DOEd-NSF Working Group on Improving Math and Science Education

FAX COVER SHEET

Date: 6/24/97

NAME	FAX NUMBER	OFFICE NUMBER
Neal Lane, NSF	703/306-0109	703/306-1000
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Luther Williams, NSF	703/306-0399	703/306-1600
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FROM: Judy Sunley

Number of pages including this Cover Sheet 22

Remarks:

56. Arkansas Democrat-Gazette

January 7, 1998

Educators add up math needs

CHRIS REINOLDS
ARKANSAS DEMOCRAT-GAZETTE

Arkansas college and university officials say students can benefit from taking a fourth year of high school math, but some educators aren't sure if it should be a college admission requirement.

Presidents and chancellors met Tuesday with state Department of Higher Education officials to discuss setting statewide admission standards. The Arkansas Higher Education Coordinating Board is considering new requirements for unconditional admission to state colleges and universities that include four high school math credits and one foreign language class. The state Board of Education in December tentatively approved revised high school graduation requirements to take effect in 2002. The proposed requirements call for students to pass three math courses, one of which must be taken in the final year of high school. Two of the required courses must be algebra and geometry. The state's existing graduation requirements call for three units of math. Most college-bound students also take three units of math.

Lu Hardin, director of the state Department of Higher Education, said he and other department officials would like colleges and universities to require students to take four units of high school math for unconditional admission.

Hardin and other educators have said students who take four years of math in high school consistently score higher on the American College Test. Remediation rates, which are up to 50 percent at some schools, could be reduced if high school students took more math classes, Hardin said. If the math requirement is approved, students who did not take four years would be "conditionally" admitted to state colleges and universities. The conditional admission would require students to take a certain number of courses and maintain a 2.0 grade point average. "If we think math skills are as important as language skills for success in the job market, then we should require a fourth year," said Winfred Thompson, president of the University of Central Arkansas at Conway. Eugene McKay, Arkansas State University-Beebe chancellor, said his college should be able to admit anyone with a high school *diploma* without putting that student on conditional admission. He questioned the value of algebra and said students should learn math that is applicable to the real world.

But University of Arkansas at Little Rock Chancellor Charles Hathaway said algebra teaches logic and problem solving — two skills employers desperately want. Hathaway suggested that high schools add a fourth year that reviews all previous math courses to make sure students understand the concepts. The University of Arkansas, Fayetteville, recently approved raising admission standards. Incoming freshmen will be required to have a minimum 3.0 grade point average, to score at least a 20 on the ACT and to have completed 16 core high school courses for unconditional admission.

Linda Jones, a counselor at Hall High School in Little Rock, said a fourth math requirement would be unfair to students who excel in other subjects like art or English. She said college-bound students now must take only three math courses: Algebra 1, Algebra 2 and geometry. Two years of foreign language are also recommended for those students. "In my opinion, there are lot of kids who go into college and do well and do not really need that much math," Jones said. "We have kids who are wonderful in social studies or English, and math could be a real hold-back." However, if the fourth math course is required, Jones said, she will recommend that her students take the appropriate classes to get into college. Counselor Judy Akins of Fort Smith's Southside High School said many students already take a fourth year of math. "I have a real problem with requiring it for admission to state schools," Akins said. Akins said adding another year of math won't help those students unless the content is more meaningful. "The problem lies with students who've not learned Algebra 2 or geometry," she said. "What is our purpose? To have students score a 19 on the ACT or be better prepared?"

Akins also said students shouldn't be required to take foreign language in high school. "I don't think every student is math-oriented or language-oriented," she said. The state higher education coordination board will discuss the proposed admission requirements at a Feb. 6 meeting.■

57. Detroit News

January 7, 1998

District experiments with science curriculum

Holland program focuses on problem-solving rather than concentrating on kids' memorization skills

By Annemarie Schultz

HOLLAND — Holland students are studying science with more than just a hands-on approach — they're using a "minds-on" method as well. The hands-on, minds-on approach is part of a 3-year-old program reforming the way students at Holland Public Schools learn science. It's designed to make students think and make educated guesses on the outcome of a science project. "Kids are learning sciences themselves through a scientific method called the 'learning angle,'" said Marty Coon, the district's science coordinator. Rather than focusing on memorization skills, which has long been associated with science, the learning angle focuses on reasoning and problem-solving. Fifth-graders at Jefferson Elementary applied the technique with a species of cricket. Each

student was given his or her own cricket in a plastic container with a slice of potato and told to write their observations in a journal. "I would like you to use all of your senses except for taste," teacher Lara Johnson said. Students enjoyed having their own live cricket to study. "It's easier to actually see the cricket close up rather than reading about it," said Courtney Lunden, 10. "It's more fun to look at it up close." One student examines the details of the cricket anatomy. "I like his colors and he's got little hands that you can hardly see on his mouth," said 11-year-old Joey Zuniga. The crickets came from the district's Living Resource Center, which lends plants and animals for science projects. "It just makes it easier for teachers to have life in their classroom," said Coon, who manages the Living Resource Center. Among the flora and fauna in the center in the district's administration building are a 3-year-old snapping turtle Coon hatched from an egg, newts, African clawed frogs, lizards and tarantulas. "For me it's so simple to actively provide resources to help biology be part of our curriculum," he said. "The resource room is important because in order to teach science well, it's important to have the supplies for hands-on science." The new science program was introduced in elementary schools in the 1994-95 school year and expanded to the middle schools and the high school the past two years. The short-term goal was to raise the district's science scores on the Michigan Educational Assessment Program test, but Coon said it's moved beyond that. "What we're doing is building a solid foundation of science," he said. "So no matter what the objectives (of state tests) are, the kids are always doing well. "My goal is to have the best science program in the country. We want the best program, because that's the best for our kids and why would we stop at anything less?" As second-graders in Maria Yoder's Jefferson Elementary School class guess why a latex glove inflates when placed over the mouth of a jar of water and Alka-Seltzer, students eagerly lean over their desks, waiting to be called on. While some students describe what they believe might be happening, others use more complex words such as "evaporate." Yoder is occasionally surprised at the language level of her students, but has come to expect more sophisticated vocabulary than she's seen in her prior 10 years of teaching. "The differences I see are in language and what they're figuring out on their own," she said. Not always giving the answer after teaching a unit is a change for Yoder, but she's learned to let the kids discover answers on their own. Johnson, who describes herself as more artistic by nature, said she didn't feel prepared to teach science before the new program was implemented. Now she's the co-leader of the district's fifth-grade science curriculum team. Johnson believes the hands-on, minds-on approach to science is a natural one. "I couldn't imaging teaching from a textbook about crickets," she said. "It wouldn't make sense." Coon said the revised curriculum would be impossible without good training of teachers. "The teachers become the key to the reform," Coon said. "That's what hasn't happened a lot in the past."

Annemarie Schultz writes for the Holland Sentinel. This report was distributed by the Associated Press.■

58. Boston Globe

January 7, 1998

Report cards show 22 schools improved

But others are failing; scores available

By Beth Daley, Globe Staff

Report cards for Boston public schools released yesterday show for the first time which schools have made the greatest strides in moving students out of the lowest performance level on a tough citywide test.

The report cards will be available to parents at the annual Citywide Showcase of Schools tonight at the Bayside Exposition Center. The showcase is designed to help parents choose what schools they want their children to attend next year.

The report cards, which the school department has released for the third year in a row, list reading and math scores in the Stanford 9 achievement test, as well as attendance records, suspension rates, staff qualifications, and specific programs in each of the system's schools. For the first time, data on student performance in open-ended testing are available, as well as how each school is dealing with the district's new math standards.

Twenty-two schools were able to significantly reduce the percentage of students in the lowest performance level in both math and reading on the Stanford 9 test between May 1996 and May 1997, compared to other schools in the district. Moving students out of that level, described as having "little or no mastery" of a subject, is one of the school department's primary goals.

Twenty-one of the district's 125 schools, however, had much less success in moving students out of that level.

As in previous years, the report cards show wide disparities in the performance levels of various schools. Boston School Superintendent Thomas Payzant urged parents to use the report cards carefully when choosing schools.

"The report cards offer parents a variety of indicators with which to measure teaching and learning in our schools," Payzant said. "However, I would caution parents against relying solely on report cards or on any one indicator as they decide on a school."

Comparative data with previous years are unavailable, as this was the first year the report cards measured movement out of a level.

Some administrators whose school ranked in the upper third for reducing level 1 performance credited staff dedication for the improvements. Still, many said the report cards showed only one year of progress, and that much more needs to be done.

"Mostly it's the hard work of teachers," said Robert W. Holland of the William E. Endicott Elementary School, which ranked in the upper third. "Teachers are identifying the needs of students, they communicate with parents."

The Citywide Showcase, which will be held from 5:30 to 8:30 p.m., provides

an opportunity for parents to talk with principals, teachers, and other parents from about 125 schools.

Under Boston's controlled choice plan, students are assigned to schools based on choice as well as race - in an effort to ensure racial balance.

School registration for the 1998-99 year begins tomorrow for kindergarten and grades 1, 6 and 9, and runs through Feb. 4. Registration and transfer requests for all other grades will take place from Feb. 9 to March 13.

Parents who pick a school during that time have the best chance of getting their first choice. To register a child already in a Boston public school, parents should fill out the applications provided to their children.

For students new to the district, parents must bring a child's original birth certificate (for children ages 4 to 6), complete record of immunizations, and two preprinted proofs of address.■

59. Boston Globe

January 7, 1998

An A for effort, but no pay

Teachers rarely compensated for supervising nonathletic activities

By Beth Daley, Globe Staff

Almost every day after school and on many weekends, Hyde Park High School teacher Demetra Stavrianidis can be found at work - running the student yearbook and supervising the multicultural club.

But despite the 10-15 extra hours a week she puts in, Stavrianidis receives little more than a thank you for her efforts: Boston, unlike most school districts statewide, rarely pays teachers for running nonathletic extracurricular activities, from the French club to the senior prom.

Now, about eight years after the no-pay policy was put into effect, many teachers still volunteer to run clubs, school newspapers, and school dances. They do it because they care about the students and know how important such activities are for their intellectual development.

But some are growing weary of the unpaid effort, and afterschool and enrichment programs have suffered. Hyde Park High School no longer has a National Honor Society, and students would be hard-pressed to find a drama club, chorus, or math team in several of the district high schools.

"I do it because it is necessary for the kids to have this, but it is a lot of work and a lot of time and teachers are not getting credit," said Stavrianidis.

Other school districts pay teachers for their extra efforts. In Cambridge, for example, the yearbook and school newspaper adviser receives $3,247 a year. The alpine ski club adviser receives the same. In Brookline, the senior class adviser, jazz band head, and math club organizer receive anywhere from $1,219-$1,319. Malden pays about $950 to the yearbook adviser.

Teachers and headmasters also say it's unfair that athletic coaches in Boston are paid stipends and they are not. In Boston, a varsity basketball coach will be paid $4,821 this year. Volleyball and soccer coaches will be paid $3,485, according to the Boston Teachers Union.

"Historically, there has been an imbalance for things that are *nonathletic*. We have never been in a position to sit down, equalize or restore the stipends," said Boston Latin headmaster Michael Contompasis.

"Why can't every school field a math team? That person spends as much time as the varsity baseball coach in one season. They work all year long for far less money," he said.

Boston Latin has many teachers that volunteer for language clubs and afterschool activities. But it also manages - with alumni funds - to pay teachers who head clubs that compete interscholastically, such as the math team.

Other schools aren't as lucky. Some teachers have been given a lighter schedule in the past to compensate, but that effort has been undermined with the recent emphasis on teaching more hours during the school day. Some schools now apply for grants to pay for stipends, while others try to raise money through booster clubs.

The extracurricular pay was eliminated when the School Department no longer required certain activities to be in a school, which meant teachers were not required to be given a stipend for them. While a dollar figure is still listed in the contract for various activities - $914 for a yearbook adviser, for example - few teachers receive it.

"Most people kept up activities for a while then they realized the inherent unfairness," said Ed Doherty, head of the Boston Teachers Union. Doherty said an arbitrator ruled that the School Department did not have to pay for activities that were not required.

"If teachers get paid for a yearbook in Brookline High School, Dorchester High deserves a yearbook as much as another school. A lot of activites that go on in other places don't go on in Boston," Doherty said.

Still, schools could create priorities within their budgets, as the Samuel W. Mason Elementary School did to run an afterschool program and the Jeremiah Burke High School did to pay a senior class adviser, school officials said.

"No budget decision is an easy one," said Tracey Lynch, a School Department spokeswoman. "But as any organization must, you weigh your priorities and potentially try to find alternative ways to address issues. It's clear some schools are successfully doing that."

Still, at Hyde Park High School, assistant headmaster Chuck Burgess bemoans the loss of a National Honor Society, "a centerpiece of a good school," gone in part, he says, because no one was being paid for it.

"Also, by statute we are supposed to have student government advisers but there is no money for it ..." Burgess said. "Some teachers have other jobs after school, not everyone can volunteer. And especially for city kids, you need programs after school."

At Boston High School, senior class adviser and special needs teacher Donna O'Brien says she and other teachers continue their extracurricular activities because they care about the students.

"Why do the elementary school teachers come in early? You just keep on doing it. You like the kids," said O'Brien. "You don't go into teaching to get rich. There are countless numbers of us who care."■

60. Chicago Tribune

January 7, 1998

'Outsiders' learning about Native America

By Jon Anderson
TRIBUNE STAFF WRITER

'Spring semester courses in Lakota, Ojibwe, History, Genealogy. Philosophy —and World View," proclaimed the classified ad, urging those who were interested to "call Dave."

That would be David Beck. Is he a busy man these days getting ready for the spring semester at the Native American Educational Services College, 2838 W. Peterson Ave.?

"Yes," said Beck happily, settling back in a book-lined office in a tree-lined, two-story building, where he is dean of the Chicago campus. Across the street is Mather Park, where dancers from the Oneida, Menominee, Ojibwe and Lakota Sioux tribes gathered last June to display ancient skills, competing for $23,000 in prizes. There was also much drumming.

In other ways as well these are boom times for native Indian cultures, which, after centuries of neglect, have seen a major upsurge in interest in their history, arts, legends, prayers, healings and what many see as a more harmonious approach to nature and environment.

For many of American Indian descent, it involves digging into matters long buried under an avalanche of foreign cultures. For them, the NAES system, offering a bachelor's degree in "liberal arts tribally defined," now runs campuses in Chicago, Minneapolis, on a reservation in Montana and another in northern Wisconsin where Menominees have lived for 5,000 years.

But Dave's ad was directed to a different audience. Call them "the outsiders," people looking to learn more about the land on which they live, from people who were here first.

"Interest is tremendous in American Indian courses these days," noted Craig Howe, director of the D'Arcy McNickle Center for American Indian History at the Newberry Library, who will be teaching "Dynamics of Philosophy and World View" at the NAES college this semester and, as he put it, "looking at some of the fundamental aspects of the culture."

So what, asked a recent Chicago campus visitor, can a modern-day outsider learn from attending lectures on ancient American Indian ways? In a word, said Beck, plenty.

"Our history courses would be of interest. Our tribal languages as well," he began, flipping through a 65-page catalog, as other staffers bustled around getting classrooms and the library ready for term. "More and more people recognize that what they learned growing up simply left out Native American history. Now they want to include that.

"We try to focus on tribal customary law," he went on. "On how Native Americans understood lands and resources. How they made treaties with other tribes. What they thought they were doing with the Europeans."

Not a little of the work has to do with giving the American Indian side of what, for them, were some rather bad real estate deals. Often, lands were ceded under the misunderstanding that they were sharing fishing and hunting rights, not selling off the land forever.

Other areas of interest, to outsiders searching for a more meaningful way of life, deal with the core values that spread across many of the nation's 550 American Indian tribes, among them an emphasis on extended family, Beck said.

Everyone pitches in, sharing chores, helping make decisions, raising children, caring for elders. Left to work properly, it can be a strong support system.

"Spirituality gives people a centeredness. It also helps in decision making," he explained, though he noted quickly that "we don't teach how to find spirituality. These are not self-help courses. But we do study the role it plays in everyday life for native peoples."

For outsiders, a study of American Indian cultures might also lead to a stronger sense of place, especially in Chicago. These days, a majority of Chicago's 8,000 to 11,000 American Indians live on the North Side, in Lakeview, Edgewater, Albany Park and Uptown.

Legacies of the city's Native American past are everywhere, from an old trail now turned into busy Ridge Avenue to a plethora of American Indian names on streets and public areas.

"I've studied a lot of (American Indian) history," noted Beck, turning to one stereotype he would like to retire, the Hollywood depiction of the blood-thirsty warrior.

In most native languages, Beck said, "the word 'warrior' included an idea of doing whatever they had to do to make sure their people were safe and secure." Far from always whooping into battle, warriors often opted for peace, he noted. They only went to war, "when that was the last thing they could do to protect their people."■

school application and what steps must be followed for it to be approved by the school board.

