NSF Takes Leap Into School Reform

States, cities, and rural areas are part of a $100 million systemic reform program. But critics worry that the job may be too big for the foundation

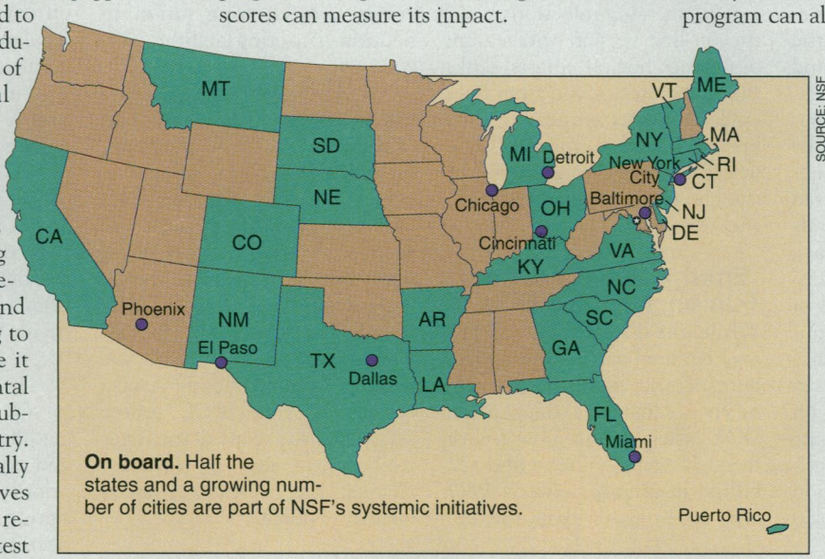
Donna York vividly recalls the young teacher who walked into her office on a recent cold, snowy day in Anchorage, Alaska. "He was a second-year teacher from around the Bering Strait," says York, the science curriculum coordinator for the city's school district. "He had been asked to write the entire science curriculum for his district, from kindergarten to twelfth grade. The problem was, he had no science training. His background was history. But he was the only one interested in science, so he got the job."

The plight of the young Alaskan teacher is a real-life metaphor for what is happening in many school districts around the United States, where teachers and school administrators are eager—but often ill-equipped—to respond to the urgent need to reform math and science education. In recognition of their plight, the National Science Foundation is pushing ahead with a major new program that represents a radical departure from business as usual. Instead of awarding individual grants to develop new curricula and train staff, NSF is trying to use what modest leverage it has to make fundamental changes in thousands of public schools across the country.

This new effort—actually a collection of initiatives jointly dubbed systemic reform—is one of the fastest growing items in NSF's budget. Launched in 1990, it currently receives about $100 million a year and supports projects in 25 states, a growing number of the nation's largest cities, and, by next spring, a handful of rural areas as well. But what makes the program really stand out is its promise to work closely with students, teachers, administrators, and state and local officials, through cooperative agreements rather than individual grants, to implement broad educational reforms.

NSF officials admit it's a gamble. "This is experimental and high-risk, but that is exactly what we should be doing," says Luther Williams, head of NSF's education and human resources directorate. But others worry that NSF could lose its way in dealing with a clientele quite different from its traditional academic customers. "It's a completely new world for NSF, and it is fraught with danger," says one congressional aide. The enormous problems confronting the nation's school systems could prove overwhelming, he adds.

Others are skeptical that systemic reform can produce quantitative results in enough time to satisfy politicians who want quick results. Williams himself hopes to have the first evidence by next year that the effort is producing better educated students. But, says York, "You need 5 to 10 years to show progress—you can't do it in a couple of years." One major problem is that the yardsticks differ from state to state and city to city, say program managers. And no single set of test scores can measure its impact.



On board. Half the states and a growing number of cities are part of NSF's systemic initiatives.

SOURCE: NSF

NSF is treating this high-visibility program with great care. Both in-house and outside groups are tracking the quality and effectiveness of the projects that are being supported, and earlier this year NSF pulled the plug on a 5-year cooperative agreement with the state of Rhode Island when the project seemed headed for failure. With measures like these, and some hints that the effort is producing better educated students, the foundation is hoping that its efforts will win passing grades from the new Republican Congress.

Tying it together

Systemic reform is the centerpiece of NSF's contribution to a national goal, spelled out at a 1989 education summit with President Bush and the nation's governors, to make U.S. students first in the world in science and math by the year 2000.

