DOCUMENT RESUME

ED 262 833 JC 850 533

AUTHOR	Luskin, Bernard J.
TITLE	Testimony on the Role of the National Science Foundation in Undergraduate Science and Engineering Education.
INSTITUTION	American Association of Community and Junior Colleges, Washington, D.C.
PUB DATE	26 Sep 85
NOTE	9p.; Paper presented to a Committee Meeting of the National Science Foundation (Washington, DC, September 26, 1985).
PUB TYPE	Guides - Non-Classroom Use (055) -- Speeches/Conference Papers (150)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	College Science; *Community Colleges; *Educational Needs; Educational Objectives; Educational Quality; Educational Responsibility; Federal Aid; *Federal Programs; Government Role; *Science Education; Technical Education; Technological Advancement; *Technology Transfer; Two Year Colleges
IDENTIFIERS	*National Science Foundation

ABSTRACT

The National Science Foundation (NSF) should be a guiding force in science education and in building public understanding of science and technology transfer issues. The nation's community, junior, and technical colleges, which now enroll 52% of all Americans who go to college for the first time, are eager to work with the NSF to further these goals. Four imperatives are critical to the future of science education and the role of the NSF: (1) developing public understanding of and support for science, with particular focus on increasing minority understanding of science; (2) meeting the nation's occupational demands for employees competent in the applied science fields; (3) ensuring that specific needs with respect to science instruction and curriculum, faculty, and facilities and equipment are met; and (4) using available technologies to create new means of instructional access and improve the nature of teaching and learning. Two additional issues that should be of major concern to the NSF are the aging of the community college faculty and the related need to train and upgrade their replacements; and the community colleges' constant struggle to provide high quality, up-to-date equipment for instructional purposes. In each of the areas of teacher training and retraining, science equipment programs, technology transfer, public understanding of science, and science education programs in general the NSF can play a major role in helping community colleges meet the educational needs of vast numbers of Americans. (LAL)

TESTIMONY

ON

THE ROLE OF THE NATIONAL SCIENCE FOUNDATION IN UNDERGRADUATE SCIENCE AND ENGINEERING EDUCATION

By Bernard J. Luskin, Executive Vice President
American Association of Community and Junior Colleges

September 26, 1985

Mr. Chairman, members of the committee, my name is Bernard J. Luskin and I am the executive vice president of the American Association of Community and Junior Colleges.

My broad concern is undergraduate science education as it relates to all of America's postsecondary institutions. The institutions whose concern I reflect specifically are the 1,221 community, junior, and technical colleges that now form the largest branch of American higher education.

This year community, junior, and technical colleges enrolled almost five million credit students. They serve 52 percent of all Americans who go to college for the first time and 41 percent of all fulltime freshmen and sophomores.

Our colleges are now the largest door of postsecondary access for minority students. In 1985 community colleges enrolled approximately 42 percent of all Black college students, 54 percent of all Hispanic college students, and 43 percent of all Asian college students attending higher education institutions.

While we meet the needs of large numbers of 18-24 year olds, many typical community college students differ in fundamental ways from the "traditional" college student. They tend to be older. They tend to work and attend college parttime. They are commuters. They are often from a minority group or are new immigrants. They are often the first member of the family to attend college. They are more likely to pursue an occupational than a liberal arts program.

Undergraduate science education is vital to the future of this nation. The National Science Foundation (NSF) should assume a leadership role in undergraduate science education. And since community colleges are a major provider of undergraduate science education, the NSF needs to work closely with two-year colleges to support and enhance their work in this area.

The very fact that our colleges now enroll the majority of Americans who are starting colleges suggests that we serve a stream of talent that, in the national interest, the NSF can ill afford to ignore. The assumption that all the learners who are better suited to science and mathematics automatically take their undergraduate work at senior institutions is the kind of position that could very well undermine American leadership in global economic and technological competition.