In other business, trustees are expected to consider spending $607,200 to upgrade salaries of some district employees; hiring a management firm to help prepare for a fall bond election; and purchasing the Trinity Valley School property at 6100 McCart Ave.■

54. Arkansas Democrat Gazette

December 9, 1997

Educators give tentative OK to new graduation criteria

CYNTHIA HOWELL
ARKANSAS DEMOCRAT-GAZETTE

The Arkansas Board of Education on Monday tentatively approved revised high school graduation requirements to take effect in 2002. The board is scheduled to consider final approval of the proposals in February. Two board members said they hope to add another math course requirement by then. Board members acted on the requirements during a meeting in which they also: Waived for two high schools a regulation requiring after-school instruction for athletes and others who hold less than a 2.0 grade point average. Expressed concerns about the minimum levels of liability insurance coverage most school districts carry for their buses. The state's existing graduation requirements call for three units of math. The proposed new requirements call for students to pass three math courses, one of which must be taken in the student's final year of high school. Two of the required courses must be algebra and geometry. Board members Jim McLarty of Newport and Betty Pickett of Conway proposed requiring four units of math instead of three. McLarty said statistics show that students who take four years of math score higher on college entrance exams, are less likely to need remedial college classes and are more likely to obtain a degree. Pickett called math just as much a foundation for learning as English. Four units of English are required currently and in the proposed standards. The Arkansas Higher Education Coordinating Council is considering new requirements for unconditional admission to state colleges and universities that include four high school math credits. **Education Department** Director Ray Simon urged the general education board to refrain from increasing the math requirement without public hearings. Simon said the proposed high school requirements are comparable to those of other states. Pickett also asked for assurances that students will graduate with computer technology skills. With the exception of the change in the math requirement and the addition of a social studies requirement, the proposed graduation requirements are similar to the existing requirements. The proposed standards call for four units of English, three units each in social studies, math and science, and one-half unit each in oral communications, physical education, fine arts and health and safety, and at least six elective credits. Also Monday, the board approved waivers that will enable students at two schools to participate in extracurricular activities even if they have less than a 2.0 grade-point average. After hearing from the principals of North Little Rock High School, West Campus, and Siloam Springs High, the board approved supplemental instruction programs in those schools. Both programs are part of the regular school day and as a result required a board waiver of a regulation mandating after-school instructional program of at least 100 minutes a week. North Little Rock Principal Gregg Thompson said the four-year-old Academic Improvement Program has helped at least six out of every 10 underachieving students to raise their grades to at least a 2.0 level, which is a "C" average. On the issue of school bus insurance coverage, a total of 211 of Arkansas' 311 school districts buy only the minimum required amount of liability insurance. McLarty said he believed the standard $50,000 to cover medical costs for up to 70 passengers on a bus is inadequate. The $50,000 would be the limit for coverage if the bus driver is found at fault in an accident. McLarty said he understood the districts are complying with the law and that raising coverage limits would increase school district costs. He suggested that the Education Board urge lawmakers to raise the minimum insurance coverage requirements.■

COMMENTARY

55. The Washington Post

12/09/97; Edition: FINAL; Section: OP-ED; Page A25

A Little Money For the Kids

By E. J. Dionne Jr.

The way the "education issue" gets discussed in politics is very different from the way it's talked about around kitchen tables.

When politicians get their hands around it, the subject becomes abstract. It's about "vouchers" or "local control" or "education bureaucrats" or "charter schools" or "unions" or "testing" or "funding."

When parents talk about it, it's about whether the teachers are good and whether their kids are safe, happy, eager and learning how to read, write and count. It's about whether the school roof is falling in and whether there are too many children in the class. It's about whether the textbooks are good and reflect the values of the household. Ultimately, it's about whether all the hours the kids are under that school roof are being spent productively.

This disjunction between political talk and household talk will matter in American politics over the next several years. Both parties are circling the education issue, trying to turn it to political advantage.

In 1996, Democrats owned the education issue. When Republicans in Congress proposed to eliminate the **Department of Education** and cut various federal programs, voters didn't read this as an attack on government or "Washington bureaucrats." The polls show that they saw it as an indifference to the schools, one of the areas where most Americans believe government necessarily plays a big role.

Democrats realized the issue's potential in the 1995 elections for the state legislature in Virginia. The state's popular Republican governor, George Allen, had hoped to take the state legislature for his party with a big tax cut campaign. The Democrats countered by arguing that helping the schools was more important than tax cuts. Many business leaders, Republican on so many issues, sided with the Democrats on this one. The Republicans fell short, and Democrats around the country spent a lot of timeover the next year doing photo ops in classrooms.

But Democrats now have a problem: The Republicans have gotten an education on the education issue. If Democrats could neutralize the Republican advantage on the crime issue, Republicans figure they can do the same with this one. Once again, Virginia was the laboratory. In the 1997 elections, Republican Jim Gilmore, running to succeed Allen, had a popular issue in his proposal to cut the state's burdensome car tax. His Democratic opponent, Lt. Gov. Don Beyer, wanted the election to be about education. Gilmore's strategists knew that education cut deeply, especially with the famous soccer moms. So Gilmore made a simple promise: to have the state pay for 4,000 more teachers to cut class sizes. The Republicans' post-election analysis showed this promise had a large impact, especially on women. They could vote with Gilmore on the car tax because he had earned himself some education credentials. Gilmore won the election.

The question at the national level is: Who will learn the most from Gilmore? President Clinton is right in pushing for national standards and testing as a way to give parents some way of judging how well their kids' schools are doing. Assessment is a precondition of reform.

But "I'll give your kids a test" is not a compelling national slogan. Rejoining the political discussion to the kitchen table discussion requires giving up boilerplate rhetoric about education being solely a local issue. It's a local issue, yes, but a national issue, too. What can Washington realistically do without imposing large regulatory burdens on localities?

It can put its money where the kitchen table wants it: to repair decaying schools and build new ones. The administration was foolish to cave in to Republicans in this year's budget negotiations on Clinton's $5 billion school construction program. Congress could also create a new version of the old "impact aid" program, to help school districts where the mini-baby boom and immigration create jammed classrooms.

It can help states to equalize spending between rich and poor school districts. Parents from poor districts have been winning lawsuits on this issue for years. But parents in wealthy school districts resent spending less on their own kids to send money to poor school districts. Washington could take the edge off these divisive fights by picking up some of the tab — and help poor kids in the process.

Yes, all this would require politicians to violate the iron law of conventional wisdom that Washington spending is always bad. Funny they never seem to think about this when they want to spend money on roads or defense installations. The people at the kitchen table would welcome a little of the largesse going to educate their kids.■

THE WHITE HOUSE

WASHINGTON

January 26, 1998

Dear Mr. Chairman:

Thank you for writing concerning the December 11, 1997, letter from Dr. Luther Williams, Assistant Director of the National Science Foundation (NSF), to Mrs. Yvonne Larsen, President of the California State Board of Education, concerning the proposed standards for mathematics recently adopted by the State of California.

Dr. Williams's correspondence was recently brought to the attention of my staff. As a result, Dr. Neal Lane, Director of NSF, sent the attached letter, in which he makes absolutely clear that the content of State standards is the responsibility of the State, and that NSF has no intention of withdrawing support for the projects it is funding in California based on the action by the State Board of Education.

Mastering the basics and advanced skills in mathematics is critical for all our young people. I look forward to continuing to work with you and your colleagues to help states and school districts around the country strengthen teaching and learning in math and other core subjects.

Sincerely,

Bill Clinton

The Honorable Bill Goodling
Chairman
Committee on Education and the Workforce
House of Representatives
Washington, D.C. 20515

Attachment

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[Identical Letters to Other Members]

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Again, thanks for writing.

Sincerely

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The Honorable Bill Goodling

Thank you for writing me concerning the December 11, 1997, letter by Dr. Luther Williams, Assistant Director of the National Science Foundation (NSF), to Mrs. Yvonne Larsen, President of the California State Board of Education, concerning the proposed standards for mathematics recently adopted by California.

I completely agree with you that Dr. Williams' letter was inappropriate. The correspondence was recently brought to the attention of my staff, who worked with Dr. Neal Lane, Director of NSF, on the attached letter, dated January 8, 1998, which superseded that written by Dr. Williams. Dr. Lane's letter makes absolutely clear that the content of state standards is the responsibility of the state, and that NSF has no intention of withdrawing support for the projects it is funding in California based on the action by the State Board of Education.

We all agree that mastering the basics and advanced skills in mathematics is critical for all our young people. As the results of the 8th grade TIMSS test, and more recent data on student achievement in urban areas make clear, we have far to go in order to achieve this important goal. I look forward to working with you and your colleagues on helping states and school districts around the country strengthen teaching and learning in this vital subject.

Again, thanks for writing.

Sincerely

cc: Dr. Neal Lane

Attachment

National Science Foundation

Office of the Director

4201 Wilson Boulevard
Room 1205
Arlington, Virginia 22230

Phone: 703-306- Fax 703-306-0109

Date: January 15, 1998

To: Bill Kincaid, DPC

Fax No.: 202-456-5581

From: Judy Sunley

Pages: 8 *(Including Cover Sheet)*

Comments:

Bill -

As per our conversation.

Judy

Please call the number above if you experience transmission problems.

ROUTING SLIP

NATIONAL SCIENCE FOUNDATION

TO: NAME	ORGANIZATION & ROOM NO.	ACTION	INITIAL	DATE
1. JUDY SUNLEY	OD	4		
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1. Note and Forward
2. Note and Return
3. Note and file
4. Per your request
5. For information
6. Concurrence
7. Approval
8. For signature
9. For comment
10. For correction
11. Recommendation
12. Please see me
13. Investigate and report
14. Keep and report
15. Necessary action

16. Prepare reply for signature of

17. Answer or acknowledge before

FROM -	DATE	ROOM NO.
LUTHER S. WILLIAMS	1/15/98	805
ORGANIZATION	**E-MAIL ADDRESS**	**TELEPHONE NO.**
AD/EHR		306-1606

REMARKS -
THE FOLLOWING LETTER ARE ATTACHED:
1. JANUARY 5, 1998 LETTER FROM YVONNE LARSEN
2. January 15, 1998 LETTER FROM BERTHA PENDLETON
3. LETTER ADDRESSED TO CALIFORNIA SUPERINTENDENTS

NSF Form 35 (5/92)

This responds to LW's letter to CSI Superintendents.

Note that this letter has crossed paths with the one Lane sent to Larsen

These letters went only to the Superintendents. I thought copies had gone to Larsen as well, but was told today that they had not.

STATE OF CALIFORNIA PETE WILSON, Governor

CALIFORNIA STATE BOARD OF EDUCATION
721 Capitol Mall; P.O. Box 944272
Sacramento, CA 94244-2720

January 5, 1998

Luther S. Williams, Assistant Director
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

Dear Mr. Williams:

This is to acknowledge receipt of your letter of December 11, 1997, regarding the mathematics standards adopted by the California State Board of Education. Respectfully, I fear that your letter was written with such haste--being dated the same day as our action--that you did not take the time to understand the situation in regard to these standards as completely as you should have. Indeed, I believe you did exactly what you accused the State Board of doing, not considering public input fully before committing pen to paper. You suggest that the mathematics standards adopted by the State Board reflect "[t]he wistful or nostalgic 'back-to-basics' approach that...overlook[s] the fact that the approach has chronically and dismally failed." You also imply that the adopted standards are somehow at odds with NSF-funded projects in six public school systems. Here is why, I would suggest, you are wrong.

The State Board-adopted mathematics standards do not favor one "approach" to mathematics instruction over another. These standards set forth the rigorous mathematics content to be delivered and leave the "how to" decisions on content delivery to local decision-making. Why? Because we listened to the public input. We heard strong, broadly based support both for traditional instructional approaches and for innovative ones. We also heard strongly voiced criticisms of each. What we did not find--and what I would challenge you to put forth--is a strong, cohesive base of current and confirmed research that demonstrates clear superiority for any particular approach. We did find plenty of broad generalizing about student achievement and mathematical literacy, contrarily-interpreted research, limited studies (usually comparisons of various approaches involving small numbers of students or classes without appropriate experimental controls), conjecture, anecdotes, and recitations of personal experiences. I should hope that these are <u>not</u> the types of information on which you would have any state base standards.

I respect the fact that you appear convinced traditional approaches to mathematics instruction are not as good as innovative ones. However, your allusion to chronic, dismal failure of traditional approaches is not supported, I would submit, by current and confirmed research. Moreover, having now listened to a great deal of public input (six public hearings around the state, and several more public discussion sessions in Sacramento), I believe I could match you story-for-story, anecdote-for-anecdote, limited-study-for-limited-study to demonstrate that traditional approaches are just as good or better than innovative ones in mathematics instruction.

With respect to the NSF-funded projects in six California districts, I would suggest respectfully that they are a non sequitur in relation to the statewide mathematics standards discussion. Absolutely nothing in the adopted standards adversely affects those projects. Presumably, students in the districts where these projects are being funded are receiving mathematics content at least as rigorous as the standards specify.

As to your comment that the State Board's action in adopting standards "vacates any serious commitment to elevating problem-solving and critical thinking skills to K-7 mathematics standards," I do not believe you can substantiate this with current and confirmed research findings. Without arguing "how" instruction should be delivered, I have yet to have anyone show me what *content* in the adopted K-7 standards is not needed to prepare for higher-order mathematics--what *content* in those standards is not essential to a balanced knowledge of mathematics--computation, problem-solving, and critical thinking. Other than what we did, I do not know of any action the State Board could have taken that would have, at once, set high content standards and allowed for local determination regarding the full range of instructional approaches.

I would also like to emphasize another important point that you may not have considered. As an extension of the standards, we will be producing a new *Mathematics Framework* in which ways to strengthening mathematics instruction will be explored for a variety of different approaches. [We have also committed to the adoption of a broad range of instructional materials that will support the different approaches.] The framework is the correct place to discuss instructional approaches, not the standards. The standards need to be the "what," not the "how." The "how" has to remain a local decision, unless the state (or the national government) can cite a body of current and confirmed research which clearly establishes the superiority of a specific approach.

I am sure that you believe you did a brave and courageous thing by sending your letter, and I am sure that you have received considerable approbation from those who share your opinion about innovative instructional approaches in mathematics. However, I did not find the letter either helpful or particularly purposeful. Please, Mr. Williams, take a careful look at our mathematics standards. Ask yourself, if students generally were to receive the rigorous mathematics content specified in the adopted standards, regardless of instructional approach, wouldn't California have made substantial strides toward the higher level of mathematics literacy we all desire? In all honesty, I believe you must agree that the answer is yes.

The problem now is not the standards. The unfortunate problem now is the fact that many (perhaps most) of our teachers do not have sufficient mathematical background to deliver the standards' rigorous content. What we need to do, both through pre- and in-service training, is strengthen the mathematical knowledge base of our teachers. Respectfully I would suggest that NSF's positive assistance in that regard would be much more helpful and purposeful than were your negative comments regarding California's first-ever mathematics standards. Let us work collaboratively on areas where there is substantial agreement (such as the need for staff development in mathematics), rather than focusing our attention on matters of instructional approach on which there is substantial disagreement among distinguished mathematicians, educators, and parents.

Sincerely,

Yvonne W. Larsen

YVONNE W. LARSEN, *President*

SAN DIEGO CITY SCHOOLS

EDUCATION CENTER • 4100 Normal Street, San Diego, CA 92103-2682 • Fax: (619) 293-8418 (619) 291-7182

DR. BERTHA O. PENDLETON
Superintendent

January 14, 1998

Dr. Luther Williams
National Science Foundation
4201 Wilson Blvd.
Arlington, VA 22230

Dear Dr. Williams:

I am in receipt of your January 8, 1998, letter in which you seek to clarify the interplay between the district standards articulated in the Urban Systemic Initiative (USI) agreement and those recently adopted by the California State Board of Education.

Let me assure you that no action of the State Board places us in jeopardy of meeting the standards and terms set forth in our USI agreement. While we are distressed with the action which the State Board took, and believe it will have its influence on publishers of texts and assessments, we do not see this impacting the execution of the San Diego USI. As a local Board of Education, we will implement a program which honors the commitment to higher standards. We would be happy to review this further with our program officer as you suggest.

Sincerely,

Bertha O. Pendleton

Bertha O. Pendleton
Superintendent

BOP:bb

c: Eric Hamilton
Irene Outlaw
Vance Mills

C/BOP/Williams/Jan 98

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

January 8, 1998

OFFICE OF THE
ASSISTANT DIRECTOR
FOR EDUCATION AND
HUMAN RESOURCES

Dr. Bertha Pendleton
Superintendent
San Diego City Schools
4100 Normal Street
San Diego, CA 92103-2682

Dear Dr. Pendleton:

The purpose of this letter is to clarify the interplay between the standards articulated in the San Diego City Schools Urban Systemic Initiative (USI) Cooperative Agreement with the National Science Foundation (NSF) and the K-7 Mathematics Standards recently adopted by the California State Board of Education.

In particular, we wish to reiterate the importance of the standards the district has set for itself as well as the importance of the terms of agreements for the USI award. Your letter of December 18, 1997 indicates that San Diego expects to adopt math standards sometime this month, which in their current form are stronger than those adopted at the state level. The letter also raises concerns about the impact of the statewide standards on issues such as instructional materials, assessment, and teacher professional development. Therefore, we need you to inform us whether you expect that the statewide Standards adoption will substantively impact the execution of the San Diego USI.

If so, NSF will enter deliberations toward reconciling the expectations in your Cooperative Agreement and those which have emerged from considerations involving the adoption of statewide standards.

Please review with your cognizant program officer, as appropriate, any questions that you have regarding this process. We look forward to a continued partnership with you in providing a high quality mathematics and science learning experience for students in the San Diego Schools.

Thank you very much.

Sincerely,

Luther S. Williams
Assistant Director

Telephone (703) 306-1600 FAX (703) 306-0399

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

January 8, 1998

OFFICE OF THE
ASSISTANT DIRECTOR
FOR EDUCATION AND
HUMAN RESOURCES

Dr. Carlos Garcia
Superintendent
Fresno Unified School District
Tulare and M Streets
Fresno, CA 93721

Dear Dr. Garcia:

The purpose of this letter is to clarify the interplay between the standards articulated in the Fresno Unified School District Urban Systemic Initiative (USI) Cooperative Agreement with the National Science Foundation (NSF) and the K-7 Mathematics Standards recently adopted by the California State Board of Education.

In particular, we wish to reiterate the importance of the standards the district has set for itself as well as the importance of the terms of agreements for the USI award. We have heard from the other USI sites in California concerning the impact of the recently adopted statewide standards and recognize that this might be of concern to you as well.

Should you inform us that the Standards adoption will substantively impact the execution of the Fresno USI, NSF will enter deliberations toward reconciling the expectations in your Cooperative Agreement and those which have emerged from considerations involving the adoption of statewide standards.

Please review with your cognizant program officer, as appropriate, any questions that you have regarding this process. We look forward to a continued partnership with you in providing a high quality mathematics and science learning experience for students in the Fresno Schools.

Thank you very much.

Sincerely,

Luther S. Williams
Assistant Director

Telephone (703) 306-1600 FAX (703) 306-0399

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

OFFICE OF THE
ASSISTANT DIRECTOR
FOR EDUCATION AND
HUMAN RESOURCES

January 8, 1998

Dr. Ruben Zacarias
Superintendent
Los Angeles Unified School District
450 Grand Avenue
Los Angeles, CA 90012

Dear Dr. Zacarias:

The purpose of this letter is to clarify the interplay between the standards articulated in the Los Angeles Unified School District Urban Systemic Initiative (LA-SI) Cooperative Agreement with the National Science Foundation (NSF) and the K-7 Mathematics Standards recently adopted by the California State Board of Education.