The program gives money to school systems around the country in exchange for comprehensive reforms that go beyond curriculum reform to include bolstering math and science requirements and allocating more resources to math and science education. In Louisiana, for example, one aspect of the program is to recruit teachers for intensive retraining. But while that normally would be the end of a typical retraining program, the Louisiana effort includes follow-up classroom visits by evaluators, additional workshops, and a $300 allotment for each teacher to buy materials. Teachers who complete the program can also get graduate credits.

All this is a far cry from NSF's traditional approach of providing grants in response to proposals from the field and requiring only that researchers account for the money they have received. "This is heresy compared to the way we used to do business," Williams says.

The first program to take this approach was the Statewide Systemic Initiative (SSI), begun in 1991. Ten states won the first round of open competition, followed by another 10 states and Puerto Rico in 1992, and five more states in 1993. Each state is slated to get up to $10 million over 5 years, matched by the state. The Urban Systemic Initiative (USI) is an offshoot of this effort and is intended to serve the nation's largest urban school districts. Nine cities were chosen in May to receive as much as $3.25 million a year, also for 5 years, and additional winners are scheduled to be announced in February and late spring next year. And next May NSF will make the first round of awards in its Rural Systemic Initiative focused on rural school districts such as the isolated outpost in Alaska.

Given the consensus that major changes are needed in how U.S. schools teach science and math, there are few outspoken critics of the systemic reform effort. But there are skeptics who wonder if NSF's modest amounts of money can significantly alter

public school systems confronted with immense fiscal and social problems. "The issues are very complex," says Ivan Legg, chair of the American Chemical Society's education committee and provost at the University of Memphis in Tennessee. "You have drugs, nutritional problems, crime, and socioeconomic differences." Although NSF is on the right track, he says, the foundation "may have bitten off more than it can chew."

Some local and state school administrators and teachers also accuse NSF of thinking that it alone recognizes the need for systemic reform. "NSF likes to tag this as the most wonderful thing since Halley's Comet, but they need to be more attentive to what the cities already have been doing," says Andrea Bowden, who coordinates math and science programs for the Baltimore schools, which receive $2 million a year from NSF's USI program. Bowden—who notes that the NSF money would run Baltimore schools for 1 day—has also learned that progress takes time. Although the USI program should produce results, she says, "one begins to wonder how big that impact can be."

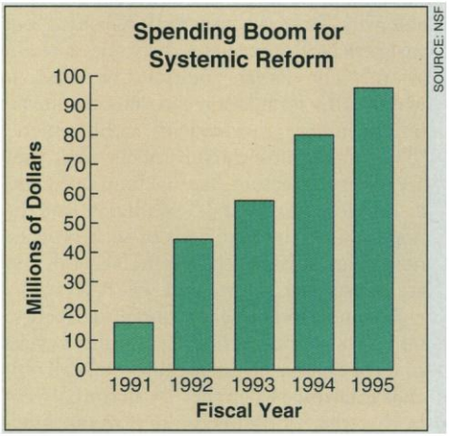
NSF officials admit that their infusion of cash and expertise is a drop in the bucket compared with the billions of dollars spent annually on education by state and local districts. But they say strategically placed funds can have a catalytic effect. "It's simplistic to say NSF money won't make a difference," says Joseph Danek, a retired NSF manager who was an architect of the systemic reform effort. "Unlike the Department of Education [which has congressionally imposed rules on how to spend its money], we can mandate more specifically what we want to accomplish." NSF managers say the agreements with cities and states also give math and science proponents leverage in arguing for more resources from their administrators.

That's what has happened in Florida's Dade County, where students rank in the lowest third of the nation in math and science achievement. A statewide NSF agreement helped math and science advocates convince school administrators to make first-year algebra a graduation requirement, says Deputy Superintendent Phyllis Cohen; the next step, she says, will be 4 years of math and science in high school. "As grants go, I think this one holds school systems accountable, and it sets appropriate benchmarks," says Cohen.

Making the grade

Those benchmarks vary from city to city and state to state. Louisiana, for example, which ranks 47th in math test scores, is focusing on retraining teachers, with a target of 800 teachers a year for 5 years. In a typical project, a teacher receives training that includes attending an intensive summer session, careful planning for the next academic year, and help from a site coordinator with extensive classroom experience. Local schools write annual funding proposals in what state officials call "a mini-NSF approach" that extends the foundation's emphasis on evaluation and quality control.