The NSF must, in my view, be a guiding force in science education and in public understanding of science and technology transfer issues, in addition to supporting science research. We at America's community, technical, and junior colleges are eager to work with the NSF to further the cause, and are glad for this opportunity to contribute our perspective to this national policy discussion.

In my brief comments, I will address four imperatives which I believe are critical to the future of science education and the role of the NSF. They are: population, work, equipment and technology, and technology transfer.

P O P U L A T I O N

Public Understanding of Science. During the coming years the United States will be confronted with major policy decisions involving science and technology. These policy decisions will have far-reaching consequences for all American citizens. If citizens are to react to issues in as rational a manner as befits the world's most scientifically and technologically advanced nation, they must be able to sort out, from all the conflicting information aimed at them by self-interested parties, the unvarnished facts from which policy should be made.

The task of informing and educating the public with regard to issues involving science and technology is a formidable one, yet it is one that must be accomplished, for our democratic society rests upon the active involvement of an informed citizenry. As the issues we must grapple with become increasingly scientific and technological in nature, so must our people become more scientifically and technologically sophisticated. Community colleges, known as "democracy's colleges," are an ideal vehicle for achieving the upgrading of scientific knowledge on the part of our citizens.

Public support of science. A general public receptivity to science undergirds the public's general attitude toward the importance of science. A public that does not understand space, laser, biological, telecommunications, genetic and engineering technology cannot be expected to support programs that break new ground in these areas.

Minority understanding of science. Minority groups are a steadily increasing proportion of the population. It is estimated that by 1990 minorities will constitute approximately 25 percent of the labor pool as compared with 17 percent in 1980; women will make up about 47 percent of the workforce. In 25 major urban centers, minorities are now the majority of the community, and many of these individuals attend community colleges.

For minority groups, the growing need for understanding of science and technology has special implications. Already out of the economic and social mainstream, these population groups cannot afford to fall any farther behind. Yet, will the growing numbers of minorities shy away from science-based programs because such programs are ill-equipped, poorly taught, and outdated?

My point here is simply that two-year colleges provide the first opportunity for postsecondary education for half of all the minority students in this country. If, as a nation, we are serious about attracting minorities into science education, we must address their needs in two-year colleges.

WORK

Occupational Demands. Employees competent in the applied science fields are imperative to the well-being of this nation. The literature is replete with descriptions of the changing nature of work and the increasing demand for analysis and computation in technical fields.

If the nation's technical workforce is allowed to deteriorate, or to fall behind the skill levels of its global rivals, American prosperity can only decline, as will the revenue and resource base that sustains our leadership in science and technology.

Simply put, the welfare of our country and enlightened self-interest on the part of the science community demand leadership in science and science education. Only the NSF is in a position to respond in these areas.

EQUIPMENT AND TECHNOLOGY

As I have demonstrated, the need for more and better science education is great, and it is clear that the NSF must play a major role in improving science education in undergraduate programs. Unfortunately, many postsecondary institutions currently are poorly equipped to provide the increased sophistication in science education that is so greatly needed.

As I am most familiar with community colleges, let me present the circumstances in which many of our schools find themselves. Most of the nation's community colleges were built during the 1950s and 1960s, in part as a result of the GI Bill and the influx of veterans. They have grown from one-half million students in 1955 to the five million credit students currently enrolled. In too many instances, the community colleges have aging science faculties, working in outdated laboratories that lack "state-of-the-art" equipment. The colleges desperately need new equipment, and the faculties need training and retraining.

The NSF has concentrated its support on a mere handful of institutions. The 100 institutions that received the largest share of NSF money are all doctorate-granting institutions representing only 3 percent of the nation's universities. Not only do these 100 institutions receive 61 percent of all federal aid to education, they also receive more than 80 percent of all science money. The 353 doctorate-granting institutions receive 76 percent of all federal education funding and 97 percent of all science money. Clearly, undergraduate institutions are underrepresented and underfunded.