In particular, we wish to reiterate the importance of the standards the district has set for itself as well as the importance of the terms of agreements for the USI award. In your December 8, 1997 "Informative to the LAUSD Board of Education," you indicate that the LAUSD Standards include and go beyond the State Board Standards and that the high expectations for student achievement held by both the Board and the Superintendent will be met by implementing the standards-based curriculum recommended by the LA-SI. This suggests that the statewide standards will have little impact on the execution of the LA-SI.

If this conclusion is incorrect, NSF will enter deliberations toward reconciling the expectations in your Cooperative Agreement and those which have emerged from considerations involving the adoption of statewide standards.

Please review with your cognizant program officer, as appropriate, any questions that you have regarding this process. We look forward to a continued partnership with you in providing a high quality mathematics and science learning experience for students in the Los Angeles Schools.

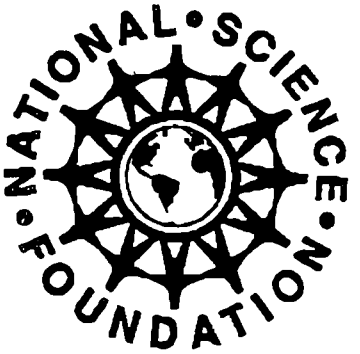
Thank you very much.

Sincerely,

Luther S. Williams

Luther S. Williams
Assistant Director

Telephone (703) 306-1600 FAX (703) 306-0399



National Science Foundation

Office of the Director

4201 Wilson Boulevard
Room 1205
Arlington, Virginia 22230

Phone: 703-306-1003 Fax 703-306-0109

Date: 1/8/98

To: Mike Cohen
Domestic Policy Council

Fax No.: 202/456-5581

From: Neal Lane

Pages: 3 *(Including Cover Sheet)*

Comments:

Please call the number above if you experience transmission problems.

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

OFFICE OF THE
DIRECTOR

January 8, 1998

Mrs. Yvonne W. Larsen
President, California State Board of Education
721 Capitol Mall, Room 532
Sacramento, CA 95814

Dear Mrs. Larsen:

Because science, mathematics, engineering, and technology education at all levels is an agency wide priority for the National Science Foundation, I follow media coverage of these issues on a regular basis. As you must be aware, the deliberations of the California State Board of Education on mathematics standards have received a great deal of attention. In some of the articles since the middle of December, reference was made to and quotes taken from a letter sent you in the course of those deliberations by my colleague Luther Williams, NSF's Assistant Director for Education and Human Resources. I was concerned about some of the interpretations of this letter in the press. At my request, Dr. Williams recently shared his letter with me. I believe it can easily be and in some instances has been misconstrued. I want to be sure that there is no misunderstanding in your mind about NSF's position on two very important matters.

(1) It is NSF policy not to prescribe particular standards for mathematics and science education to NSF proposers and grantees or to the states in which they reside.

NSF's K-12 mathematics and science education activities are funded through competitive programs to which interested organizations apply. The proposals made to us by states, districts, schools. and other educational organizations are evaluated based on established criteria, which usually include reference to high-quality, rigorous standards to be designed and implemented by the participating entities. NSF believes that it is the responsibility of states and local school districts to establish and implement the standards to which they hold themselves.

(2) NSF does not regard the State Board's action with respect to statewide standards as grounds for terminating funding to what we believe are critically important projects in California school districts.

Dr. Williams' letter expressed his personal concern that the statewide standards you were considering could have a negative impact on the ability of the school systems listed to live up to the objectives of the cooperative agreements negotiated in the award process. Unfortunately, his letter has been interpreted as a threat to terminate the awards, if the State Board enacted the standards under consideration. Neither he nor I would countenance such an action.

Finally, my reading of the media articles surrounding the California standards for K-12 mathematics is that, while the standards have been adopted, the underlying issues remain controversial in your state, as they are in other parts of the Nation. I hope California will take the lead in initiating a broad public discussion of what is important in mathematics education that avoids the polarization of issues that has characterized much of the debate thus far. This could be vitally important to other states involved in establishing standards and in the periodic revision of standards that is expected to occur.

While the California standards are described as placing their focus on basic computational skills, I see also clear recognition on your part that the needs for mathematics education do not stop there. All students must be able to use basic skills effectively in developing means of solving more complex problems. We need to find a way to demonstrate that basic skills and the contextual framework of real-world problems or more advanced mathematics in which they can be used reenforce one another, accomplishing what we all want -- a set of varied approaches that in combination provide what is best for the students.

Please feel free to contact me if I can provide any additional clarification on these matters.

Sincerely,

Neal Lane

Neal Lane
Director

National Science Foundation

Office of the Director

4201 Wilson Boulevard
Room 1205
Arlington, Virginia 22230

Phone: 703-306- 1018 Fax 703-306-0109

Date: 1/15/98

To: Bill Kincaid

Fax No.: 202-456-5581

From: Judy Sunley

Pages: *(Including Cover Sheet)*

Comments:

As per our conversation.

Judy

Please call the number above if you experience transmission problems.

COMMITTEE ON EDUCATION
AND THE WORKFORCE
U.S. HOUSE OF REPRESENTATIVES
2181 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, DC 20515-6100

MAJORITY—(202) 225-4527
(TTY)—(202) 226-3372
MINORITY—(202) 225-3725
(TTY)—(202) 226-3116

January 13, 1998

The Honorable William Jefferson Clinton
President of the United States
The White House
Washington, DC 20500

Dear Mr. President:

The purpose of this letter is to express our deep concern about the interference of the federal government, specifically the National Science Foundation, in State governance matters involving school curriculum. We believe this warrants your personal and immediate attention.

California has been in the process of developing rigorous, academic standards in mathematics, and other subject areas for the past several years. The California State Board of Education, by law has the final authority on what these standards should be, and it has been deeply involved in their development. On December 11, 1997, the day before the State Board of Education was to approve new mathematics standards, The National Science Foundation Director for Education and Human Resources, Luther Williams, in his official capacity, sent a letter to the President of the State Board of Education Yvonne Larson, criticizing the Board's preliminary decision to adopt standards of which Mr. Williams disapproved.

In his letter he made clear his disdain for the competence of the State Board of Education to decide what is best for California children as indicated below:

> "The Board actions, charitably, is shortsighted and detrimental to the long-term mathematical literacy of children in California....The wistful or nostalgic "back-to-basics" approach that characterizes the Board standards overlooks the fact that the approach has chronically and dismally failed."

For a Federal official, with no legitimate stake in the debate and no facts to back up his claims, to openly seek to influence the decision was bad enough. However, the following paragraph from his letter definitely crosses the line between Federal and State jurisdiction over local education matters:

> "The National Science Foundation currently maintains a portfolio exceeding $50 million in awards to six public school systems in California (East Side Union, Fresno, Los Angeles, Oakland, Paramount, San Diego)....These awards, though

> only moving into their second and third years of implementation, are beginning to stimulate significant learning gains in mathematics and science achievement....You must surely understand that the Foundation cannot support individual school systems that embark on a course that substitutes computational proficiencies for a commitment to deep, balanced, mathematical learning."

It is clear from Mr. Luther's own comments that there is insufficient scientific data to back up his claims that "significant gains in mathematics achievement" will result from this "approved" National Science Foundation approach to mathematics instruction. In fact the National Science Foundation conducted research in Project Follow Through over twenty five years at a cost of more than one billion dollars, that supports "computational proficiencies" as a fundamental and necessary part of mathematics instruction. Mr. Williams conveniently ignores these findings. His heavy-handed approach is further reflected in the final paragraph of his letter:

> "We view the Board action in California with grave disappointment and as a lost opportunity for the cities we support - indeed, for the entire state....We disagree, decisively, with the Board's decision to systematically remove components from the standards that focus on problem solving and other elements of the rigorous and powerful use and learning of mathematics."

It is our view that the National Science Foundation should not try to override a State Board decision. To use the hammer of possible withdrawal of federal funds to force a state into compliance with un-proven practices is unconscionable.

We consider the action taken by Mr. Williams as totally inappropriate, and an infringement of the Federal government upon the will of the States and the people of California. The Federal government has no business interfering with the California State Board of Education on something as sensitive as the content of school curriculum. Please let us know what action you intend to take to address the actions of Mr. Williams.

Sincerely,

BILL GOODLING
Chairman

FRANK RIGGS
Member of Congress

HOWARD 'BUCK' MCKEON
Member of Congress

PETE HOEKSTRA
Member of Congress

LINDSEY GRAHAM
Member of Congress

Cc: Yvonne Larson, Chairman, California State Board of Education
Delaine Easton, California Superintendent of Instruction
Honorable Richard Riley, United States Secretary of Education
Neil F. Lane, Director, National Science Foundation
Luther Williams, Assistant Director for Education, National Science Foundation
Pete Wilson, Governor of California

FAX

Date: 1/20/98

Number of pages including cover sheet: 2

To:

Bill Kincaid

Phone:

Fax phone: 4568-5581

CC:

From:

Pat Forgione

Phone: Brian Thompson (202) 219-1333

Fax phone: (202) 219-2061

REMARKS: ☐ Urgent ☐ For your review ☐ Reply ASAP ☐ Please comment

MEMORANDUM

To: Mike Cohen
Jennifer Davis
David Frank
Mary Frase
Bill Kincaid
Tom Lyon
Martin Orland
Eugene Owen
Terry Peterson
Pat Ross
Bill Schmidt
Kevin Sullivan
Larry Suter
David Thomas
Maureen Treacy
Alex Wohl
Judy Wurtzel

cc: Ricky Takai

From: Pat Forgione

Date: Tuesday, January 20, 1998

Subject: Department Briefing on TIMSS 12th-Grade Release

The release of the TIMSS 12th-Grade report is rapidly approaching (February 24, 11:00 a.m.) Accordingly, NCES will begin a series of regular meetings to brief senior deparment officials on the findings, how to interpret them, and dissemination/outreach plans. I am writing to invite you to the first such meeting.

The meeting will include individuals from NCES, the Dept. of Ed., the White House, The Widmeyer-Baker Group, and the TIMSS production team. It will take place as follows:

When: Friday, January 23, 10:00 a.m. - 12:00 p.m.
Where: Room 5342, Federal Building 10, 600 Independence Ave. SW

I hope that you will be able to attend.

Strengthening Math Education: The budget includes a $40 million increase for the Department of Education matched by a $40 million increase for the National Science Foundation for jointly coordinated activities designed to help raise math achievement, especially among middle school students. Funded activities will address three priority areas critical to helping students master basic and advanced skills in math: strengthening teacher preparation and on-going professional development; helping communities select and implement high quality materials and technology; and fostering public understanding and engagement. Proposed activities will leverage existing programs and respond to recent results of the Third International Math and Science Study (TIMSS) which showed that U.S. 8th graders perform below the international average in math.

U.S. DEPARTMENT OF EDUCATION
OFFICE OF THE DEPUTY SECRETARY
600 INDEPENDENCE AVENUE, S.W.
WASHINGTON, D.C. 20202-0500

DATE: 11/25

TO: Mike Cohen

ORGANIZATION: DPC

PHONE: (202) 456-5575 FAX: (202) 456-7028

FROM: Marj Wirtz [illegible]

PHONE: (202) 401-3281 FAX: (202) 401-9027

COMMENTS:
Mike — Mike Smith suggested I get this information with you. I will get it to OMB (Barry + Mary Cassell) as well. I think it's important to highlight this FY as our head to one of our initiatives. I'd appreciate feedback & ideas re how to move this forward.
Thanks!

TOTAL PAGES (including cover): ______

Funding for the Department of Education's Mathematics Initiative in FY99 Proposed Increases in Eisenhower Professional Development Federal Activities and Eisenhower Regional Mathematics and Science Education Consortia

Earlier this year the President directed the Department of Education (ED) and the National Science Foundation (NSF) to create an action strategy for improving the use of federal resources to help students meet challenging mathematics standards in the eighth grade. The three major priority areas in the soon-to-be released action strategy are: (1) promoting public understanding and engagement; (2) assisting communities in selecting and implementing appropriate instructional materials and technology; and (3) improving the mathematics teaching of elementary and middle school teachers by improving teacher preparation and on-going professional development. An important cross-cutting strategy is the improved coordination of ED and NSF programs in order to build on their strengths and leverage reform.

The action strategy lays out a series of programmatic and policy directions for the two agencies. To address the first priority area, the two agencies are using FY98 funds to launch a national campaign to build public understanding and support of high standards in mathematics that will begin in the fall of 1998. To address the second and third priority areas, the Department's FY99 budget request includes a $40 million increase in the Eisenhower Professional Development Federal Activities and Eisenhower Regional Mathematics and Science Education Consortia. This increased funding will allow the Department -- in conjunction with NSF -- to develop a national campaign to improve math achievement parallel to efforts underway in reading. FY99 will be a critical year for this effort with the further development of the voluntary national mathematics test and the spring 1998 release of the 12th grade TIMSS results.

PROPOSED ACTIVITIES TO IMPROVE MATH ACHIEVEMENT

Joint Competitive Planning Grants to Jumpstart Mathematics Improvement in Grades 5-8: Strengthening the impact of federal resources to upgrade mathematics instruction is a major priority of the action strategy. This joint initiative, with significant additional funding from NSF, will award $50,000 planning grants to school districts to develop strategies to better coordinate and leverage Title I, Eisenhower, NSF and other funds to improve elementary and middle school mathematics. The resources will target mid-size districts that do not receive Urban Systemic Initiative (USI) grants from NSF, and, within those districts, high poverty schools. ($10 million from ED)

The National Mathematics Project: Teacher networks are an extremely powerful and relatively inexpensive and under-utilized way to improve the teaching workforce. Based on the National Writing Project, this project will support the development of several national models for improving mathematics content knowledge of elementary and middle school teachers with the goal of enhancing participants' fundamental knowledge of mathematics. These funds will be used for the development of the materials and professional development models, which would become self-sustaining over time. Participants would eventually be supported with funds from local, state and other federal funds (including SSI, USI, Eisenhower state grants and Title I) to participate in the network of their choice. ($5 million)

Leadership Training: An important finding in the action strategy is the nationwide shortage of well-informed and well-trained leaders who can help schools improve mathematics instruction.

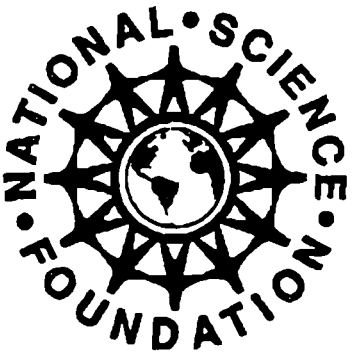
This program will help develop experts who can provide technical assistance and professional development to schools on improving mathematics instruction in ways that are suggested by the findings of the Third International Mathematics and Science Study (TIMSS). The initiative would also share professional development models and materials, including materials on TIMSS and the support materials developed around the Voluntary National Test in Mathematics. This program will focus primarily on developing leadership capacity of school and district-based leaders and professional developers to match NSF's commitment to developing leadership capacity among university-based mathematics educators. ($3 million)

Technology-Based Professional Development: Technology has the potential to be a powerful tool for professional development. Through video, CD-ROM, Internet and other technology, teachers can actually see models of effective teaching and upgrade their mathematical skills and knowledge. Currently, very few such materials exist. This initiative would fund a number of projects to create more high-quality, technology-based professional development materials and to build professional development curriculum around these materials. Funding would be provided to states, districts, teacher centers and other high-quality professional development providers to create effective strategies for using these materials and accompanying curriculum in mid- to large-scale professional development efforts, including intensive training of teacher leaders and the creation of networks to provide ongoing support in using the materials for professional development. ($5 million)

Teaching for Understanding: TIMSS and other research show that many of the countries with high levels of mathematical performance concentrate on developing the conceptual understanding of mathematical principles in students. In contrast, research shows that the U.S. concentrates more on teaching procedural knowledge -- or how to do things -- without tying this knowledge to mathematical concepts. This program will develop professional development materials and training models that are designed to help teachers, particularly middle school teachers, develop pedagogical approaches that emphasize conceptual understanding of mathematics in students while ensuring they still master the basics. ($5 million)

National Mathematics and Science Education Materials Clearinghouse: Increased funds for the Eisenhower National Clearinghouse will help support the Department's Mathematics Initiative by furthering materials development, the creation of Web sites, access to information via technology, and TIMSS-related activities. The Clearinghouse works in conjunction with the mathematics and science education regional consortia to provide assistance across the country to upgrade teaching and learning in mathematics and science consistent with challenging academic standards. ($2 million)

Eisenhower Regional Mathematics and Science Consortia: This increase would provide an additional $1 million to each consortium to train a group of regional leaders to improve mathematics education by teaching more advanced mathematics content in middle school and raising students' conceptual understanding of mathematics. The increase would also be used to support partnerships of regional consortia with urban and rural school districts that require more intensive technical assistance in planning, training, and identifying and using the best resources to improve teaching and learning to higher mathematics standards. ($10 million)



National Science Foundation

Office of the Director

4201 Wilson Boulevard
Room 1205
Arlington, Virginia 22230

Phone: 703-306-1000 Fax 703-306-0109

Date: 1/9/98

To: Mike Cohen
Domestic Policy Council

Fax No.: 202/456-5581

From: Neal Lane

Pages: 2 *(Including Cover Sheet)*

Comments:

FYI

Please call the number above if you experience transmission problems.

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

OFFICE OF THE
DIRECTOR

January 9, 1998

The Honorable
Richard W. Riley
Secretary of Education
Department of Education
600 Independence Avenue, NW
Washington, DC 20202-0100

Dear Mr. Secretary:

Over the past two days, I have been working with staff at the Domestic Policy Council and the Office of Science and Technology Policy to address a problem that may have some bearing on activities of the Department of Education. I want to make sure you understand the situation, as I would not want it to in any way jeopardize the partnership we have worked so hard to put together.

During the deliberations of the California State Board of Education on standards for K-12 mathematics, Dr. Luther Williams sent a letter to the President of the Board discussing what he believed were important issues for several of our large educational reform projects in California (Attachment A). I first became aware of the letter when references to it and quotes from it appeared in the media. I became concerned because the reporting gave the impression that NSF, a federal agency, had intervened substantively in the California deliberations. It now appears that this impression is broadly shared, and that certain factions may use that to question the federal role in education.

Based on the potential for serious fallout, I felt that NSF must act to clear up the misunderstandings. Thus, I have written to the President of the California State Board of Education to make absolutely clear what NSF's position is with regard to standards (Attachment B). Dr. Williams is also preparing some follow-up materials.

