

Institute for Chemical Education

Special ICE Lecture

**Developing a National Will to Enhance
the Quality of Science Education
in America**

Bassam Z. Shakhashiri

Assistant Director

Directorate of Science and Engineering Education
National Science Foundation

Tuesday, July 18, 1989

7:00 p.m.

1361 Chemistry Building

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ENHANCING THE QUALITY OF SCIENCE EDUCATION IN AMERICA

As a member of the faculty since 1970 I have the privilege of promoting the Wisconsin Idea in Madison, in Washington, and across the country. Our value system with its emphasis on teaching, research, and service is manifest in all aspects of my work whether it is in formulating and implementing national policies, in developing new and effective ways to communicate science, and in working with various segments of our society. My proudest professional achievement is attaining tenure at the University of Wisconsin-Madison. I am pleased with the invitation to share a few observations and some of my convictions about the status of science education.

So-called "research universities" such as ours have an important mission of advancing knowledge and training graduate students. There is no debate about that mission nor about our preeminence in achieving it. Our faculty and our alumni are testimony to the standard of excellence we continue to maintain. By all measures, the Madison graduate programs in many fields are among the best in the country, indeed in the world. This is a tribute to the enlightened leadership of a great public institution, to the hospitable and supportive environment provided by the citizens of Wisconsin, and to the creativity of faculty and students who not only thrive in such a setting, but who contribute to enhancing the quality of life in Madison, throughout Wisconsin, across the country, and around the world.

This attainment carries with it several responsibilities. Foremost is the maintenance of excellence. This responsibility can be met if we clearly understand, and act on, the rapidly changing national societal forces which affect our setting, the people who are drawn - and who must be drawn - to that setting, and what eventually emanates from that setting.

The shrinking pool of students who choose to pursue graduate work at Madison and across the nation is a source of alarm. The number of 22-year-olds has been declining annually since 1981 and will continue to decline through the end of the century. This will have serious consequences on the supply of natural scientists, mathematicians, and engineers. If one projects through the year 2000, the cumulative shortfall in holders of B.S. degrees in natural science and engineering is estimated to be about 430,000. Similar projections based on current trends indicate a shortfall of about 8000 Ph.D.s in those fields by the year 2004. Academic institutions and industry will soon be competing for a shrinking supply of Ph.D.s since an estimated 40% of the present science and engineering faculty will retire in the next 10 years. Effective recruitment and retention strategies targeted at all segments of the population must be deployed now in order to meet the demands of the next decade.

Not only will our ability to carry out graduate research be affected, but so will the quality of our professional and personal lives. Although there are signs that we do not work sufficiently at nurturing and developing the talent of our youth, I believe strongly that we have the national capacity to deal successfully with these issues. What we must do now is develop quickly a national will to enhance the quality of science education throughout America.

The situation that our country faces now is by far more critical and more consequential than what we faced in the immediate post-Sputnik era. There are at least three reasons for this. First the population of the United States has increased in the past 30 years or so by about 50 million people. To put that number in perspective that is approximately the population of Great Britain. What does that mean? It means that we have more students to teach and we need more qualified teachers to teach them. We need more qualified teachers (and faculty) at all educational levels. The second reason is that for our country to maintain its international preeminence in the global economy, in science, in technology, in the arts, in the humanities, in all walks of life, we need to have a good supply of scientists and engineers coming through our educational systems. That is essentially what the National Science Foundation set out to do in the immediate post-Sputnik era. Now we need to maintain the flow of talent to careers in science, mathematics, and engineering despite alarming demographic data. The third reason, and in my judgement, the most important of all three reasons, is that we now live in a much more advanced scientific and technological society than we did back then. It is the education in science and technology of the non-specialist that requires our very special attention. We need an educated citizenry that can distinguish between astrology and astronomy. We need an educated citizenry that understands the complex issues related to animal rights. We need an educated citizenry that can successfully deal with issues related to global warming and environmental pollution. We need an educated citizenry that will benefit from the advances in the nutritional sciences and their effect on our health. In short, we need a scientifically literate society that is able to make rational choices and that will avoid being bamboozled into making foolish decisions. Our educational mission is a dual one. We must increase

the flow of talent to careers in science, mathematics, and engineering and we must heighten the level of science literacy of the population at-large. In this connection, I would like to give an analogy. This analogy comes from sports. Just as we have professional basketball players, professional baseball players, professional football players, professional hockey players, etc., we also have sports fans. Without those fans, the entire professional sports enterprise would be nothing, and that is not an exaggeration. So that is what we need. We need scientists and we need science fans. We want the science fans themselves to be "physically fit". We want them to be scientifically literate so that they are supportive, at least tolerant, of what scientists do. We want their behavior to be responsible and rationale (unlike the behavior of soccer fans in parts of South America and Europe). We need fans of true science; not fans of pseudo-science. Another analogy helps make the same point: we need good orchestra players and we need audiences that appreciate what the performers are doing.

Recently, we began to focus on a large and important source of brainpower that has historically been excluded, or at least ignored, in science, mathematics, and engineering--women and ethnic minorities. Females are in the majority in the adult segment of our population; However, studies of population trends in the United States show that by the end of this century, 85 per cent of those entering the labor force will be either women or minority males.

There is another underutilized group in our society: those with physical disabilities. Consider Stephen Hawking, the English cosmologist. It is hard to imagine a person more severely impaired physically than Hawking--he cannot even

vocalize intelligibly to strangers--yet he has developed a view of the universe that has taken the intellectual world by storm, and has even produced a book--"A Brief History of Time"--that quickly became a dark-horse best seller after its publication last year.

The Underrepresented pool of talent--women, minority males, and the disabled--must not be lost to use in the years ahead. "A mind is a terrible thing to waste" is the slogan of the United Negro College Fund, and those words hold equally true for other ethnic minorities, for women, and for the physically handicapped. As things stand, so much is stacked against them that these individuals often drop out when, with just a little bit of effort, they could be persuaded to stay in science.

A startling datum-point underscores this concern. The number of blacks who, in 1986, received Ph.D. degrees awarded in this country in every discipline from anthropology to zoology is a mere 820; and that was down from 1,116 black Ph.D. recipients in 1977. Among these 820 there were only 25 blacks who received Ph.D. degrees in all the physical sciences--and only 4 in mathematics--and there's nothing to suggest that things are improving.

We are very creative in solving complex scientific problems and society is the better off for that. Should we not be creative and inventive in addressing the task of enhancing the quality of science education in America?