Breakthrough for Education at NSF?

Education got a major budget increase this year and continues to get favorable treatment from Congress, but what happens next is still a big question

For the science and engineering education directorate at the National Science Foundation, the years of the Reagan Administration have followed a sort of Cinderella scenario. In 1981, the incoming Administration abolished the directorate and cut spending for education to $16 million for graduate fellowships. Since that low point, the directorate has been reestablished and significant funding restored. A 44% increase this year pushed NSF's education budget to $139 million and the request for next year is $156 million.

Education at NSF owes its resurgence most directly to Congress. And behind the congressional initiative has been strong public sentiment for reform in U.S. schools powered by concern about the quality of American education in a competitive world economy.

Looked at another way, however, the education directorate had the good luck to be rebuilding in a period when NSF was enjoying favored treatment and the agency budget was growing at a comfortable rate. But two tighter budget years for the NSF at large may well herald a period of deficit-fighting restraint on spending. And this is likely to mean a sharper intramural contest for funds at NSF and, perhaps, a reversion to attitudes that cast education in stepchild status in previous years.

Partisans of a strong NSF role in education hope, however, that the upward trend will continue and the directorate will reclaim a larger share of the agency's budget. In the late 1950s, education received nearly 40% of the total foundation budget compared with well under 10% now.

Until the recent big budget increase for education, critics in Congress and elsewhere complained about the slow pace of growth of the education directorate's budget and activities, particularly its precollege program. Not untypical was the exasperation expressed by Florida congressman Don Fuqua when he retired last year from the House and the chairmanship of the its Science, Space and Technology Committee, NSF's authorizing committee.

Among the recommendations in a personal statement he issued as a swan song was a suggestion that Congress consider whether the NSF's responsibilities for precollege science education should be transferred to the Department of Education. As Fuqua put it, "bearing in mind the abysmal record of the NSF in this area. It may well be that the problem of precollege science education in the nation is better handled by educators than by research scientists."

Pressure has been exerted even more directly by the House and Senate appropriations committees' earmarking of funds. For the current year, the House Appropriations subcommittee chaired by Representative Edward Boland (D–MA) raised the Administration request for precollege science education by $30 million. Its report noted that "The Committee has strongly supported increased science education funding over many years. Further, it believes that for too long this activity has been severely 'shortchanged.' The unfortunate result of that long-standing policy is now being seen in the continuing decline of high quality science and math teachers, students, curriculum, and equipment at the nation's secondary schools."

Bassam Shakhashiri. *NSF's assistant director for science and engineering education has increased emphasis on the scientific literacy of the work force.*

NSF management also came under increasing criticism on the issue from within the education community, which in the past has usually confined itself to polite encouragement of bigger appropriations for science education. What rankled were incidents like that in which unspent 1985 funds originally voted for education were transferred to the research directorates. Discontent mounted early last year when the Administration's new budget projected virtually level funding for the education directorate. Soon after, at the 1987 annual meeting of the National Science Teachers Association, NSTA's outspoken executive director Bill Aldridge said that NSF was "lying" when it claimed it was spending more on precollege programs.

Thanks to the intercession of Congress, precollege education now receives by far the largest portion of the directorate's funds. The office also administers major programs for undergraduate and graduate education. In addition to $90 million for precollege programs, including the 44% increase over 1987, the budget provides $19 million for undergraduate programs, a 100% increase, and $30 million for graduate support, primarily in the form of graduate fellowships, an 11% increase.

The chief strategist for education's reconstruction at NSF has been Bassam Z. Shakhashiri, who left a chemistry professorship at the University of Wisconsin in 1984 to take over as assistant director for science and engineering education. Shakhashiri has gotten generally high marks for rebuilding the directorate staff and launching the new program. He is also regarded as surefooted in treading the corridors of power on Capitol Hill and at NSF.

Like all his predecessors in the job, Shakhashiri has had to contend with the basic dichotomy at NSF that produces a chronic competition for funds between research and education. NSF's charter gives it the dual responsibility "to initiate and support basic scientific research and programs to strengthen scientific research potential and scientific education programs at all levels." Striking a balance has always been difficult.