At the President's Management Council retreat on Wednesday, I discussed this briefly with Mike Smith, so I know that the Department is aware of the nature of the situation. But, I wanted to be sure that you were aware of the current status of its resolution before you met with mathematics organizations this afternoon. If you would like to talk about any of this, I would be happy to do so.

Sincerely,

Neal Lane
Director

Attachments

Copy to: Marshall Smith

National Science Foundation

Office of the Director

4201 Wilson Boulevard
Room 1205
Arlington, Virginia 22230

Phone: 703-306- Fax 703-306-0109

Date:

To: Mike Cohen, Bill Kincaid

Fax No.: 202-456-5581

From: Judy Sunley

Pages: 3 *(Including Cover Sheet)*

Comments:

Dr. Lane took a quick look at this before a 3:00 mtg that will tie him up much of the afternoon. If this is okay, I can get it out. If there are problems, it may get held until tomorrow morning. I think this addresses your concerns. Please get back to me ASAP. Judy

Please call the number above if you experience transmission problems.

January 8, 1998

Mrs. Yvonne W. Larsen
President, California State Board of Education
721 Capitol Mall, Room 532
Sacramento, CA 95814

Dear Mrs. Larsen:

Because science, mathematics, engineering, and technology education at all levels is an agency wide priority for the National Science Foundation, I follow media coverage of these issues on a regular basis. As you must be aware, the deliberations of the California State Board of Education on mathematics standards have received a great deal of attention. In some of the articles since the middle of December, reference was made to and quotes taken from a letter sent you in the course of those deliberations by my colleague Luther Williams, NSF's Assistant Director for Education and Human Resources. I was concerned about some of the interpretations of this letter in the press. At my request, Dr. Williams recently shared his letter with me. I believe it can easily be and in some instances has been misconstrued. I want to be sure that there is no misunderstanding in your mind about NSF's position on two very important matters.

(1) It is NSF policy not to prescribe particular standards for mathematics and science education to NSF proposers and grantees or to the states in which they reside.

NSF's K-12 mathematics and science education activities are funded through competitive programs to which interested organizations apply. The proposals made to us by states, districts, schools. and other educational organizations are evaluated based on established criteria, which usually include reference to high-quality, rigorous standards to be designed and implemented by the participating entities. It is the responsibility of awardees to establish and implement the standards to which they hold themselves.

(2) NSF does not regard the State Board's action with respect to statewide standards as grounds for terminating funding to what we believe are critically important projects in California school districts.

Dr. Williams' letter expressed his personal concern that the statewide standards you were considering could have a negative impact on the ability of the school systems listed to live up to the objectives of the cooperative agreements negotiated in the award process. Unfortunately, his letter has been interpreted as a threat to terminate the awards, if the State Board enacted the standards under consideration. Neither he nor I would countenance such an action.

Finally, my reading of the media articles surrounding the California standards for K-12 mathematics is that, while the standards have been adopted, the underlying issues remain controversial in your state, as they are in other parts of the Nation. I hope California will take the lead in initiating a broad public discussion of what is important in mathematics education that avoids the polarization of issues that has characterized much of the debate thus far. This could be vitally important to other states involved in establishing standards and in the periodic revision of standards that is expected to occur.

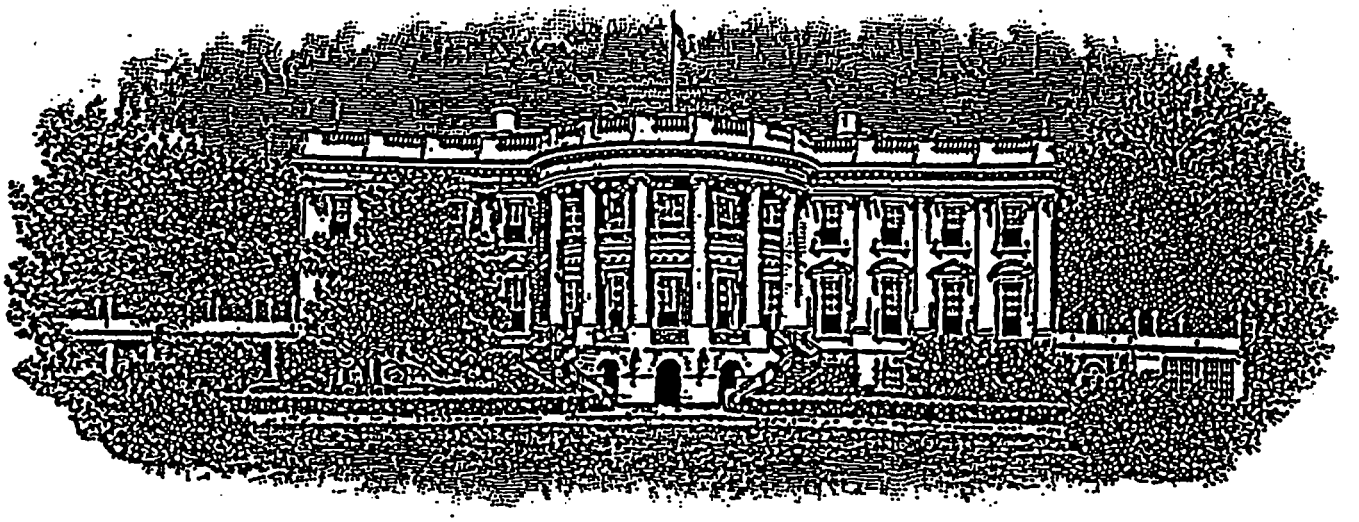
While the California standards are described as placing their focus on basic computational skills, I see also clear recognition on your part that the needs for mathematics education do not stop there. All students must be able to use basic skills effectively in developing means of solving more complex problems. We need to find a way to demonstrate that basic skills and the contextual framework of real-world problems or more advanced mathematics in which they can be used reenforce one another, accomplishing what we all want -- a set of varied approaches that in combination provide what is best for the students.

Please feel free to contact me if I can provide any additional clarification on these matters.

Sincerely,

Neal Lane
Director

The White House



Domestic Policy Council
Old Executive Office Building, Room 220
Washington, DC 20502

Telephone Number: (202) 456-2857
Alternate: (202) 456-2216

FAX Number: (202) 456-7028
Alternate FAX: (202) 456-7431

FAX COVER SHEET

TO: Judy Sunley

FAX: 703-306-0108

FROM: **BILL KINCAID**

THIS FAX INCLUDES THE COVER SHEET PLUS 02 **PAGES.**

IF YOU DID NOT RECEIVE THE COMPLETE FAX, PLEASE CALL (202) 456-2857.

MESSAGE:

Suggested edits to draft letter. Please call me or Mike.

Thanks.

Bill

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

OFFICE OF THE
DIRECTOR

Final draft
1/8/98

January 8, 1998

Mrs. Yvonne W. Larsen
President, California State Board of Education
721 Capitol Mall, Room 532
Sacramento, CA 95814

Dear Mrs. Larsen:

Because science, mathematics, engineering, and technology education at all levels is an agency wide priority for the National Science Foundation, I follow media coverage of these issues on a regular basis. As you must be aware, the deliberations of the California State Board of Education on mathematics standards have received a great deal of attention. In some of the articles since the middle of December, reference was made to and quotes taken from a letter sent you in the course of those deliberations by my colleague Luther Williams, NSF's Assistant Director for Education and Human Resources. I was concerned about some of the interpretations of this letter in the press. At my request, Dr. Williams recently shared his letter with me. I believe it can easily be and in some instances has been misconstrued. I want to be sure that there is no misunderstanding in your mind about NSF's position on these matters.

Put this 1st

Then this 2nd

NSF's K-12 mathematics and science education activities are funded through competitive programs to which interested organizations apply. Their proposals are evaluated based on established criteria, which usually include reference to high-quality, rigorous standards to be designed and implemented by participating schools and districts. While we will provide examples of extant standards when such are requested, we believe it is the responsibility of the states, districts, and schools participating in NSF projects to establish and implement their own standards. It is NSF policy not to prescribe particular standards to NSF proposers or to the states in which they reside.

Once decisions are made on which projects will be funded, the larger ones, such as the Urban Systemic Initiatives in Fresno, Los Angeles, and San Diego, are funded through cooperative agreements, where the conditions of the award are carefully negotiated and criteria for evaluation are established. The standards to which the organization elects to hold itself are part of the basis for the award. Each year, NSF and the grantee organization evaluate progress toward the objectives as outlined in the cooperative agreement, and NSF makes a decision as to whether the progress is sufficient that the award should continue.

Dr. Williams' letter expressed his personal concern that the statewide standards you were considering could have a negative impact on the ability of the school systems listed to live up to their cooperative agreements. Unfortunately, his letter has been interpreted as a threat to pull the awards, if the State Board enacted the standards under consideration. I want to make clear to you that NSF does not regard the State Board's action with respect to statewide standards as grounds for terminating funding to what we believe are critically important projects in California.

under USIs

Finally, my reading of the media articles surrounding the California standards for K-12 mathematics is that, while the standards have been adopted, the underlying issues remain controversial in your state, as they are in other parts of the Nation. I hope California will take the lead in initiating a broad public discussion of what is important in mathematics education that avoids the polarization of issues that has characterized much of the debate thus far. This could be vitally important to other states involved in establishing standards and in the periodic revision of standards that is expected to occur.

While the California standards are described as placing their focus on basic computational skills, I see also clear recognition on your part that the needs for mathematics education do not stop there. All students must be able to use basic skills effectively in developing means of solving more complex problems. We need to find a way to demonstrate that basic skills and ~~substantive~~ advanced mathematics reenforce one another, accomplishing what we all want -- a set of varied approaches that in combination provide what is best for the students.

Please feel free to contact me if I can provide any additional clarification on these matters.

Sincerely,

Neal Lane
Director

DIRECTORATE FOR EDUCATION
AND HUMAN RESOURCES
OFFICE OF THE ASSISTANT DIRECTOR
4201 WILSON BOULEVARD, SUITE 805
ARLINGTON, VA 22230

FACSIMILE TRANSMITTAL SHEET

TO:	FROM:
Mike Cohen	Luther S. Williams
COMPANY:	DATE:
The White House	December 31, 1997
FAX NUMBER:	TOTAL NO. OF PAGES INCLUDING COVER:
202-456-5581	1
PHONE NUMBER:	SENDER'S REFERENCE NUMBER:
202-456-5575	
RE:	YOUR REFERENCE NUMBER:
LETTER TO YVONNE LARSEN	

☐ URGENT ☐ FOR REVIEW PLEASE COMMENT PLEASE REPLY ☐ PLEASE RECYCLE

NOTES/

AS REQUESTED

NATIONAL SCIENCE FOUNDATION
TELEPHONE: 703-306-1600 FAX: 703-306-0399

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

OFFICE OF THE
ASSISTANT DIRECTOR
FOR EDUCATION AND
HUMAN RESOURCES

December 11, 1997

Mrs. Yvonne W. Larsen
President, California State Board of Education
721 Capitol Mall, Room 532
Sacramento, CA 95814

Dear Mrs. Larsen:

California appeared poised to make an important contribution to the national discussion regarding the appropriate balance of mathematical problem-solving, procedural skills, and critical thinking with the September, 1997 proposal of the Commission for the Establishment of Academic Performance and Content Standards. Instead, the decision last week by the California State Board of Education, with little or no public input, to adopt alternative standards vacates any serious commitment to elevating problem-solving and critical thinking skills in K-7 mathematics standards. The Board action is, charitably, shortsighted and detrimental to the long-term mathematical literacy of children in California.

The wistful or nostalgic "back-to-basics" approach that characterizes the Board standards overlooks the fact that the approach has chronically and dismally failed. It has excluded youngsters from engaging in genuine mathematical thinking and therefore true mathematical learning, and has produced a disproportionately mathematically illiterate citizenry.

The National Science Foundation currently maintains a portfolio exceeding $50 million in awards to six public school systems in California (East Side Union, Fresno, Los Angeles, Oakland, Paramount, San Diego). These districts are undertaking systemic initiatives to offer their students much greater opportunities to learn and achieve in high-quality, rigorous, mathematics and science. These awards, though only moving into their second and third years of implementation, are beginning to stimulate significant gains in mathematics and science achievement. A growing body of research also shows significant learning gains elsewhere. You must surely understand that the Foundation cannot support individual school systems that embark on a course that substitutes computational proficiencies for a commitment to deep, balanced, mathematical learning.

We view the Board action in California with grave disappointment and as a lost opportunity for the cities we support -- indeed, for the entire state. We have followed the debate closely. We

Telephone (703) 306-1600 FAX (703) 306-0399

obviously share your stated interest in improving the rigor of the mathematics instruction in the state. We disagree, decisively, with the Board's decision to systematically remove components from the standards that focus on problem solving and other elements of the rigorous and powerful use and learning of mathematics.

Sincerely,

Luther S. Williams
Assistant Director

cc: Delaine Eastin
Superintendent for Public Instruction

Mrs. Yvonne W. Larsen
President, California State Board of Education
721 Capitol Mall, Room 532
Sacramento, CA 95814

Dear Mrs. Larsen:

My colleague Luther Williams, NSF's Assistant Director for Education and Human Resources, recently shared with me a December 11 letter he sent to you in the course of the California State Board of Education's deliberations on statewide standards for K-12 mathematics. I have also become aware of a number of articles from the media which quoted or summarized from that letter. Based on my reading of these materials, I believe Dr. Williams' letter can easily be and, in some cases has been, misconstrued. I want to be sure that there is no misunderstanding in your mind about NSF's position in these matters.

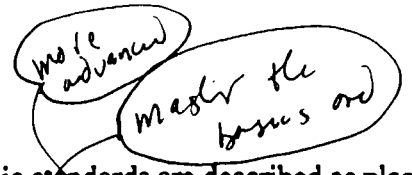
First, I want to congratulate the California State Board of Education on adopting its first set of statewide standards for K-12 mathematics. Developing educational standards is not an easy process. There is general agreement that students perform better when there are clear expectations for their performance, yet that agreement does not always extend to what those expectations should be. The existence of standards is a testament to hard work and persistence.

NSF's K-12 mathematics and science education activities are funded through competitive programs to which interested organizations apply. Their proposals are evaluated based on established criteria, which usually include reference to high-quality, rigorous standards to be designed and implemented by participating schools and districts. While we will provide examples of extant standards when such are requested, we believe it is the responsibility of the states, districts, and schools participating in NSF projects to establish and implement their own standards. We would not presume to prescribe standards to NSF proposers or to the states in which they reside.

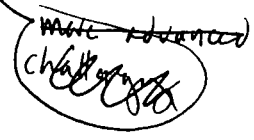
Once decisions are made on which projects will be funded, many, particularly the larger ones, are funded through cooperative agreements, where the conditions of the award are carefully negotiated and criteria for evaluation are established. The standards to which the organization will hold itself are part of the basis for the award. Dr. Williams' letter expressed his concern that the statewide standards you were about to adopt could have a negative impact on the ability of the school systems listed to live up to their cooperative agreements.

This component of his letter has been interpreted as a threat to pull the awards, if the State Board enacted the standards under consideration. Under no circumstances would we withdraw funding from what we regard as critically important projects in California based solely on the State Board's action with respect to statewide standards. ~~Indeed, we have maintained close contact with the superintendents of districts involved in our Urban Systemic Initiative (USI) program and are actively seeking to ensure their continuance. See the attached letter.~~

Finally, my reading of the media articles surrounding the California standards for K-12 mathematics is that, while the standards have been adopted, the underlying issues remain controversial. I hope we can use this experience to initiate a broad public discussion of what is important in mathematics education that avoids the polarization of issues that has characterized much of the debate thus far. This could be vitally important to other states involved in establishing standards and in the periodic revision of standards that must take place.



While the California standards are described as placing their focus on basic computational skills, I see also clear recognition that the needs for mathematics education do not stop there. Students must be able to use ~~those~~ computational skills effectively, to develop appropriate means of solving problems, ~~and to know when the use of computers or calculators is truly warranted.~~ ~~Perhaps we can use the existing USI awards in California~~ to ~~demonstrate that basic skills and substantive mathematics~~ reenforce one another, finding a path ~~that accomplishes what we all want~~ -- varied approaches that in combination provide ~~what is best for the students.~~



William
cc: Superintendents

jsunley @ nsf.gov
01/05/98 10:49:00 AM

What about Riley/Lane school visit? or DC event?

Record Type: Record

To: William R. Kincaid

cc:
Subject: action strategy -- transmittal and release

Bill,

I know that Judy has talked to you about transmittal and release of the action strategy. We had talked on Wednesday, and I sent her these additional thoughts on Friday. I don't know if she had an opportunity to share them with you before she left. I thought it might be important for you to see them as timing may be important.

Judy S.

>Date: Fri, 2 Jan 1998 11:54:48 -0500
>To: Judy_Wurtzel@ed.gov
>From: Judy Sunley <jsunley@nsf.gov>
>Subject: action strategy -- transmittal and release
>Cc: mcozzens
>Bcc:
>X-Attachments:
>
>Judy,
>
>I said in our phone conversation on Wednesday that I would try to think a
>bit more about transmittal of the action strategy to the President and its
>public release. Here are some thoughts. I'm including your suggestion
>that the release be concurrent with the release of 12th grade TIMSS
>results for completeness. I will reiterate that I am uncomfortable with
>simply holding the document and not giving the White House the opportunity
>to evaluate it and recommend it to the President.
>
>1. Release the action strategy concurrent with the release of the 12th
>grade TIMSS results. (If I understood what you said on Wednesday, this
>would be announcement by Riley and Lane that they had transmitted the
>action strategy to the President as it is unlikely the President will
>participate in the release of this essentially negative information.)

No

>
>Pros:
>
>The TIMSS results, which raise attention to shortcomings in math and
>science education, are part of the impetus for the action strategy.
>
>We can argue that the action strategy represents a first step at dealing
>with the poor results the TIMSS rollout points to.
>

>Previous TIMSS releases have had good press coverage, and such coverage is
>likely this time as well.
>
>Cons:
>
>The 12th grade results are bad, so we would be tying the action strategy
>to what is basically a negative event.
>
>The TIMSS 12th grade results are confusing; the messages are complex; it
>is not clear people would pick up on the positive message of the action
>strategy.
>
>Rather than the President acknowledging receipt and intention to act on
>the action strategy, Riley and Lane would indicate they had forwarded it
>to the President.
>
>2. Release the action strategy concurrent with the announcement of the
>winners of the Presidential Awards for Excellence in Mathematics and
>Science Teaching.