There are specific, identifiable needs for science education at undergraduate institutions. These are: Science Instruction and Curriculum; Faculty Needs; Facilities and Equipment.

Examples of associate degree science programs in Community Colleges

A partial list of programs follows to show the range of programs now offered and for which attention is needed:

Engineering Science (Transfer)
Biology (Transfer)
Geology (Transfer)
Astronomy (Transfer)
Chemistry (Transfer)
Mathematics (Transfer)
Physics (Transfer)
Aeronautical Engineering Technology
Airframe and Power Plant Technology
Architectural Engineering Technology
Biomedical Electronics Technology
Civil Engineering Technology
Communications Technology
Computer and Digital Technology
Cytotechnology
Fluid Power Technology
Genetic Engineering Technology
Information Systems Technology
Laser Electro Optics Technology
Machine Tool Technology
Materials Engineering Technology
Mechanical Design Technology
Nuclear Technology
Petroleum Technology
Plastic Technology
Radiologic Technology
Robotics and Automated Manufacturing
Telecommunications
TV and Satellite Technology
Viticulture

These programs are expensive and they take sophisticated, highly-educated, up-to-date faculty and state-of-the-art equipment to teach them.

If the NSF does not give its weight of prestige, support and commitment to the obvious needs I have described, who will?

TECHNOLOGY TRANSFER

Computers, broadcast television, satellites, cable, instructional television fixed service (ITFS), point-to-point microwave, video disc and videocassettes, telecomputer networks and the various subgroups encompassed by each of these technologies are creating new means of instructional access and are changing the shape of teaching and learning through diversity. They also reflect the socialization of the exploding media technology and communications.

As their use permeates education, they provide many opportunities to do an even better job of what we already do well in education, by bringing new dimensions to the roles of teachers and students. The effectiveness of these approaches has been demonstrated in hundreds of experiments. Classroom and non-classroom-based learning systems will coexist side-by-side as new, accessible and flexible educational forms emerge. In fact, broadcast courses which enable formal learning to take place in the home give education the potential of becoming a family affair and offer examples of both dramatic tehcnology transfer and vehicles to strengthen both science education and public understanding of science.

Industry is investing millions of dollars into configuring the home entertainment center for movies and records. Science recently sent a rocket through the tail of a comet and computer-controlled cameras into the ocean depths to scan the decks of the Titanic. Science research is going to outer space and inner space with accelerating intensity. These developments all have implications for science and science education. The question we face is, "what will be the nature of the home education center and how will these developments affect instruction on campus?"

The NSF has made a significant economic and leadership contribution to these efforts, and it must now be prepared to help colleges and universities stay abreast of these advances.

Some concluding observations

In conclusion, as obvious as some of the realities may be, several are worth reemphasizing:

1. Most science faculty have been around for awhile. An entire generation of science teachers is reaching the last third of its career. Fifty percent of these faculty, according to studies I've seen, indicate that they received their initial training because of both the encouragement and financial assistance of the NSF. Who will take their places? This issue should be a major concern of NSF. For many community college faculty, contact with the mainstream is nonexistent. Ignoring this reality deprives our educational system and country and a vast resource in talent, experience and dedication that exists in the science faculties of these institutions. For those with experience, some genuine improvements in instruction would occur with modest funding commitments from relevant agencies. Opportunities for community college teachers to reenter the mainstream via funded sabbaticals at research institutions or at research laboratories would create extremely effective paths to upgrading undergraduate education.

2. In the area of equipment, we face a constant struggle. Nationally each year funds are cut with the same consistency and dedication by which they were included in the budgets in the first place. In the long run this leads to an inferior level of some of the equipment. High quality chemistry scales, computer hardware for laboratories, numerical control machines for such programs, etcetera, create obstacles which faculty must "teach around." Stimulating commitment and providing a catalyst for support is a responsibility NSF should consider.