Sputnik provided the impetus for the

expansion of undergraduate and precollege education programs. The 1960s were the heyday of education at NSF. The mainstays of the precollege program in the 1960's were school curriculum reform projects and teacher training institutes, designed to upgrade teachers' knowledge and classroom skills. The precollege education program was popular then with Congress—particularly teacher training which had a wide geographic spread—and has remained so. At its apogee, the education budget reached the equivalent of nearly $500 million in constant dollars (note SEE on graph).

Education at NSF ran into trouble in the 1970s. A squeeze on science funding sharpened the rivalry for agency resources. At the same time, the education program drew flak over its sponsorship of a behavioral sciences course for elementary schools, dubbed MACOS (for Man a Course of Study), which critics claimed undermined American values. MACOS became a handy club for NSF critics who mistrusted federal involvement in education in general or had a specific brief such as the creationist cause.

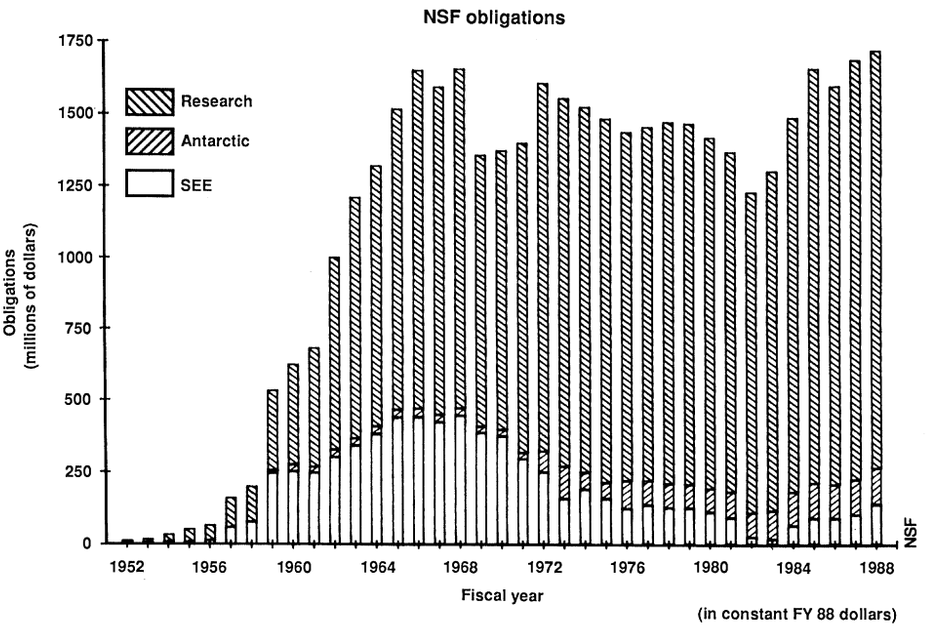
Within the foundation, the furor sharpened antagonism in the research directorates toward precollege education programs. Many in the disciplinary directorates were comfortable only as long as education at NSF was defined as support of graduate students. And now science education had thrust NSF into unwelcome controversy at a time when inflation had virtually ended growth in the research budget.

When the Reagan Administration took over, its passion for reducing the role of government was translated at NSF into abolition of the education directorate and drastic budget cuts. Congressional pressure and the crisis in confidence in U.S. education soon caused a reversal, but caution was to be the watchword for the revived program.

Under Shakhashiri, the new education program was not to be a carbon copy of the old. In the postsputnik push, the focus was on students heading for careers in science, engineering, or mathematics. This time, scientific manpower remains a concern, but a broader aim is to increase the scientific literacy of the work force.

In the precollege program, Shakhashiri has veered away from NSF's earlier emphasis on high school science, announcing that the directorate expected to put half the precollege funds into projects for elementary and middle schools, where he said he felt the battle for students' interest in science is won or lost.