When?

>
>Pros:
>
>This is a very positive announcement; the teachers are spectacular.
>
>There is generally a lot of local publicity for the awardees; it is
>possible that the local press would pick up the action strategy as well.
>
>Cons:
>
>The action strategy is not aimed at this particular group of teachers --
>they are already doing the job well.
>
>The announcement is usually fairly low key. It is not clear that it would
>attract national coverage.
>
>3. The President has visited a number of schools over the past several
>months, interacting with students and teachers. Find an appropriate time
>when such a visit is planned (or make one), and incorporate release of the
>strategy with the visit.

Not POTUS
Riley/Lane
Rec
Maybe VP

>
>Pros:
>
>This type of "event" regularly gets good press coverage.
>
>If there were a visit to a middle school, it would be a good opportunity
>to highlight what we think could be done in middle school mathematics. It
>would be even better, if we were able to do it in a Title I schoolwide
>school that already has some related activities underway.
>
>Riley and Lane could participate as well.
>
>Cons:
>
>It is not clear that such an event is in the works right now.

>
>4. The State of the Union Address. (This effort, in part, had its
>genesis in last year's State of the Union Address, with the proposal for
>national voluntary exams in reading and math. What I contemplate here is
>a short update on the status of those exams with brief mention of the
>action strategy in math and science to complement the Department's longer
>term efforts on reading.)
>
>Pros:
>
>This is very visible, would get good press coverage.
>
>While it is not a separate event focused on the strategy, it provides a
>natural opportunity to highlight the existence of a strategy that will, in
>part, be realized through the FY99 budget.
>
>Would obviate the necessity of a separate event.
>
>Cons:
>
>Action strategy might get lost in the broad set of issues raised in the
>State of the Union.
>
>Action strategy (and budget increments supporting it) may not be deemed
>important enough for the State of the Union.
>
>5. Combination strategy:
>
>Have press release for PAEMST reference that President has received the
>action strategy, lay the groundwork for further information. Mention the
>strategy and its implementation in the State of the Union. Follow up with
>a visit to a school that would, among other things, illustrate the
>potential impact of the strategy.
>
>Pros:
>
>High visibility for the strategy; lets the public know that action is
>underway.
>
>Doesn't rely on a single event; mixes modes of transmittal, just as
>strategy mixes approaches to implementation.
>
>Permits us to lay the groundwork with education press before the State of
>the Union so that even brief mention in that address could capture
>attention.
>
>Cons:
>
>May overstate importance of the strategy.
>
>
>
>
>

UNITED STATES DEPARTMENT OF EDUCATION

OFFICE OF THE DEPUTY SECRETARY

FOB-10 Rm 6251

Telephone Number: (202) 401-3281 Fax Number: (202) 401-3095

FAX COVER SHEET

TO: Bill Kincaid

FROM: JUDY WURTZEL

FAX: 456-7028

NUMBER OF PAGES TO FOLLOW, INCLUDING COVER SHEET: 4

IF YOU DID NOT RECEIVE THE COMPLETE TRANSMISSION, PLEASE CALL (202) 401-3281 or (202) 401-1000.

MESSAGE:

This letter is now public. Please fax it to whomever you'd like.

November 24, 1997

Dear Colleague:

The National Science Foundation (NSF) and the U.S. Department of Education are pleased to announce an opportunity for you and/or your organization to participate in the *Public Understanding and Engagement Mathematics Initiative.*

Background:

The attention of parents, educators, students, and the public is needed if this Nation is to realize the goal that all American students will leave eighth grade prepared to pursue the higher-level mathematics and science courses that are the gateway to college, productive employment, lifelong learning, and effective citizenship. The middle school years are critical in the mathematical development of children. The results of the recent Third International Mathematics and Science Study (TIMSS) show that, while U.S. fourth graders are making real progress in mastering the basics of mathematics, U.S. eighth graders score below the international average in mathematics. Many middle school students, often through no fault of their own, fail to master the mathematics necessary to pursue the higher-level mathematics and science courses in high school that are the gateway to college and careers. TIMSS suggests that it is in grades 5-8 -- when our students should be moving beyond studying arithmetic to incorporating arithmetic in solving more complex, multi-step problems and to learning elements of geometry, algebra, and measurement -- that we need to do more to raise expectations and achievement. The release of the TIMSS results, and the resulting interest in improving student learning and achievement, suggest that, as a nation, we have a window of opportunity to communicate and raise expectations for improved student learning and achievement in mathematics.

Reaching high levels of performance in mathematics requires teachers who possess the skills and knowledge to teach challenging mathematics content in effective ways and to implement high-quality, standards-based curricula and instructional materials, including effective uses of educational technologies. The NSF and the Department of Education have programs to help accomplish these two components of a strategy for improving mathematics achievement. These programs will be expanded and linked in the near term.

Activities outside the classroom for both students and adults are important if one is to improve student achievement in mathematics. Activities outside of schools can make mathematics come alive and more relevant to student's daily lives and career choices. At the same time, these activities can help many parents and other adults develop a clear sense of what students should be expected to know and do in mathematics in school, especially in the middle years.

The NSF and the Department of Education intend to support the creation of a large-scale, national public education effort that is coupled with extensive opportunities for active engagement of students, parents, and the larger community in the support of mathematics education. By way of this letter, the two agencies are calling for proposals to be submitted to NSF for the *Public Understanding and Engagement Mathematics Initiative*. Awards under this initiative will be co-funded by the two agencies.

Elements of the *Public Understanding and Engagement Mathematics Initiative*:

Building on a well-defined theme(s), projects are expected to inform and engage the general public with a clear, coherent message directed towards improved student learning and achievement in mathematics. Collectively, the projects should:

- use simple and compelling messages to tell the public what middle school students should know and be able to do in mathematics. These messages should be widely and regularly disseminated in a recognizable format, and should include sample problems and student work.

- place an emphasis on important mathematics and interesting problems that engage middle school students, parents and the general public; some problems should illustrate the power of using solutions of elemental problems to produce solutions for those that are more complex;

- illustrate the relevancy of challenging mathematics to success in college and a wide range of careers;

- create well-designed products that will engage the public in actually doing mathematics and that target a variety of media, along with a plan for disseminating the products;

- foster and create active partnerships to engage parents and the community, to include professional organizations, scholarly societies, community-based organizations, and the business sector.

- mobilize adult volunteers to assist students in doing high-quality mathematics problems in a variety of settings -- summer, after-school and weekend programs, contests, etc.;

- provide high quality printed and Internet-based support materials as guides for volunteers which might include examples of student work, hints for solving problems, and pointers to additional resources; and

- sponsor highly visible local and national events and activities that engage the community which could include such things as math fairs, business sponsored contests, etc.

All proposed activities are to be coordinated with other NSF and Department of Education funded activities that take place outside the classroom, e.g., the 21st Century School Initiative, Title 1 after-school programs, Partnerships for Family Involvement in Learning, Informal Science Education projects, etc. Strategies to reach populations currently underserved by attempts to improve mathematics achievement are particularly encouraged.

Administrative Aspects:

It is expected that grants and/or cooperative agreements will be made for a period of one to three years. The initiative will be funded for approximately three million dollars. It is expected that up to five (5) awards will be made.

Concept papers are required and must be received at the National Science Foundation by January 5, 1998. These concept papers may address all aspects of the initiative or individual parts. Concept papers should be limited to five pages and must include a budget narrative. Concept papers should be sent to Dr. James Oglesby at NSF, 4201 Wilson Blvd., Room 885, Arlington, Virginia 22230. Feedback on the concept papers will be provided by February 16, 1998. Included with this feedback will be information about the submission of full proposals and the criteria for their review.

Full proposals should be prepared in accordance with the guidelines provided in the *Grant Proposal Guide* (NSF 98-2) and must be received at NSF by April 1, 1998. It is expected that there will be substantial cost sharing or leveraging in the final proposal, given the limited funds available for the initiative. Any cost sharing commitment specified in the proposal will be referenced and included as a condition of an award resulting from this *Dear Colleague* letter.

Should one proposal for the whole task not be submitted, or not be competitive, one of the awardees will be chosen competitively to coordinate all of the activities in the set. This lead organization will insure that all activities are consistent with NSF's and the Department of Education's priorities for this initiative.

If you have any questions about this initiative, please call NSF Program Officers, James Oglesby or Diane Spresser at 703-306-1620.

Most sincerely

Margaret B. Cozzens
Division Director
Elementary, Secondary, and
Informal Education Division, NSF

Judith Wurtzel
Mathematics Initiative Director,
Department of Education

13. LRP Publications

Dec. 22, 1997

Energy Department to Offer Science and Math Internet-based Tutorials

Department of Energy Secretary Frederico Pena recently unveiled the National Science Education Strategy, under which Department scientists will serve as on-line mentors for elementary and secondary school teachers.

"It is our obligation as parents, teachers and elected officials to give our children tools they will need to take us into the 21st century," said Pena. "This means we must maintain the standard of excellence that has made our nation a world leader in science and technology. We need to get our children excited and motivated about science and math so they can compete in a world where technology is at the forefront of the global marketplace."

The National Science Education Strategy will utilize the technological resources of the Department of Energy's national laboratories to develop state-of-the-art educational technologies in science and math for elementary and secondary school students.

The initiative is designed "to create effective Internet learning tools that can be used nationwide," according to a DOE spokesperson. In addition to giving teachers on-line access to "expert" mentors, the program is also geared to provide teachers an opportunity "to access the latest innovations in science and technology."

The Internet-based tutorials will focus on science and math education for K-12 students, and will be designed by Department of Energy scientists in partnership with teachers and schools across the country. The tutorials will be accessible via the Department's science education website.

The new science education website will funnel the enormous amount of information available from the national labs into one central location. The website will provide teachers and students, via the Internet, the opportunity to conduct hands-on experiments and tutorials, as well as access to the national labs.

The website will provide a means by which the Energy Department, in partnership with the National Science Foundation, will help get information to teachers on new scientific discoveries. The Energy Department will also use the site to offer teacher training and instruction on science and technological advances.

The Department of Energy, working in conjunction with the National Science Teachers Association, will recruit 1,000 among scientists, engineers, and technicians from the national labs and facilities by the year 2000 to serve as on-line mentors. These experts will be available to answer teachers' questions on basic science and technology; energy use and efficiency; environmental studies; engineering; computer science; and math.

"I want the Department of Energy to open its doors of knowledge and make them available to the next generation of scientists," said Pena. "I hope this National Science Education Strategy will help our children learn about the wonders of science and math so that they will keep our nation at the forefront of scientific and technological excellence."■

14. Education Daily

December 23, 1997

ED'S 1998 TECHNOLOGY DOLLARS YIELD FUNDING CHANGES

K-12 educators can expect some changes next year for **Education Department** technology grants, including additional funding cycles, larger grant sizes and new focus areas, due partly to extra fiscal 1998 appropriations.

ED's two major technology grant programs are the Technology Literacy Challenge Fund and the Technology Challenge Grants, both of which received major fiscal 1998 increases.

The year-old Technology Literacy Challenge Fund grows from $200 million in fiscal 1997 to $425 million in fiscal 1998, and ED sent the money in block grants Dec. 10 to state education agencies (SEAs). Schools and school districts should contact their agencies now to see about fiscal 1998 funding.

The fund provides formula grants to SEAs to help them implement statewide technology plans through competitive funding to local education agencies (LEAs) that are using new technologies to improve schools.

Massachusetts will move to two cycles+from one last year+for its largest of four grant-giving components, which handed out three grants totaling $750,000 in fiscal 1997.

Fiscal 1998 grants, however, will be no more than $500,000 for each of 11 grants, said educational technology coordinator Connie Louie, and the program component's budget now is $4 million.

California received $46.5 million, the largest amount among the states. It too will have an additional funding cycle this spring, said spokeswoman Karen Steentofte. The state received about

TRADE

11. Commerce Business Daily

12/22/97 Section: DEADLINE: DUE 020998

RELOCATION OF DEPARTMENT OF EDUCATION IN THE WASHINGTON, DC METROPOLITAN AREA.

NOTICE TYPE: Solicitation

NOTICE DATED: 121897

OFFICE ADDRESS: General Services Administration, NCR, Special Services Center (WPMFC), 3101 Pennsy Dr., Landover, MD 20785

ZIP CODE: 20785

SUBJECT: V - RELOCATION OF DEPARTMENT OF EDUCATION IN THE WASHINGTON, DC METROPOLITAN AREA.

SOLICITATION NO.: SOL GS11P98YXC0046

RESPONT: POC Juanita Harris, Carol A. Rivers - (301) 436-6000

NOTICE TEXT: Total Small Business Set-Aside Definite Quantity Type Contract for the relocation of the Department of Education, from (4) locations to Federal Office Building #6, 400 Maryland Ave., S.W., Washington, DC, a modernized headquarters facility. This move will include approximately 1,500 workstations of only contents and /or equipment, 250 positions of furniture, the National Library of Education, the Barnard Auditorium, photography studio, training and development center, mail room, and LAN room. Inspection of property and locations will be conducted on Thursday, January 22, 1998, at 10:00 a.m.(prompt). Prospective bidders will meet on the lobby level of Federal Office Building #10, 600 Independence Ave., S.W., Washington, DC. Bidders that fail to participate in the walk-through or inspection of property to be relocated, will not be considered for award. Solicitation will be issued on or about January 10, 1998. The move is currently scheduled to begin early April 1998 through August 1998. All interested parties are invited to request a solication package in writing either by mail to the address above or by FAX to (301) 436-7178.

RECEIVED: (W-352 SN152254) Provided by Federal Information & News Dispatch, Inc. (FIND) 202-544-4800■

12. The Hotline

12/22/97

NATIONAL BRIEFING - BOWLES WATCH: ICKES WOULD CONSIDER COS IF CLINTON ASKED

Ex-WH Dep. CoS Harold Ickes, asked if his name would be thrown into the mix when and if WH CoS Erskine Bowles leaves: "I have no idea. My partner, Janice Enright and I are busy with a very thriving consulting business here in Washington D.C., and we're devoting our attention to that." CNN's Blitzer: "If he called you to come back to serve in the White House, would you go back?" Ickes: "I would always answer a call to the President of the United States and have a discussion with him. You don't turn down the President of the United States if he asks you to come and talk to him." Ickes, asked about Pres. Clinton's "shabby" treatment of him: "That's a long time ago. And the fact is, he and I have been friends for 25 years and continue to be friends." Ickes, on whether he is a target in either the Teamsters of campaign finance investigations: "I have not been told that. ... I have testified, I think, 17 times. Not on campaign finance reform, but since coming to Washington in various forms. But I've not been told I'm a target or a subject" ("IP Weekend," 12/20).

Potential replacements, culled from The Hotline's database: NSA Sandy Berger, Commerce Sec. Bill Daley, House Dem caucus chair Vic Fazio, Ag. Sec. Dan Glickman, WH legis. liaison John Hilley, ex-Commerce Sec/USTR Mickey Kantor, Dep. CoS John Podesta, ex-WH counsel/ex-VP Gore CoS Jack Quinn, **Ed. Sec. Richard Riley** and Treas. Sec. Robert Rubin.■

Jan. 4, 1997

Memorandum for Bill Kincaid

From: Mike Cohen

Subject: Reactions to ED/NSF math strategy

1. Overall, the strategy is fine.

2. I'm less concerned than you about the lack of reference to the national tests in the cover letter; I'm not opposed to having some reference to it, but I don't think its critical.

3. I am very concerned, however, that in its current form the document will be portrayed by critics as the federal government's master strategy for promoting fuzzy math through the top-down implementation of the NCTM standards. This will hurt our overall efforts in general, and our national test effort in particular.

While this document can't be the place to explain or defend the NCTM standards, there are several steps that must be taken to minimize the criticism we will inevitably encounter:

- **Emphasize the importance of mastering the basics in math**. The document talks about rigorous standards and problem-solving, but it doesn't say clearly--and often -- that doing well and reaching standards by the 8th grade requires kids to know how to add, subtract, etc. very well.

  It should. And it needs to repeat this idea often, especially in the sections that deal with public engagement and with curriculum and instruction issues.

  I don't believe the NCTM standards intend schools to stop teaching kids the basics. Unless I'm wrong, this needs to be said early and often. And we should make better use, in this document and in its release, of the value that federal scientific agenices place on the NCTM standards. If NASA wants people to know the NCTM standards in order to get rockets to Mars, that should be made clear up front. Nobody thinks that the team got the rocket to Mars is weak in math, or can't do basic calculations without a calculator.

- **Emphasize state standards and NAEP as well as the NCTM standards.** First, the document has to acknowledge that ED programs require states to set their own standards, not to use national ones. Second, it has to make clear up front that the national tests are based on the NAEP frameworks. Third, it has to make clear that state standards, NCTM standards, and NAEP frameworks all have a substantial degree of overlap. As a result, this action strategy is anchored in the policy decisions of responsible state officials and a broad national consensus of what kids should learn in math; not just in what one national organization has promoted.

- **Provide evidence of success.** NSF has data from at least a number of SSI's and USI's that these efforts have produced student achievement gains. There ought to be a few examples of this throughout the report. Similarly, ED has success stories of standards-based reforms in states such as Kentucky and Maryland. We will be far less vulnerable to attack on the grounds that we are promoting some untried and untested approach (and walking away from the "tried and tested" back-to-basics approach) if there are some stories about places that have put into place the kinds of standards we are envisioning (and strategies for achieving them), and have seen measured improvements in student achievement in math as a result.

One way to deal with all of this would be to expand the current "Need for Action" section starting on page 1. They might want to consider relabeling it something like "A Time for Action", with an outline along the following lines:

-- 4th grade TIMSS data are positive--US kids do well on international comparisons (and, at 4th grade, are presumably picking up the basics reasonably well) We can talk about the basic skills in math being important..

--8th grade TIMSS s how disturbing results--overall US performance is low compared to other countries. Our kids are being outperformed in more advanced math subject and skills. There is lots of evidence from TIMSS that shows that teaching practices, curriculum, textbooks, etc. are weak compared to countries that outperform us.

--Doing well in 8th grade math is really important (Pick up from brief report ED released in the Fall)--we need to focus on improving middle school math performance

--We know a lot about what needs to be done -- higher standards and standards-based reforms are critical (can draw on NSF and ED examples of success stories); TIMSS findings point to areas we must focus on, etc.