But success on that front is only one step toward meeting the state's real goal—improving student performance. "Our current tests don't measure the right stuff," says R. D. Anderson, senior adviser on the project. "We are shooting for a very different kind of math program that emphasizes problem-solving and reasoning." His office is now designing new tests that will be given to students affected by the initiative and those who are not. Some preliminary results in Lake Charles, near the Texas border, show "a sizable improvement in concepts and applications but slight decreases in computational skills," he adds.



Going up. Funding is rising for NSF's three systemic initiatives, which began in 1990.

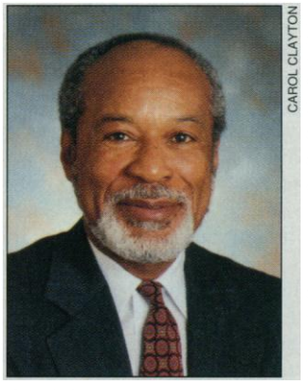
NSF officials say they are acutely aware of the problem of evaluating success. "The result is not a single data point," says Daryl Chubin, director of research, evaluation, and dissemination for NSF's education directorate. Measuring the existence of more favorable attitudes toward math and science education, for example, will be difficult, and some want NSF to spend more on research. "I don't think there is enough money for evaluating whether these efforts work or don't work," says Mary Lindquist, a member of NSF's education advisory board and a mathematics education professor at Columbus College in Georgia.

Even so, NSF was able to determine that one state's initiative was not working. In March, the foundation decided to cancel its cooperative agreement with Rhode Island, chosen in the first round. NSF evaluators determined that the state's systemic reform plan was in trouble after 2 years of funding and that it could not be salvaged.

The state was dropped because its plan did not spell out how the effort would improve student performance, focused too much on technology, and was hobbled by weak and unstable management, according to a letter from Julia Wan, a program director for systemic reform, to Dennis Cheeks, project director for the state's effort. "They lacked a systemic approach—that was their fatal flaw," said Janice Earle, senior program chief. "They did not have the management and leadership they needed, and there were repeated staff changes." By contrast, NSF warnings to Florida officials led to quick changes that saved that state's program, says Danek.

While Cheeks agrees that "Rhode Island dropped the ball in many ways," he says NSF evaluators were overwhelmingly from the world of higher education and lacked experience in kindergarten through grade 12. And he thinks their expectations were unrealistic. "You don't change culture by mandates or fiat," he says. "NSF has a heavy-handed central approach to educational change."

The decision to end the Rhode Island agreement sent shock waves through those states participating in the project, several state educators said. That may have been the point, according to Cheeks: "A political decision was made that someone had to lose—and we were in the wrong place at the wrong time." Although Danek disputes this—"it was pretty hard to turn Rhode Island off," he says, given pressure from the state's congressional delegation—sources say NSF wanted to prove it could make tough decisions when necessary.


CAROL CLAYTON

Gambling man. NSF's Luther Williams says systemic reform should be "high-risk."

More states could follow in Rhode Island's path. The second round of SSI evaluations will be held next month, and several states have similar problems, according to NSF and state sources. Florida is in trouble again , says one official familiar with the program, and North Carolina, South Dakota, New Mexico, and Texas "are on thin ice." Williams admits that "based on the evidence, [the states] are not all performing at the appropriate level," but he declines to say whether the foundation will sever its agreements with any.

Watching the watcher

While NSF is keeping close tabs on how the states are performing, its own performance is also under close scrutiny from Congress.

How well it does could prove critical in determining NSF's future budget for math and science education at the precollege level.

Support for systemic reform comes mainly from the congressional committees that appropriate funding, in particular the panel chaired for the past 6 years by Senator Barbara Mikulski (D–MD). Last May, when NSF chose Baltimore and eight other cities for USI awards, Mikulski presided over a press conference that also featured John Gibbons, the president's science adviser.

Thanks to a long record of peer-reviewed awards, NSF so far has successfully managed to avoid so-called "earmarks" from individual legislators interested in obtaining systemic reform funds for their districts. "NSF is driving the educational programs, not Congress," says one staffer. "And NSF has the reputation of looking at its programs on merit rather than politics."

The program has also attracted the attention of the panels responsible for authorizing NSF spending. The explosive growth in NSF's educational activities led Representative Rick Boucher (D–VA), outgoing chair of the House Science, Space, and Technology science subcommittee, to ask the General Accounting Office to examine whether the foundation was managing the programs effectively. The report, completed in June, recommended that NSF find better ways to evaluate its efforts but uncovered no serious problems.