The directorate also did not follow the model of the 1960s with curriculum reform, as it was then called. The term now is "materials development." In an interview,



Shakhashiri acknowledged that there may have been some sensitivity about the name of the activity. "We are not interested in developing a national curriculum. We are very much interested in developing alternatives in various curricular matters in a variety of sciences and in mathematics so that school systems can choose."

In practice, NSF has not backed the large curriculum study groups that produced the high-profile high school science courses that were the best known products of the NSF program in the 1960s. Typically, the directorate has supported work to develop "modules" to assist in the study of a more narrowly defined subject, such as acid rain "kits," for example, or to produce instructional software on a particular topic in science or mathematics. "Our hallmark remains quality control and that is what we insist on having in all of our products."

From the start, NSF director Erich Bloch and Shakhashiri have insisted that because of NSF's limited resources, NSF must be highly selective in what it does in education. "Leadership, catalyst," and, particularly, "leverage" are terms that both use frequently in discussing NSF's education role publicly.

How successful the reborn education program will be in exerting such leverage is not yet clear. The directorate had to start from scratch and things did not move rapidly at first because prospective recruits to the staff apparently took some convincing that NSF was really serious about reviving education. Shakhashiri points out that the first major grants were made only in 1985 and the results are only beginning to percolate through the system.

The directorate's undergraduate education program had languished. In its revived form it has been limited largely to minor support for instrumentation and research in undergraduate science programs. This despite a National Science Board endorsement of its task force report calling for a major expansion of NSF's efforts in the undergraduate sector. The 100% increase this year will serve mainly to start development of an innovative calculus program and an overhaul of the undergraduate engineering curriculum.

One of the directorate's general priorities was to reestablish contact with scientists and mathematicians in academia. Cooperation that involved educators from elementary and secondary schools, scientific publishers, and university scientists was regarded as an essential factor in the earlier success of the NSF program, but the partnership had flagged.

Helping to rebuild the bridges is the directorate's advisory committee, which, as NSF advisory committees go, is unusual for the number, diversity, and prestige of its members. The chairman is Harvard physicist Gerald Holton and vice chairman is Margaret MacVicar of MIT. The 30 members include researchers such as George Pimentel of the University of California, Berkeley, and research administrators like Walter E. Massey, vice president for research of the University of Chicago. Members from outside the immediate boundaries of academia have included former Bell Labs chairman William O. Baker, Arkansas governor Bill Clinton, and Carnegie Corporation of New York president David A. Hamburg, although participation of some members appears to have been nominal.

In addition to "opening avenues" into the research community, Shakhashiri says that

the advisory committee has played an important part in charting the course the directorate has followed. Not so incidentally, the advisory group offers the political fringe benefit of bolstering the program's credibility and clout with Congress and within NSF.

Increasingly, the directorate will be judged on actual performance as more of its projects are completed and its products used in the classroom. Holton says that the advisory committee has been keeping close watch on the evaluation process employed by the directorate to monitor development of the projects and, so far, the committee has been favorably impressed with their quality.

Some observers question whether in avoiding large national curriculum projects in the former style the directorate may be sacrificing broad impact. NSTA's Aldridge, for example, acknowledges that opinions differ on the effectiveness of "trying to leverage publishers into incremental change."

The major question, however, is whether funding for the education directorate will grow substantially. A strategic plan for education at NSF done by the SRI think tank projects $600 million a year as required for the task. Aldridge points to a common view in the education community that this year's budget was a modest success, but that the "magnitude of the problem" requires spending of $400 to $500 million a year for several years.

When the Administration last year announced a goal of doubling the NSF budget in 5 years, Bloch went on record saying that funding for the education directorate would increase faster than the total NSF budget, but no specific figures or timetable was mentioned. This year a 19% increase in NSF funding is targeted by the Administration, but chances for such an increase or for the doubling in 5 years are being called into question on Capitol Hill in the new round of NSF authorization and appropriations hearings. The strong implication is that Congress will have to make hard choices in funding and so will the agencies.