-- Rigorous standards are essential--and there is strong overlap among state standards, NCTM, NAEP (used for national test framework) and TIMSS over what kids should know and be able to do. This reflects the collective judgement of state officials, math experts and community, and expectations around the world...

--National Tests will help by providing valuable information for parents, kids and schools, etc.....

-- Now is time to act; this action strategy shows how federal goverment will help schools, states/districts, etc.

4. A couple of editorial/political points to help sidestep unwarranted criticisms--it's always a good idea to list parents at the front rather than the back end of a list of key players in education, whether it is a list of who is being challenged to do what by this strategy, or who has to be involved in improving education. Otherwise they look like an afterthought. Also, re: the PRIME

example from Pittsburgh (p.9): Instead of describing this as a model for "leveraging" local funds (which sounds like we've made the district spend its own $ on something it otherwise wouldn't have), could we describe it as a model for showing how, through a cost-sharing requirement, a federal investment could help a local school district more effectively spend $6.7 million of its own and other federal funds to improve math ?

National Science Foundation

Office of the Director

4201 Wilson Boulevard
Room 1205
Arlington, Virginia 22230

Phone: 703-306- Fax 703-306-0109

Date: 1/8/98

To: Mike Cohen, Bill Kincaid

Fax No.: 202-456-5581

From: Judy Sunley

Pages: *(Including Cover Sheet)*

Comments:

Dr. Lane has agreed that he would send this letter. If you have no changes, it can go as soon as you get back to me. If you feel changes are necessary, you may need to talk with him about 2:30 or 3:00 this afternoon. Judy

Please call the number above if you experience transmission problems.

National Science Foundation

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4201 Wilson Boulevard
Room 1205
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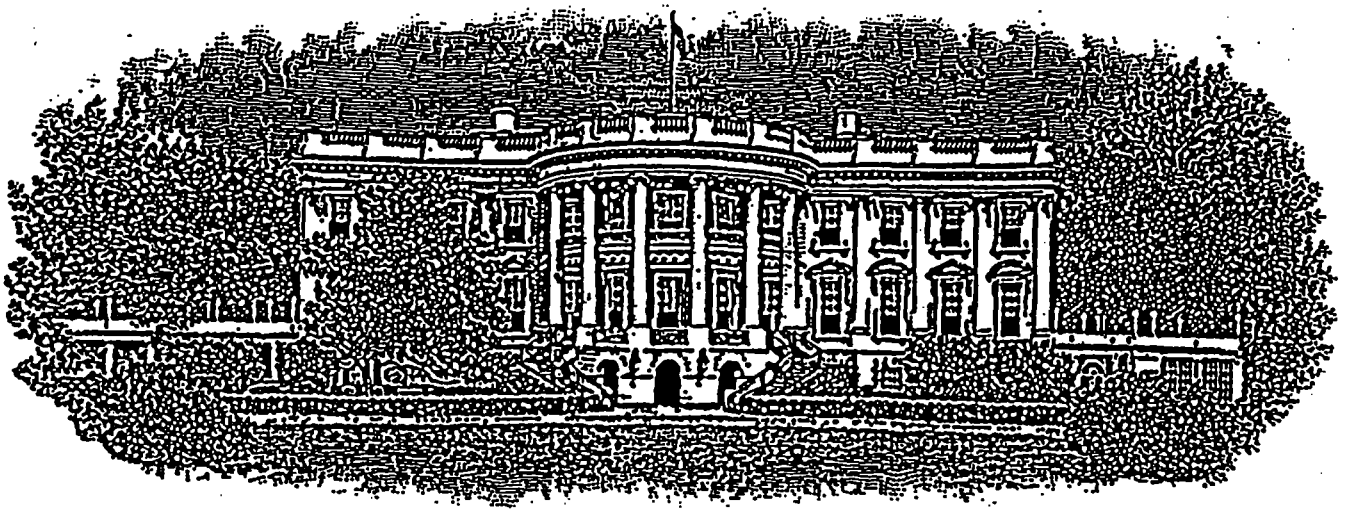
The White House



Domestic Policy Council
Old Executive Office Building, Room 220
Washington, DC 20502

Telephone Number: (202) 456–2857 **FAX Number: (202) 456–7028**
Alternate: (202) 456–2216 **Alternate FAX: (202) 456–7431**

FAX COVER SHEET

TO: Judy Wurtzel

FAX: 401 - 9027

FROM: **BILL KINCAID**

THIS FAX INCLUDES THE COVER SHEET PLUS many **PAGES.**

IF YOU DID NOT RECEIVE THE COMPLETE FAX, PLEASE CALL (202) 456–2857.

MESSAGE:

Judy - Here are comments on the draft strategy (including appendices) I will also run the major ones by Cohen in the a.m. My biggest comments have to do w/ the rationale/text - the appendix, dates, etc - but I also suggest some changes for tone or clarity, and caught some typos, too. The most significant comments are starred. I wanted you to have in hand before you called Judy in the a.m. Let's talk tomorrow.

Thanks

Changes to Appendix 2 on the Voluntary National Tests

Replacement A:

The voluntary national tests for 4th grade reading and 8th grade math will help give parents and teachers this information. These tests will be field tested in the spring of 1999 and administered in the spring of 2000.

Replacement B:

The National Assessment Governing Board (NAGB), an independent bipartisan board, has been authorized to make policy for and oversee the voluntary national tests as it currently does for NAEP.

Insert C:

In addition, when parents, teachers and students receive test results, they will also learn which questions the student got right and which ones were incorrect.

Insert D:

As part of this effort, every year the entire test (along with answers, scoring guides, and other materials) will be released to the public and available on the Internet so that students, parents, and teachers can know what is expected for students to reach standards of excellence.

National Tech

DRAFT

NOV 24 1997

The President
The White House
Washington, DC 20500

Dear Mr. President:

We are pleased to transmit the report of the Department of Education-National Science Foundation joint working group on mathematics and science education.

In a March 6 Presidential Directive, you asked us to convene a working group to develop an "action strategy" for using Federal resources to assist State and local school systems to prepare students to meet challenging mathematics standards in the eighth grade and for involving the mathematics, science, and technical communities in those efforts. You asked that the action strategy include recommendations for using Federal resources to help States, local educational agencies, and schools to improve teaching, upgrade curriculum, and integrate technology and high-quality instructional materials into the classroom, and to motivate students and help them understand how mathematics concepts are applied in the real world. You asked the working group to review the current status of improvements in mathematics education and to identify and address critical areas of need, drawing on research and input from educators and professional organizations. Finally, you asked us to explore how Federal resources and partnerships with other organizations can help improve student achievement in mathematics and science.

We believe that the enclosed action strategy meets those objectives in all respects. Consistent with your Directive, and with the results of the Third International Mathematics and Science Study (TIMSS), the strategy focuses most prominently on the improvement of middle-school (grade 5-8) mathematics, but also addresses broader needs in all of elementary and secondary mathematics and science education. More specifically, the strategy proposes a new Federal effort focusing on middle school mathematics, with an extension to other areas of mathematics and science in future years.

Also consistent with your Directive, the strategy focuses on three principal areas where Federal investments can achieve maximum leverage and impact: upgrading teaching, improving curriculum and instructional materials, and building public awareness and engagement. In each of these areas, the strategy seeks to maximize the potential benefits obtainable through the programs of our two agencies, that is, the competitive grant programs administered by NSF and the formula and competitive grant programs of ED. It also acknowledges the potential contributions of other Federal agencies to this effort.

The joint working group identified many areas where we can make progress with existing resources and programs. In fact, the Department and the Foundation have now committed to launching, in fiscal year 1998, a new set of planning grants for local reform and improvement of middle-school mathematics instruction. These grants will, in particular, help middle schools that enroll large concentrations of children from low-income families to use all relevant Federal, State, and local resources in a way that produces meaningful gains in mathematics achievement. In addition, our agencies have committed to launching a new public information and engagement campaign during the current fiscal year.

While we will initiate these efforts this year, the potential for bringing about significant improvements in the mathematics education of the Nation's 13.5 million middle school students, and in elementary and secondary mathematics and science education more broadly, will depend on the level of resources the Federal Government commits to this effort. In order to benefit a significant number of schools, teachers, and students in the coming years, we have included additional funds for activities linked to the action strategy in our respective fiscal year 1999 budget requests to the Office of Management and Budget. ~~Without these increases, the impact of our efforts will necessarily be limited; on the other hand, the additional funding, if we can obtain it, should have a synergistic impact because our new activities~~ should result in more effective use of the more than $8.4 billion that the Federal Government now makes available to schools for mathematics and science education and for broader purposes.

Thank you for providing the stimulus that has resulted in a closer working relationship between our agencies and in the new activities set forth in the action strategy. We are prepared to do whatever it takes to bring the ideas in the strategy to fruition.

Yours sincerely,

, as we build toward the initial administration of the voluntary national tests in the spring of 2000, *

AN ACTION STRATEGY FOR IMPROVING ACHIEVEMENT IN MATHEMATICS AND SCIENCE

EXECUTIVE SUMMARY

On March 6, 1997, the President issued a memorandum (Appendix 1) directing the Secretary of Education and the Director of the National Science Foundation to form an interagency working group to develop an action strategy for using Federal resources to assist States and local school systems in preparing students to meet challenging mathematics standards in the eighth grade, and for involving the mathematical, scientific, and technical communities in support of those efforts.

The Presidential directive specified that the action strategy include recommendations for the use of Federal resources to help States, local school districts, and schools improve teaching, upgrade curriculum, integrate technology and high-quality instructional materials into the classroom, and motivate students to help them understand how mathematical concepts are applied in today's global workplace. The directive called for the interagency group to review the status of improvements in mathematics education and identify critical needs, drawing on research and input from educators and professional organizations. In addition, it called for the working group to review how Federal resources and partnerships with other organizations can help improve student achievement in science.

The request was based, in part, on results of the Third International Science and Mathematics Study (TIMSS), which demonstrated a clear need to focus on improving mathematics achievement in grades 5-8. The President's proposed voluntary national test in mathematics at grade 8 provided an additional stimulus. The action strategy targets mathematics in grades 5-8, building on a strong foundation of activity underway across the country to improve elementary and secondary mathematics and science education.

The action strategy:

- Challenges the Department of Education and the National Science Foundation to work together more closely and to partner with other Federal agencies and with State and local educational agencies to strengthen the impact of Federal investments in mathematics and science education.
- Challenges State and local-level school superintendents, mathematics supervisors, school boards, principals, and other educators to take a fresh, critical look at curricula, instructional materials, and professional development strategies (and the use of Federal resources in these areas) in light of TIMSS and other recent research results and to be prepared, as needed, to reformulate current approaches so as to improve effectiveness.
- Challenges the Nation's colleges and universities to develop rigorous new programs for teacher preparation, stressing both subject matter expertise and pedagogical mastery. These institutions will also need to take a far more active role in enhancing the skills and knowledge of today's teachers, working closely with States, local school districts, and schools in the process.

- Challenges professional organizations in mathematics, science, engineering, and technology to join with schools, parents, students, community organizations, and business and industry in developing a strong network of local partnerships aimed at raising student achievement.
- Challenges U.S. families to provide strong support and encouragement for their children to reach high standards of achievement in mathematics and science.

Based on the Federal role in improving achievement in K-12 education, the priorities of the action strategy focus Federal investment on:

- Assisting States, local school districts, and the Nation's colleges and universities to provide the skills and knowledge that equip teachers in grades 5-8 to teach challenging mathematics content in effective ways, with high expectations for their students;
- Assisting States and local school districts to select and implement high-quality, standards-based curricula and instructional materials, including making effective use of educational technologies; and
- Building public understanding of challenging mathematics in grades 5-8, and gaining public support for raising student achievement toward high standards.

The bulk of the Federal resources for improvement in K-12 mathematics and science education flows from the programs of the Department of Education and the National Science Foundation. A coherent approach to strengthening the impact of Federal resources used to improve mathematics achievement in grades 5-8 must begin with these programs. Drawing on the resources of other Federal agencies in an effective manner can then follow.

The Department of Education and the National Science Foundation plan a set of joint activities that are the synergy-producing elements of the action strategy. These activities include:

- Competitive planning grants to accelerate the strategic use of resources in improving achievement in mathematics;
- A National Convocation on middle school mathematics that will initiate an on-going dialogue among all stakeholders;
- The Public Understanding and Engagement ~~Mathematics~~ Initiative, a mechanism to involve the public more directly in mathematics education;
- Coordinated research and informational activities; and
- Systematic involvement of other agencies.

Other elements of the action strategy draw on the individual strengths of Federal agency programs aimed at improving mathematics education.

The time is ripe for a concerted effort to improve the achievement of U.S. students in mathematics and science. By focusing our immediate attention on improving performance for middle school mathematics, we will be able to give local, State, and Federal educational agencies a target for action that is substantive, timely, and sufficiently targeted that it is reasonable to anticipate progress. As our effort to address this area of greatest concern gets underway, we can develop models for future action across disciplines and grades.

But the action strategy must be only the beginning of the effort. The interagency cooperation must continue and move to the substantive agenda of implementation. The Department of Education and the National Science Foundation are committed to meeting the challenge of continuing cooperation so that their programs work in concert. The two agencies will develop appropriate mechanisms to ~~keep~~ other agencies and the professional scientists, mathematicians and engineers with whom they work actively involved in improving achievement in mathematics and science education. ~~Perhaps most importantly, they will~~ keep the goal of raising the achievement of all American students in mathematics and science at the forefront of their attention.

assist to be and effectively

Ultimately, all partners in this effort must

→ Some language on p. 19 ←

AN ACTION STRATEGY FOR IMPROVING ACHIEVEMENT IN MATHEMATICS AND SCIENCE

I. INTRODUCTION

On March 6, 1997, the President issued a memorandum (Appendix 1) directing the Secretary of Education and the Director of the National Science Foundation to form an interagency working group to develop an action strategy for using Federal resources to assist States and local school systems in preparing students to meet challenging mathematics standards in the eighth grade, and for involving the mathematical, scientific, and technical communities in support of those efforts.

The Presidential Directive

The Presidential directive specified that the action strategy include recommendations for the use of Federal resources to help States, local school districts, and schools improve teaching, upgrade curriculum, integrate technology and high-quality instructional materials into the classroom, and motivate students to help them understand how mathematical concepts are applied in today's global workplace. The directive called for the interagency group to review the status of improvements in mathematics education and identify critical needs, drawing on research and input from educators and professional organizations. In addition, it called for the working group to review how Federal resources and partnerships with other organizations can help improve student achievement in science.

The Need for Action

The Third International Mathematics and Science Study

The need for this effort to improve mathematics and science education in eighth grade was made clear by the Third International Mathematics and Science Study (TIMSS). Results of tests administered in 1995 to students in grades 4 and 8 are now available. The fourth grade results show U.S. students above the international average in both

The Third International Mathematics and Science Study (TIMSS)

TIMSS is the largest and most ambitious of a series of international comparative studies of educational achievement. The Department of Education and the National Science Foundation sponsored the U.S. testing, conducted in 1995 at grades 4, 8, and 12, and the subsequent analysis.

TIMSS involved more than half a million students in 45 countries. 30,000 U.S. students took part. While the relative performance of U.S. students in comparison to students of other countries improved over performance on similar international comparisons of earlier years, there were signs ~~of problems~~ particularly at grade 8. U.S. students performed above average at grade 4 and below average at grade 8 in mathematics, the only country with such a pattern in either science or mathematics. Grade 12 results will be announced shortly.

While collecting achievement data in each participating country, TIMSS researchers also developed a wealth of information about teachers and teaching, about curricula and instructional materials, about classroom lessons and interactions, and about student attitudes and habits outside the classroom. For example, TIMSS results show that

- US student performance increases more slowly between elementary and middle school years than in most other countries;
- The U.S. curriculum is not as well focused on topics that would propel students toward more advanced levels of understanding as are curricula in other countries;
- U.S. teachers work longer hours, have less time during the day for preparing classes, and experience more disruption in their classrooms than do their counterparts in other countries.

~~Thus,~~ the TIMSS results have become a source of constructive motivation for mounting an action strategy, taking the issue well beyond the simple comparison of scores in international test taking.

science and mathematics. In science, U.S. students were outperformed only by those in Korea. However, the eighth grade results show lackluster performance by U.S. students, with scores only a bit above the international average in science, and below the international average in mathematics.

TIMSS results for the fourth grade are much more positive than the results of similar international comparisons in the past. They demonstrate that it is possible to make significant progress in international comparisons over time, and that U.S. students can compete favorably with those of other nations in mathematics and science achievement. Our National Education Goals proclaim our dedication to making U.S. students first in the world in mathematics and science achievement by the year 2000. In the early grades, we are making demonstrable progress toward that goal. These results clearly indicate that mathematics and science education in the middle school years should be an important focus for national efforts to help ensure that our students meet world-class standards.

Opportunities for the Future

Eighth grade is a critical point in mathematics education. Achievement at that stage lays the foundation for students to take the advanced high school mathematics and science courses that are keys to college entrance and well-paid jobs. Today, too many students enter high school without this solid grounding in mathematics and, unfortunately, they never gain it, closing doors to opportunities for the future. Often students and their families do not even know that the doors are closing, leading to a mismatch between their expectations for the future and their actions in the present. This is particularly true for students from disadvantaged backgrounds. It is a factor in perpetuating inequities both in participation in advanced education and in lifetime income.

A Voluntary National Test in Mathematics

The President has proposed a voluntary national test in mathematics, to be taken near the end of eighth grade, as a very visible part of an ambitious, sustained drive for higher, more challenging standards of learning for all students. The test will be based on the framework of the National Assessment of Educational Progress (NAEP). It will be available by the spring of ~~1999~~ 2000. Parents and teachers will receive an individual score for each student who takes the test. That score will be linked to national and international benchmarks, in order to provide additional context for parents, teachers and students. For more information, see Appendix 2.

The voluntary national test is only one element of the comprehensive effort needed to accomplish the objective of having all students achieve challenging national standards for performance. This effort will require many individuals -- students, parents, teachers, and community leaders -- working in concert with a common understanding of what they want to see happen. The test, in combination with a national effort to boost achievement, will provide a powerful lever to amplify the effects of existing efforts at local, State, and national levels to improve student achievement in mathematics and science.