"The growth in these programs has been more rapid than this committee is comfortable with," says the congressional aide. "But we know NSF appreciates the value of evaluation." The larger question, he adds, is whether the foundation can demonstrate an improvement in student achievement: "They must think carefully about what they are trying to measure, because [improvement] is the long-term goal." Williams says he hopes to see the first signs of such progress next year, although NSF officials add they are not sure what form that will take.

The new Republican Congress is likely to take a tough look at NSF's centralized effort to force change at the local level. NSF officials still wince when they recall the 65% cut in the education directorate's overall funding in the first year of the Reagan Administration on the grounds that such activities are the responsibility of the states. But many observers believe that systemic reform is less ideologically offensive to Republicans than is a typical Department of Education grant because of its emphasis on evaluation and benchmarks. "This program is different, and I don't think it will arouse much ire," says one Republican staffer. And Representative Robert Walker (R–PA), the new chair of the House Science Committee, had kind words for NSF's education efforts at a press conference this week.

Williams says he is counting on the support of Republican governors and mayors in many of the systemic-reform states and cities if Congress tries to gut the program. But he's not expecting any huge increase, either. "If the overall NSF budget is not growing, I am positive the education budget is not going to grow," he says. In the meantime, staying the course during the bumpy season ahead is likely to rest on his ability to post clear and convincing yardsticks of success.

–Andrew Lawler

SCIENCE AND THE NEW CONGRESS

Walker Unveils R&D Strategy

Representative Robert Walker (R–PA) may represent the tradition-minded Amish region around Lancaster, but the incoming chair of the House Science Committee has some nontraditional plans for the nation's high-tech future. Last week, in a press conference, Walker made it clear that he would use his position to promote sweeping changes in U.S. science and technology. He said he would try to shift money from applied to basic research, promote hydrogen as an alternative fuel, and take a hard look at research on global climate change.

Walker also plans to move quickly. Early next month the committee will summon the chiefs of science agencies under the committee's jurisdiction to a hearing on the direction of science and technology. "We want to focus not on programs in the next budget, but programs into the next century," he says. Along the way, he would like to abandon what he calls the government's "command and control" approach toward science and substitute methods such as an R&D investment tax credit.

Sitting silently to the side during the press conference was Representative George Brown (D–CA), the outgoing panel chair. "Walker does have some good ideas, but some of them may turn out to be totally off the wall," Brown said the next day at his own gathering with reporters.

One major difference of opinion concerns government-industry cooperation. Walker says he wants to return the National Institute of Standards and Technology to its traditional mission of helping industry meet its technical challenges rather than pursuing the type of large-scale joint government-industry projects supported by the rapidly growing Advanced Technology Program (ATP). But Brown hopes to fend off Walker's attacks on ATP and related programs by enlisting the support of industry and "weaning away enough Republicans." Walker also wants the National Science Foundation to rededicate itself to supporting basic academic research, presumably trimming or ending the half-dozen or more "strategic" initiatives such as high-speed computing and advanced manufacturing. But Brown feels that the NSF debate is more semantics than substance. "All of the applied science and engineering work at NSF accounts for no more than 10% to 15%," he says.

Long view. Rep. Walker wants to focus on "the next century."

The National Aeronautics and Space Administration can expect to garner bipartisan support from the new committee. Walker pledged to fight for a NASA budget that keeps pace with inflation—a significant boost above the steady state proposed by the Clinton Administration. That White House plan is "disastrous," agrees Brown, who warned Clinton's chief of staff, Leon Panetta, that he will "raise all kinds of hell" to protect areas like space science in the 1996 budget. But that doesn't mean a free ride for every research program. For example, Walker wants to review NASA's multibillion-dollar Earth Observing System—a planned constellation of satellites—to determine if it is necessary.

The new chair's success in pushing through his agenda will depend in large part on how seriously the Republicans carry out their pledge to slash the deficit. Although he declined to list specific cuts he would make, Walker spoke of diverting money from one science effort to another rather than reducing overall science funding. Other Republicans, however, have demanded significant cuts, including abolishing the U.S. Geological Survey, the new National Biological Survey, and the Office of Technology Assessment. Walker says he has an open mind on OTA's future. "There probably needs to be restructuring ... but having such a body probably is valuable," he says.

For his part, Brown doubts that USGS will get the ax given its reputation for quality science and its solid record of scientific achievement. "I don't think there's a one-in-a-million chance it will be abolished," he says.

–Andrew Lawler