Does this mean that NSF faces a return to budget Darwinism in which education has given way to research when money has been scarce? Holton acknowledges that a tightening of research funds would create a "difficult atmosphere," but compares what has been accomplished in education to establishment of a "base camp" and sees cause for optimism that the ascent will continue.

As for Shakhashiri, he says he is encouraged by the interest in education expressed by NSF's congressional patrons at the recent hearings. His strategy now: "Count our blessings and keep on going." ■

JOHN WALSH

Test Ban Test Back on Track

A team of Soviet seismologists arrived in the United States on 6 April to monitor a series of chemical explosions that will be set off near the underground nuclear test site in Nevada. The experiment, which is being jointly sponsored by the Soviet Academy of Sciences and the Natural Resources Defense Council (NRDC), a U.S. environmental organization, is part of a novel reciprocal arrangement aimed at laying the groundwork for verifying a ban on nuclear testing.

The blasts, the first of which will take place on 29 April, are designed to study the propagation of seismic waves from precisely calibrated explosions in the area around the nuclear test site. The aim is to gather baseline data that could be used to detect small explosions and tell them apart from other seismic events.

An equivalent set of chemical explosions was set off last September in the Soviet Union, and the seismic signals were monitored by similar equipment installed near the Soviet nuclear test site at Semipalatinsk.

The planned Nevada experiments are being hailed by the NRDC as evidence that the cooperative arrangement with the Soviet Academy is back on track after a difficult political period. The private venture, which has never been popular with the U.S. government, has encountered obstacles put up by officials on both sides (*Science*, 7 August 1987, p. 594).

The troubles began last February when the Soviet government refused to accept visa restrictions, set by the U.S. State Department, on Soviet seismologists who were planning to help supervise the installation of seismic equipment at the monitoring stations established near the Nevada test site. As a result, the seismologists were prevented from visiting the stations.

This time, however, unrestricted visas were issued both for the technical team and for observers and Soviet journalists who will witness the experiment. "At last, the Soviet seismologists have been accorded the same latitude to conduct research here as our scientists have enjoyed for almost 2 years in the Soviet Union," says S. Jacob Scherr, a senior staff attorney at NRDC.

Operations in the Soviet Union have not been without problems, however. Three seismic monitoring stations were established under the cooperative arrangement near the Semipalatinsk site, with the expectation that they would be kept running continuously. When the Soviets resumed nuclear testing last February after an 18-month moratorium, however, they insisted that the seismic equipment be shut down during the tests. This interrupted the flow of seismic data from around the test site, and the equipment was often shut down by Soviet military officials so thoroughly that there have been difficulties restarting the seismic stations.

Under an agreement signed by NRDC and the Soviet Academy last summer, the three stations near Semipalatinsk were shut down at the end of last year, following the series of chemical explosions equivalent to the planned Nevada tests. They are being replaced by five stations, each located at least 1000 kilometers from the test site. Thomas Cochran, NRDC's senior scientist, says that although "we were hoping that they wouldn't shut us down" near the test site, the new stations will more closely resemble those that would be required to verify a test ban. Moreover, they will be permitted to operate during nuclear tests. Equipment will be installed at the new stations this summer, Cochran says.

The aim of the experiments is to demonstrate that seismic monitoring will be capable of verifying compliance by each side with a ban on all nuclear tests or a very low limit on the permitted size of underground nuclear blasts. This has been a point of contention. The Reagan Administration has argued that a more intrusive monitoring technique known as CORRTEX is required to verify that nuclear blasts are indeed below a specified limit. The technique requires placing a cable in a borehole right next to the shaft containing the nuclear explosive. The Administration is insisting that CORRTEX be used to monitor the Threshold Test Ban Treaty, which sets a limit of 150 kilotons. The treaty, which was signed in 1974, has not been ratified by the U.S. Senate, in part because of the dispute over monitoring.

A dramatic test of CORRTEX is planned for later this year, when U.S. and Soviet scientists are expected to set off nuclear explosions at each others' test sites in order to test the sensitivity of monitoring technologies. Teams of scientists visited the sites earlier this year to plan for the test. ■ COLIN NORMAN