know a lot about history or government -- ~~I would like to illustrate this last point with~~ a point that is well illustrated by some quotations by Benjamin Stein based on his recent conservations with high school and college students in the Los Angeles area. I think ~~it~~ these quotations might put the "problem" we face in some perspective.

I quote: Recently a 19-year-old junior at the University of Southern California sat with me while I watched "Guadalcanal Diary" on TV. It goes without saying that the child had never heard of Guadalcanal. More surprisingly, she did not know who the United States was fighting against in the Pacific. ("The Germans?") She was genuinely shocked to learn that...the United States had fought a war against the Japanese. ("Who won?")

Stein goes on to describe another student at USC who did not have any clear idea when World War II was fought. She believed it was some time this century. (She is a journalism major.) She also had no clear notion of what had begun the war for the United States. ("Pearl Harbor? Was that when the United States dropped

the atom bomb on Hiroshima?") Even more astounding, she was not sure which side Russia was on and whether Germany was on our side or against us.

A few students have known how many U.S. senators California has, but none has known how many Nevada or Oregon has. (Really? Even though they're so small?")

Of the teenagers with whom Stein worked, none had ever heard of Lenin. Only one could identify Joseph Stalin. (Stein's favorite was the student who responded that Stalin was the president just before Roosevelt.)

None (of the students) could name even one of the first 10 Amendments to the Constitution or connect them with the Bill of Rights.

Only a few could articulate in any way at all why life in a free country is different from life in an un-free country.

- Fourth, I am also concerned that inaccurate assumptions about the state of math and science education in the United States may lead to unrealistic expectations about the job market. ~~Obviously~~ Clearly, our society will need significant numbers of highly trained scientists, mathematicians, engineers, computer scientists. But the proportion of total employment in these fields has been greatly exaggerated and may already have led to unrealistic expectations on the part of some students, who are ~~being encouraged to~~ choosing these fields in ever-increasing numbers.

- Finally, I am concerned that little attention has been paid to the financial and social costs of the recommendations.

  --It has been estimated that the total cost of all the recommendations in recent education reports would be $20B to $30B in new funds each year--more than the total federal expenditure ($15.4B) in FY 1983 for elementary, secondary and higher education programs, including student aid at the college level.

  --There is also little consideration given to the social costs of such recommendations as stricter course and graduation requirements.

How would requiring algebra II and physics affect dropout rates, tracking, or the future employment prospects of students who fail?

~~In short,~~ Unfortunately, the conclusions of recent education reports have not encouraged a careful consideration of the effects of suggested "reforms." I am concerned that in the rush to offer solutions for ill-defined problems, we may neglect students and issues most in need of attention.

Thank you.