In short, there seems to be both good news and bad news.

Regardless of obstacles, including ill-prepared students, heavy teaching loads, feelings of isolation, etcetera, most of the science teachers in our community colleges will continue to do their jobs even if they never hear from NSF again. They love what they do and care deeply about the students in their classrooms. They are, however, eager to do better and to learn new science and new ways of communicating that science, if given the opportunity. So the good news is that people are doing the best they can in deteriorating circumstances. The bad news is that a large segment of the educational population has been long-ignored by those making funding decisions.

Perhaps that middle 50 percent of the student population who are part of the "neglected majority" will continue to be excluded from the more elite educational community either by birth or circumstances, but their dedication and talent can be as important to our national success as that of students attending large and prestigious institutions.

RECOMMENDATIONS

1. Teacher Training and Retraining
   1.1 Take a leadership role in identifying and supporting areas important for the improvement of science teaching, such as attracting qualified teachers, urging teacher preparation programs to become "state-of-the-art," and conducting programs for retraining and upgrading of staff.
      1.1a Establish and operate teacher training institutes for two-year college faculty.
      1.1b Support development and dissemination of materials for training, retraining, and in-service development in mathematics, science, computer science and technical occupation fields.
   1.2 Establish an industry/education matching grant program to support experience opportunities for faculty through cooperative arrangements.
   1.3 Foster a faculty exchange program between institutions of higher education.
   1.4 Include two-year college faculty in programs for graduate fellowships.
   1.5 Support summer institutes and workshops that provide for the improvement of science teaching and programs.
   1.6 Fund commissions, task forces and publications that specify and urge new developments and directions in college science teaching.

2. Science Equipment Programs
   2.1 Support programs that provide strategic science equipment for new and emerging science education programs.
   2.2 Fund commissions, task forces, and publications that outline the need for refurbishing science teaching equipment in colleges and that develop recommendations for improvements.

3. Technology Transfer
   3.1 Support broad-based projects designed to foster wide use of high technology applications in teaching.
   3.2 Support studies and publications that foster technology transfer.

4. Public Understanding of Science
   4.1 Provide support for special programs that help the general public understand the benefits and the problems related to technological development.

5. Science Education Programs in General
   5.1 Support programs that encourage and improve articulation of programs and facilitate student transfer from high schools to colleges. Improve the high school/college connection.
   5.2 Support roundtables across the nation that improve science teaching and learning in both high schools and colleges.
   5.3 Support applied science and technical programs in emerging science-related programs.

5.4 Impanel a special broad-based commission to give guidance to high schools and colleges in science education and technology transfer.

5.5 Modify the College Science instrumentation program to include two-year colleges. This program presently provides funds only for four-year institutions.

Funds expended to improve science faculty, equipment and programs must be seen as an investment both to move us forward and as a form of maintenance that will prevent our programs from deteriorating.

As previously noted these programs should include, but not be limited to, such fields as robotics, computer applications, microelectronics, laser technology, telecommunications and biotechnology.

A look back and a look ahead.

It is well known that science education has consistently been a problem area within the Foundation and should be a pacesetter for NSF[1].

Stresses between the priorities of research and the responsibility for leadership in science education have been visible. We at AACJC advocate the need for science research. But also we support the need for leadership and support for science teaching in undergraduate science programs.

We call your attention to the two-year college as a major provider of both transfer and occupational science education to vast numbers of Americans, including those who transfer to traditional colleges. We call your attention to the neglected majority who comprise the middle 50 percent of American citizens who fix the airplanes, keep our electricity charging, man our laboratories and run our computers.

We at AACJC believe that the needs I have expressed for support of teacher education, program planning and implementation, equipment improvement, and technology transfer should have significant priority in your deliberations.

Mr. Chairman and members of the committee, thank you for hearing my views and the views of the American Association of Community and Junior Colleges.

---

1 The Annual Report of the Advisory Committee for Science Education, 1976.