Plan of Action: Place Immediate Focus on Mathematics

The TIMSS results show the need for an immediate focus on mathematics education in grades 5-8, where the serious drop from above to below international norms threatens achievement in both mathematics and science at higher grade levels. The President's proposed national voluntary test in mathematics in eighth grade provides a tool to measure progress and also challenges us to provide students with the mathematics in grades 5-8 that will enable them to perform well ~~on it~~. The National Council of Teachers of Mathematics (NCTM) has developed sets of standards for content, teaching, and assessment that provide a strong footing for standards-based instruction.

The action strategy targets grades 5-8, building on a strong foundation of activity underway across the country to improve elementary and secondary mathematics and science education. It ~~requires~~ anticipates that these

activities continue, at all levels in both mathematics and science, and lays the groundwork ~~in both substance and process~~ for expanded activities in the future.

Raising Achievement for Disadvantaged Students

Efforts to raise student achievement in mathematics and science must be particularly intensive in high-poverty communities and schools. The National Assessment of Educational Progress (NAEP) in mathematics shows that students from poor families perform significantly less well than other students. In 1996, the average score on the 500 point NAEP scale was 252 for 8th graders who are eligible for free and reduced price lunch as compared to 280 for ineligible students. Students from poor families are also less likely to take algebra, geometry, and more advanced courses in high school.

On July 25, 1997, fifteen urban school districts, including the nation's three largest, pledged to participate in the voluntary national test. They sent a clear signal that students in inner city schools can and should be held to the same challenging standards that are being set for all students throughout the nation. These communities recognize that setting high standards is a prerequisite for improved teaching and learning. Research and experience shows that virtually all students can meet high standards, and that low expectations lead to low achievement.

Challenges for All Parties

The goal of the action strategy is for all American students to leave eighth grade prepared to pursue the higher-level mathematics and science courses that are the gateway to college, productive employment, lifelong learning, and effective citizenship. Reaching this goal will require action in five areas:

- High expectations, held by teachers, school administrators, parents, and students themselves, for student performance in mathematics and science;
- Challenging standards for content of curriculum, teaching, assessment, and student achievement;
- Instructional materials and technology of high quality that incorporate these challenging standards;
- Teachers with the pedagogical skills and rigorous knowledge of mathematics and science needed to teach these subjects effectively; and
- Activities outside the classroom that reinforce the classroom experience by drawing on the support of parents, the professional communities of mathematicians, scientists, and engineers, business leaders, and the broader public.

Thus, the action strategy:

- Challenges the Department of Education and the National Science Foundation to work together more closely and to partner with other Federal agencies and with State and local educational agencies to strengthen the impact of Federal investments in mathematics and science education.
- Challenges State and local level school superintendents, mathematics supervisors, school boards, principals and other educators to take a fresh, critical look at curricula, instructional materials, and professional development strategies (and the use of Federal resources in these areas) in light of TIMSS and other recent research results and to be prepared, as needed, to reformulate current approaches to improve effectiveness.
- Challenges the nation's colleges and universities to develop rigorous new programs for teacher preparation, stressing both subject matter expertise and pedagogical mastery. These institutions will also need to take a far more active role in enhancing the skills and knowledge of today's teachers, working closely with States, local school districts, and schools in the process.

- Challenges professional organizations in mathematics, science, engineering and technology to partner with schools, parents, students, community organizations, and business and industry in developing a strong network of local partnerships aimed at raising student achievement.
- Challenges U.S. families to provide strong support and encouragement for their children to reach high standards of achievement in mathematics and science.

These challenges are focused on the immediate, urgent need to improve mathematics education in grades 5-8. But to be fully effective, this effort must broaden to include both mathematics and science in all grades once the immediate needs have been addressed.

II. PRIORITIES FOR ACTION

Consistent with the President's directive, this action strategy identifies steps that Federal agencies, along with their partners, can take to help students reach challenging standards in mathematics in grades 5-8 and to ensure that Federal resources will effectively support State and local reforms. It is based on the efforts of the interagency working group, which reviewed the current state of mathematics education, consulted with other Federal agencies and with outside organizations, and reviewed Federal programs before identifying three priority areas for action. (See Appendices 3-6 for more detailed information.)

The Federal Role

While education is a national priority, it is primarily a State and local responsibility. The Federal role is to provide good information, effective tools, and financial support that will assist States and local communities in ensuring that all of their students have the mathematical skills they need to succeed in the workplace as productive citizens. This includes promoting effective partnerships that mobilize support from the community -- students, parents, educators, business leaders, volunteers, and concerned citizens from all walks of life -- to that end.

Priorities for Action

Therefore, the priorities of this action strategy will focus Federal investment on:

- Assisting States, local school districts, and the nation's colleges and universities to provide the skills and knowledge that **equip teachers in grades 5-8 to teach challenging mathematics** content in effective ways, with high expectations for their students;
- Assisting States and local school districts to **select and implement high-quality, standards-based curricula and instructional materials,** including effective use of educational technologies; and
- **Building public understanding** of challenging mathematics in grades 5-8, and **gaining public support** for raising student achievement toward high standards.

Scope and Scale

In grades 5-8 there are approximately 13.5 million students taught by about 320,000 teachers of mathematics. These students and teachers are distributed among 34,000 schools in close to 15,000 districts. Many of these schools and districts are already actively involved in setting high standards for instruction and student achievement and are implementing plans to achieve them.

The core of this action strategy is assisting all schools and districts to make more effective use of Federal resources in their efforts to address ~~these~~ the above priorities with respect to mathematics in grades 5-8. The Department of Education and the National Science Foundation ~~will~~ plan to provide opportunities for districts to accelerate their progress toward improved achievement in this area through incentives for enhanced coordination, planning, and implementation. Districts that

serve large numbers of disadvantaged students will receive particular attention. The number of districts, schools, teachers, and students served will depend largely on the level of resources that can be devoted to the acceleration effort and the readiness of districts to respond.

At the same time, an effort at public information and engagement provides a much-needed ~~alternative~~ mechanism to reach a broader base of students and their parents ~~in a more timely fashion than can be accomplished through these core activities.~~ The participating Federal agencies, with their ties into the science, mathematics, engineering, and technology communities, are well-positioned to encourage these communities to cooperate in spurring such an effort.

Finally, it is not enough to address only today's teachers and implementation of instructional materials and technologies available now. Approximately 30,000 new teachers of mathematics in grades 5-8 are needed each year. At the same time, development of learning technologies is extremely rapid, and adaptation of curricula to accommodate this pace is a continuing concern. Addressing these issues is also an important part of the action strategy.

Progress in any one of the three priority areas -- teachers, instructional materials and technology, and public information and engagement -- will often depend on and demand improvement in others. For instance, the introduction of high-quality instructional materials will have little impact if teachers are not trained to use those materials effectively. The action plan must work on all fronts in order to make progress toward improved student achievement. The action plan below first provides an orientation to existing resources and specific new joint activities. The final sections are organized around the three priority areas.

III. ACTIONS TO STRENGTHEN THE IMPACT OF FEDERAL RESOURCES

The bulk of the Federal resources for improvement in K-12 mathematics and science education flows from the programs of the Department of Education and the National Science Foundation. (See Appendix 3 for a summary.) Developing a coherent approach to strengthening the impact of Federal resources used to improve mathematics achievement in grades 5-8 begins with these programs. Drawing on the resources of other Federal agencies in an effective manner can then follow.

Current Federal Resources

In FY 1997, the National Science Foundation invested $377 million in K-12 science and mathematics education, including investments in the undergraduate preparation of teachers. The funds go largely to colleges and universities, State and local educational agencies, and nonprofit organizations. They are awarded through competitive review of proposals for funding of specific projects. Over the past few years, the Foundation has placed a high priority on system-wide reform of mathematics and science education. It asks local and State educational agencies to align resources of all types, including those obtained through other Federal programs, to effect change. The Foundation highlights specific areas of emphasis within broader programming, establishes clear priorities for funding within the criteria for selection of awards, and holds grantees accountable for performance. Over the years, projects aimed specifically at mathematics in grades 5-8 have been comparatively scarce.

The Department of Education allocated approximately $8 billion in FY 1997 through three major formula-driven programs (Goals 2000; Eisenhower Professional Development State Grants; and Title I: Education for the Disadvantaged) that include improved achievement in mathematics and science among their objectives. Goals 2000 aids States and school districts to develop and implement challenging academic standards and upgrade teaching and learning in order to

reach the National Education Goals, including the goal of becoming first in the world in mathematics and science. The Eisenhower program places an explicit focus on science and mathematics. Of the $310 million appropriated for FY 1997, $250 million was required to go to mathematics and science.

The 1994 reauthorization of Title I placed new emphasis on helping disadvantaged students meet the same challenging academic standards expected of all children. States are currently developing standards ~~and standards~~ and assessments in reading and mathematics consistent with that emphasis. The Department of Education works actively with States and school districts on identifying actions that can be taken to achieve significant improvement ~~change~~, provides information and examples, and makes technical assistance available as needed.

Title I Schoolwide Programs

The 1994 reauthorization of Title I gave the program an entirely new purpose, namely, to teach disadvantaged students to the same high standards to which all other students are held. States are now in the process of establishing assessment mechanisms to measure students' progress against such standards, in at least reading and mathematics. In addition, the reauthorization lowered the eligibility threshold for Title I schoolwide programs. Schools with at least a 50 percent child poverty rate may now use their Title I funds (along with other Federal, State, and local funds) to make comprehensive improvements in the instructional program of the entire school, rather than providing discrete services to individual children. This change gives those schools the flexibility, for instance, to use Title I funds to upgrade the mathematics curriculum for all students.

A dozen other departments and agencies sponsor activities that relate to, and could promote, standards-based education that improves students' mathematics and science learning and overall academic performance. In general, these agencies focus far more on science than mathematics, and commit modest resources to improving K-12 education. Most offer staff and facilities, often on a volunteer basis, to support local schools and teachers. And all have developed and are sharing supplementary instructional materials on their Web sites.

Mathematics Education and the Department of Defense

Two agencies within the Department of Defense (DoD) offer complementary approaches to introducing rigorous national standards in their educational activities.

The DoD Education Activity (DoDEA) provides education for military and civilian dependents overseas (DoD Dependents Schools or DoDDS) and on some military bases in the U.S. (DoD Domestic Elementary and Secondary Schools or DDESS). DoDDS is essentially an autonomous school system that has developed a mathematics curriculum based on the NCTM standards, adopted standards-based instructional materials for use throughout all the overseas schools, and is continually training teachers in these materials and strategies using teacher-leaders. DDESS schools operate independently and cooperate with local education areas in addressing standards. ~~As the~~ DoDEA ~~structure solidifies, there will be~~ is working toward system-wide commonality in curriculum, instructional materials, and student assessment aligned with the NCTM standards.

The National Security Agency established a Mathematics Education Partnership Program (MEPP) in 1991. MEPP sponsors over a thousand talks per year to schools and colleges through its Speakers Bureau. It donates excess computers to classrooms, sponsors seminars and inservice teacher training, and conducts extended summer workshops for teachers at all levels. These MEPP activities, including projects such as collaboration with the University Corporation for Atmospheric Research's *Project SkyMath*, are all informed by the NCTM Standards, which are an explicit subject of study and reference at MEPP's Summer Institutes for Teachers. For a description, see www.nsa.gov.8080/programs/mepp.

Strengthening the Impact of Federal Resources

Using Existing Programs

The first step in moving forward is to make the most of existing programs aimed at improving student achievement through standards-based education across all subject areas and all grade levels. Such programs provide a fundamental level of information and opportunity important for progress, but currently have limited focus on mathematics in grades 5-8.

Within those existing programs, the participating agencies will promote means of emphasizing mathematics in grades 5-8. For example, the competitive programs at the National Science Foundation can incorporate priorities for work in this area in selection criteria, and the Department of Education can enhance the level of technical assistance it provides to State and local educational agencies. Expanding the scale of such existing programs will also help, as will the development of new ~~programs~~ initiatives in the individual agencies, but issues of scope and synergy remain.

Creating Synergy

The programs of the Department of Education and the National Science Foundation have different approaches and strengths. The Department generally provides large-scale, flexible support directly to State and/or local educational agencies for improving teaching and learning to high standards, coupling this support with technical assistance. NSF's portfolio is much smaller in scale, is targeted at improving mathematics, science, and technology education, and is established through competitive processes. To create synergy, this action strategy combines the agencies' strengths, permitting those involved with upgrading mathematics professional development and instruction through major Department of Education programs to draw on NSF's competitive programs to step up the pace of change.

The work of improving student achievement must be done at the State and local level, and, most fundamentally, within individual schools. State and local educational agencies can maximize the impact of Federal resources by choosing to use them in a coordinated, concentrated way. Thus, the National Science Foundation and the Department of Education will champion State and local educational agencies in the strategic use of all types of Federal, State and local funds toward improving mathematics achievement, offer examples of effective coordination in the use of such funds, and provide incentives to initiate effective improvements. At the same time, they will work together to encourage the nation's colleges and universities to do a better job in educating future teachers for the work they will do in the schools and will combine with other agencies in a broad program of public information and engagement.

Pooling Resources to Enhance Student Achievement

Kenton Elementary School in Portland Oregon, and 12 other schools in the region decided to place a high priority on student achievement using Title I and other resources. During the 1995-96 school year, the schools held full-day, weekly workshops on best teaching practices as identified by the school principals. The principals developed a regional Title I plan and, with the help of consultants, have all staff working together to implement it. Title I staff worked with regular classroom teachers on new strategies, and Kenton staff agreed to use Title I benchmarks and assessments for all students.

Kenton's curriculum emphasizes interactive writing and vocabulary development, and uses innovative mathematics materials. Teachers use cooperative learning and peer tutoring to help students grow toward proficient and advanced levels, and students are encouraged to analyze, evaluate, and interpret information. Kenton teachers regularly meet with small groups of students outside of class to give extra help in mathematics, reading, or writing. Teachers also train the school's many volunteers to support the benchmarks while working with students. Assessments indicate some success in the early years of this effort to improve instruction. The percentage of third-graders scoring in the advanced category in mathematics increased from 15 percent to 35 percent.

New Joint Activities

The Department of Education and the National Science Foundation plan a set of joint activities that are the synergy-producing elements of the action strategy. They will include the other participating agencies to the extent possible.

- **Competitive planning grants to accelerate strategic use of resources in improving achievement in mathematics.**

  The Department and the Foundation jointly will provide competitive planning grants to jump-start intensive, coherent efforts to upgrade mathematics instruction that use Federal, State, and local funds to sustain long-term improvements and provide models for the future. Funds may be used to initiate planning and to contribute toward one-time costs of initiating a coherent set of activities. A principal target for the agencies' cooperative activities will be middle schools with schoolwide Title I programs and districts with many such schools. This focus permits large numbers of disadvantaged students to benefit from the enhanced synergy of Department and Foundation programs.

  To support the joint effort, the Department of Education will provide active encouragement and support, opportunities to pool resources originating in the Department through waivers for consolidated programming, and information and technical assistance, as appropriate. The National Science Foundation will emphasize support for development and implementation of State and local strategies for improving mathematics education in grades 5-8.

  The Department and NSF will convene a national conference of key actors in determining how Federal resources are used by States and local districts. Participants will include state and local leaders of Title I, Goals 2000, Eisenhower, and State, urban and rural systemic initiative activities.

Texas Statewide Systemic Initiative

The NSF-supported Texas Statewide Systemic Initiative (SSI) also operates the U.S. Department of Education's Comprehensive Assistance Center for Elementary and Secondary Act Programs in Texas, bringing into one unit the state's leadership both in science and mathematics education and in Title I technical assistance. In the past two years, the SSI has provided incentive grants and technical support in integrating ~~their~~ Title I, Eisenhower, and professional development activities in mathematics and science to more than 100 Title I schools serving more than 100,000 Title I students. In July, 1995, the SSI held an intensive summer institute designed to support Title I schools in (1) reconceptualizing the use of formula funds, (2) adopting standards-compatible mathematics curricula, and (3) adopting effective schoolwide program models. As a result of the SSI/Title I collaboration, state mathematics and science leaders are now active members of school support teams engaged in mentoring over 700 Texas Title I schools. At the same time, increasing numbers of teachers in high poverty/high minority schools are being trained as SSI mathematics, science, and technology specialists.

- **National Convocation on middle school mathematics.**

  The two agencies will sponsor a national convocation on middle school mathematics to initiate a continuing dialogue on what students need to know and what this means for effective classroom practice.

- **Public Understanding and Engagement Mathematics Initiative.**

  NSF and the Department will support a joint, multi-year effort to create a large-scale, national public education effort that is coupled with extensive opportunities for active engagement of students, parents, and the larger community in the support of mathematics education.

- **Coordinated research and informational activities.**

  The Department and NSF will undertake a coordinated set of research and informational activities around mathematics in grades 5-8. These activities include release of a TIMSS resource kit that contains specific tools for professional development, curriculum analysis, and achievement benchmarking; readministering TIMSS in the spring of 1999 to get updated information on our international standing; a program of research informing continued development of the eighth grade national test over time; and a sustained agenda of basic research in teaching and learning of mathematics, including research on the use of learning technologies.

- **Systematic involvement of other agencies.**

  The Department and the Foundation will work systematically with other agencies to enhance the impact of Federal resources by upgrading their activities to reinforce a standards-based approach for mathematics in grades 5-8.

Each of the specific items above will be aimed at mathematics in grades 5-8, reflecting the urgent need to raise achievement at this stage of the educational process. However, the activities described above can also serve as models for more effective approaches to educational change in the broader arena of mathematics and science education. The working group strongly endorses the idea of future efforts that would encompass additional aspects of K-12 mathematics and science education.

PRIME in Pittsburgh

The Pittsburgh Reform in Mathematics Education (PRIME) project supports teachers in the classroom implementation of standards-based mathematics instruction and assessment in grades K-12 through the use of exemplary materials. PRIME provides teachers with a broad knowledge base in both the mathematics content and the successful mathematics pedagogy needed to implement the new materials successfully.

Funded under National Science Foundation guidelines as a project of *Local Systemic Change through Teacher Enhancement in Mathematics*, PRIME provides all 924 Pittsburgh public school teachers of mathematics with a range of experiences that include summer workshops; release-day professional development workshops; and individualized, in-class support provided by demonstration teachers within each school. Teachers of grades 6-12 receive 234 hours of professional development, and teachers of grades K-5 receive 102-132 hours. By equipping *all* Pittsburgh mathematics teachers with the knowledge, skills, and support necessary for using exemplary materials and assessment, PRIME is designed to ensure that *all* students experience a coherent mathematics program that is expected to yield high achievement at *all* levels.

This four-year project, funded for over $ 3 million, is a model for its ability to leverage an additional $ 6.7 million in cost-sharing from district funds and commitments from Eisenhower and other Federal dollars.

IV. EQUIP TEACHERS TO TEACH CHALLENGING MATHEMATICS

In grades 5-8, students should begin to move from mastering the basics of arithmetic to using arithmetic in complex problems and learning the foundations of geometry, algebra, probability, and statistics. Teachers must know substantial mathematics and have strong pedagogical skills if they are to be effective in helping their students make this transition and meet high standards. Practices in teacher education, licensure and certification, and in-service teacher enhancement do not always reflect these needs.

Over the next ten years, approximately 2 million new teachers will enter the workforce. It is essential that these future teachers receive adequate preparation in mathematics content and pedagogy and in the use of contemporary technological tools before they enter the classroom. And many of the approximately 320,000 teachers who are already teaching mathematics in grades 5-8 would benefit from upgrading their math content knowledge and teaching skills.

Quantitative Literacy Program for Alabama K-12 Teachers

The Quantitative Literacy Program for Alabama K-12 Teachers, a project administered by the University of Alabama and supported by the Eisenhower Professional Development program, assists elementary and secondary teachers in implementing the probability and statistics goals for grades K-12 as outlined in the National Council of Teachers of Mathematics standards. The program's workshops teach quantitative concepts in the context of solving meaningful problems, with content taught in reference to teaching strategies that participants use when they return to their classrooms. The program includes a pre-workshop orientation, an intensive one-week training workshop, and two follow-up sessions. In the follow-up sessions, teachers describe how they planned, taught, and assessed their own Quantitative Literacy units. They also present examples of their students' projects. The project is currently operating in 14 of the 67 counties of the State.

This action strategy addresses both the professional development of teachers who are already in the classroom and the preparation of new teachers. In order to assist current teachers, the strategy promotes sustained and intensive professional development activities that are based on mastery of mathematical content and tied to high-quality instructional materials and technology. Teacher preparation activities will aim at preparing future teachers of grades 5-8 to teach effectively the challenging mathematics content geared to national standards of excellence.

The increased demand for high-quality professional development generated by these plans could, without action now, exceed the capacity of those individuals and organizations currently supplying it. Thus, an essential component of fully equipping teachers will be ensuring the presence of a sufficient cadre of individuals and institutions skilled in providing professional development. This will require working with the mathematics communities, institutions of higher education, and other Federal agencies to help ensure the capacity to respond effectively.

To address **professional development needs of current teachers**, the National Science Foundation and the Department of Education will:

- Stimulate state and local educational agencies to implement comprehensive programs of sustained, intensive, high-quality professional development for teachers of mathematics in grades 5-8. The two agencies will make such efforts the cornerstone of their new competitive planning grants, with emphasis on incorporating resources from Title I schoolwide programs and on involving all teachers in target schools. They will continue existing programs that provide resources for districts to implement professional development programs, incorporating priorities for activities involving teachers of mathematics in grades 5-8, where feasible.

- Initiate a short-term effort to strengthen the pool of talented, committed individuals able to provide exemplary professional development for classroom teachers. The agencies will provide opportunities for competitive support of projects that will provide intensive training experiences for those who will lead future teacher training efforts.

- Support the creation of materials for professional development of teachers of mathematics in grades 5-8 that are grounded in the NCTM standards, tied to newly emerging educational materials and technologies, and assist teachers to link mathematics to real-world skills and applications.

- Support wider opportunities for teachers to help one another with content knowledge and teaching skills through such activities as dissemination of information about effective forms of professional development and encouraging the development of master teachers (including those recognized through the Presidential Awards for Excellence in Mathematics and Science Teaching and the National Board for Professional Teaching Standards Certification), mathematics specialists, and teacher networks.

Improving Teaching Through Distance Learning

The Department of Education's Star Schools Program provides quality, cost-effective instruction through distance education technologies to more than 1,640,000 learners annually in 50 states and U.S. territories. Although the program began with small rural schools in 1988, it is now equally valuable to schools in large urban areas.

The *Star Schools: The Next Generation* project of Oklahoma State University and Northern Arizona University delivers the "Getting Ready for Algebra" program, which provides simultaneous student instruction and teacher training to middle school students and teachers. Its units are student-centered and activity-oriented and emphasize learning by discovery. They focus on the big ideas common to arithmetic and algebra.

Similarly, the United Star Distance Learning Consortium project, led by Education Service Center--Region 20 in San Antonio, Texas, offers the *Algebra and Geometry Applications for Teachers* program, inservice training. The project models worthwhile mathematical tasks and helps teachers improve their ability to develop these tasks. The focus of the project is on mathematical topics that illustrate connections to real-life problems and exciting mathematics.

To promote **improved preparation of future mathematics teachers for grades 5-8**, the Department of Education and the National Science Foundation will:

- Prepare and disseminate widely a study on State licensure requirements, focusing particularly on requirements for middle school teachers of mathematics, comparisons to other nations, and the impact of licensure requirements on the knowledge of mathematical concepts that teachers bring to their work in the classroom.

- Provide incentives for appropriate organizations to develop voluntary national standards for the preparation of teachers of mathematics.

- Support the development of materials for preparation of K-8 mathematics teachers that are grounded in the NCTM standards and tied to newly emerging instructional materials and educational technologies.

- Challenge the Nation's colleges and universities to step up to the needs for preparing a new generation of teachers for the 21st century by encouraging, supporting, and funding the development of teacher preparation approaches that:
  - more tightly link college departments of mathematics and schools of education;
  - include courses focusing on developing the background concepts for the rigorous mathematical content that future teachers of mathematics in grades 5-8 will teach;
  - demonstrate effective classroom practices; and
  - involve local K-12 schools in the design of teacher preparation requirements.

New Initiatives in Teacher Preparation

President Clinton has proposed a $350 million initiative to attract talented people of all backgrounds into teaching at low-income schools across the U.S., and to improve dramatically the quality of training and preparation given to our future teachers, with an emphasis on mathematics and reading. Under the initiative, new scholarships would help bring nearly 35,000 outstanding new teachers into high-poverty schools in urban and rural areas over the next five years. These scholarships could cover costs of tuition, room, board, and other teacher preparation expenses -- and could help fund additional preparation during the first two years of teaching.

The initiative will also provide competitive five-year grants to 10-15 national lighthouse models of excellence -- institutions of higher education that operate the highest quality teacher education programs. Each institution receiving a lighthouse grant will use most of these resources to assist several other institutions of higher education improve their teacher preparation programs, helping to strengthen the preparation of future teachers at an estimated 150 institutions of higher education across the nation.

Teacher Preparation in Louisiana

What began as a movement to change the way mathematics is taught in grades K-8 in the Louisiana State Systemic Initiative has grown into a program that addresses the way in which teachers are taught. The NSF-funded Louisiana Collaborative for Excellence in the Preparation of Teachers is producing future teachers who will transform teaching practice in the state.

In the first three years of the program, over 100 college faculty (both mathematics faculty and education faculty) on 15 campuses across the state have been involved in the project, 69 courses for future teachers have been revamped, and approximately 20,000 future teachers have been affected.

The central principle is to incorporate in the education of future teachers the new methods of teaching mathematics that they will be expected to implement in the classroom. Examples of these methods include working in small groups on challenging problems and using technology resources such as calculators or the Internet.

V. IMPLEMENT CURRICULA, INSTRUCTIONAL MATERIALS, AND EDUCATIONAL TECHNOLOGIES IN CLASSROOMS

The TIMSS results showed that the content of curricula and instructional materials used in U.S. classrooms in the middle school years in 1995 differed from those in high performing countries in significant ways. The content taught in most U.S. eighth-grade mathematics classrooms would be found in the seventh grade in high-performing nations. Our low expectations for student performance are also shown by the fact that only about 25 percent of U.S. eighth grade students are enrolled in algebra courses, while in high-performing nations virtually all students have the opportunity to master the foundations of algebra and geometry by the end of eighth grade.

In addition, TIMSS noted that middle school mathematics materials covered more topics and were less focused in the U.S. than in leading countries. For example, typical American eighth grade mathematics textbooks in 1995 covered as many as 35 major topics compared to as few as 10 such topics in Japanese textbooks, leaving little time for teaching for student mastery and depth of understanding.

New, comprehensive mathematics instructional materials, linked with high standards for mathematical content and pedagogy and aligned with the NCTM standards, are now emerging from development and reaching the market. These materials provide a range of different approaches to classroom instruction, while focusing on 15 or fewer topics per year.

Supplementary materials can permit teachers to tailor instruction to particular classrooms, facilitating the transition to new curricula. They can be particularly helpful in taking advantage of new and emerging learning technologies and in providing examples from real life for new concepts.

Selection of comprehensive curricular materials usually takes place at the district or even the State level, whereas the choice of supplementary materials is more likely to be made at the school level. Speeding the transition to more appropriate instructional materials, while tying in professional development for teachers, will have a significant impact on student achievement.

Open *CESAME!*

Northeastern University's Center for the Enhancement of Science and Mathematics Education (CESAME), through its Statewide Implementation Program (SIP), demonstrates how school districts can successfully implement challenging standards-based instructional materials. Through a contractual agreement, the project provides districts in Massachusetts with multi-year funding, technical assistance, professional development guided by curriculum developers, and linkages to statewide reform efforts. SIP also conducts research to determine the most effective model for disseminating such materials. Throughout, SIP works to make districts accountable by collecting data and continually focusing on achieving a sustained, high-quality materials implementation.

Funded by the National Science Foundation's Teacher Enhancement program, SIP provides expertise in implementing high quality materials to any Massachusetts district engaged in mathematics and science reform, and leads one of the five regional centers of the Massachusetts Statewide Systemic Initiative (SSI). This five-year project, funded for over $4.4 million, has leveraged an additional $3.8 million in cost-sharing from district funds, Northeastern University, and the Noyce Foundation.

To assist schools, districts, and States in choosing and implementing effective curricula and instructional materials for mathematics in grades 5-8, the National Science Foundation and the Department of Education will:

- Encourage and support coordinated efforts aimed at:
  - purchasing new instructional materials geared to rigorous standards;
  - providing high quality professional development connected to implementation of new materials; and
  - employment of highly skilled mathematics specialists who are prepared to teach the new materials and guide others in their implementation.

Each of these, for example, would be eligible for use of Title I funds, and could be part of the coordinated plans described in applications for the planning grants discussed above.

- Develop and disseminate guides to help interested schools and school districts select instructional materials and software most appropriate for their local needs and undertake the necessary steps to effective implementation. This effort will include reviews of instructional materials and software designated by experts as promising or exemplary.

- Provide technical assistance for schools and school districts in putting new mathematics instructional materials to work in the classroom. NSF-supported curriculum implementation sites dedicated to mathematics materials for grades 5-8 will work with broader technical assistance providers, including the Department's Eisenhower Regional Consortia and National Clearinghouse, as needed.

- Provide teachers and other educators with information on how they might use assessment in planning instructional improvement strategies. These materials will include information on how best to use results from the voluntary national mathematics test -- to interpret them to students and parents, place them in appropriate context, and improve mathematics instruction.

- Seed research and development of powerful models for integrating technology into classroom practice and informal learning environments. This will include support for critical expansion and evaluation efforts preceding commercialization of these models. K-8 mathematics will be a high priority in the near term.

Eisenhower Regional Consortia for Science and Mathematics Education

The mission of the ten Eisenhower Regional Consortia is to provide a field-based national infrastructure for systemic improvement of science and mathematics education. Projects provide information on curriculum, assessment, and teaching practice; conduct workshops and training; and serve as advisors to the field.

One example of the work of the consortia is the 1996 publication by the WestED consortium of Tales From the Electronic Frontier. This is a collection of ten teachers' narratives regarding their use of the Internet to enhance science and mathematics instruction and create opportunities for their own professional growth. The accounts describe using this resource for project-based learning, for making abstract scientific principles more concrete, and for promoting deeper understanding. Each story provides information on related resources and programs, and concludes with a section of questions and issues to stimulate further thought and discussion.

"Hoop Happenings" is the tale of a mathematics communication project between students at the Drexel Hill School in Philadelphia, Pennsylvania, and senior education majors at Iowa State University. During their teaching methods class for elementary mathematics, each student at Iowa State is paired with a group of students at the elementary school in Philadelphia with whom she interacts (via e-mail) over a math problem she defines each week. The interactive discussion provides the education majors with insight into children's thinking; for the children the project strengthens their abilities to solve problems and to discuss their problem solving approaches.

Tales can be found on WestED's WWW site at http://www.wested.org/tales.

- Continue competitive support for the development of supplementary materials, with new priority for efforts aimed at mathematics in grades 5-8, to assist schools and districts in making the transition to standards-based comprehensive materials.

While several other Federal agencies have long worked to support educational improvement efforts, in the past, few other agencies have contributed to the development of standards-based instructional materials in mathematics and science. This is changing, and there are significant contributions that other agencies can make in this area, consistent with their primary missions. The development of supplementary materials with mission-oriented situations that generate real-life problems and the delivery of such materials through technology are key potential contributions.

- Agencies will work in cooperation with NASA and NCTM to develop standards-based materials along the lines of NASA's "Mission Mathematics." These materials illustrate the use of mathematics in engaging, real world examples related to the agency mission.

- The Department of Education is chairing a Federal Government-wide working group that has already begun to promote and develop -- and make it easier for teachers and others to find -- high-quality educational materials, including instructional units and related materials, for use on the Internet. This group's role is to take the rich informational resources of organizations such as the Census Bureau or the U.S. Geological Survey, and make them easier for teachers and others to find and use. The first priority will be to identify materials that support teaching of challenging mathematics.

- The Departments of Defense and Education and the National Science Foundation are leading an interagency review of Federal activities related to research in learning technologies in order to establish effective practices for their use.

Each of these efforts could make new types of materials and capabilities possible in the future. Activities that enable students to achieve to high standards play an important role in all these Federal activities.

NASA's Mission Mathematics

The recent production of "Mission Mathematics" by NASA demonstrates how an agency can base its educational work on national standards. These three volumes of problems and activities are the descendants of NASA's first mathematics curriculum supplement, "Space Mathematics: A Resource for Teachers," published in 1972. That popular title was updated repeatedly over the years. "Mission Mathematics," however, is totally revamped to accord with national standards. Indeed, the subtitle is now "Linking Aerospace and the NCTM Standards." The three volumes are divided into K-6, 5-8, and 9-12, and the contents of each are keyed not only to NCTM's curriculum standards, but also to those for teaching and for student assessment. Examples of activities include calculating orbits, collecting and analyzing specimens, and planning for spaceflight needs.

This linking to standards was accomplished by making "Mission Mathematics" a joint project of NASA and NCTM. Writing teams included teachers, supervisors, and university professors working in consultation with NASA representatives. Their drafts were field-tested by classroom teachers and reviewed by NCTM's Educational Materials Committee. The results are attractive and modestly priced, with publicity, marketing, and distribution through NCTM's established network.

VI. BUILDING PUBLIC UNDERSTANDING AND SUPPORT.

All American students should leave eighth grade prepared to pursue the higher-level mathematics and science courses that are the gateway to college, good citizenship, productive employment, and lifelong learning. In realizing this vision, it is essential that educators, parents, and students themselves understand what high standards in mathematics look like and why they are important. This outcome requires activities and information that reinforce the classroom experience and convey the importance of mathematics achievement. Such activities should draw on the support of parents, the professional community of mathematicians, scientists, and engineers, business, and the broader public.

This section of the action strategy includes two complementary elements. The first consists of efforts to make high standards fully and clearly understood. If parents and students and teachers don't know where they should be headed -- what they agree students should know and be able to do -- it is hard to pull together to get there. Schools must have a clear sense of what they are doing and be able to communicate effectively with parents as well as work to invite active parental participation.

The second element builds on the first through partnerships that bring together the many groups that can contribute to helping students achieve high standards in mathematics. These partnerships will elevate the importance of mathematics achievement and provide clear avenues through which interested members of the mathematics, science, engineering, business and education communities, as well as parents and interested citizens, can contribute to efforts to raise mathematics achievement.

Saturday Schools Provide Tutoring Boost

The George B. Thomas Sr. Learning Academy Inc. (known as Saturday School), with modest support from the National Science Foundation, has provided free tutoring and mentoring to minority students in Montgomery County (MD) for nearly 11 years. Spearheaded by members of the Mu Nu chapter of the Omega Psi Phi fraternity, the program began in a public housing community's day-care center, but is now located at Sherwood High School (Olney, MD) and Springbrook High School (Silver Spring, MD).

About 180 students and 100 tutors--engineers, mathematicians and others (including high school students fulfilling Maryland's community service graduation requirement)--are registered at the centers; there is often a waiting list of pupils because there aren't enough tutors. Saturday School views itself as a partner with the students' schools; principals refer students to the program and teachers advise tutors on where students need help. Montgomery County Public Schools contributes classrooms, supplies, and training for tutors and parents. The sessions last 2 or more hours; tutors work with students on a wide range of mathematical topics and help students prepare for the Scholastic Assessment Test. Parental participation is required; about one-fifth of the parents tutor, with the remainder providing support and assistance in other ways.

The Department of Education, the National Science Foundation, and other Federal agencies will foster the partnerships by promoting a national dialogue on improving mathematics, acting as a clearinghouse for information and proven approaches to action, helping partners to develop exemplary materials that can be used in their State and local efforts, and mobilizing staff and resources to support local partnership efforts. Effective partnerships must build upon and complement what goes on in the schools. Thus, teachers and school administrators must be vital participants, either formally or informally.

In order to support these strategies, the Department of Education and the National Science Foundation have taken the initial steps to move forward on the ***Public Understanding and Engagement Mathematics Initiative***, an activity designed to create a large-scale, national public education effort that is coupled with extensive opportunities for active engagement of students, parents, and the larger community in the support of mathematics education.

Collectively, the projects selected through this initiative will:

- Use simple and compelling messages to tell the public what middle school students should know and be able to do in mathematics, illustrating the points through sample problems and student work;

- Emphasize important mathematics and interesting problems that engage both middle school students and the public;

- Illustrate the relevance of achievement in challenging mathematics to success in college and a wide range of careers;

- Create well-designed products that will engage the public in doing mathematics;

- Target a variety of media through a plan for disseminating the products;

- Support active partnerships to engage parents and the community, including those with professional organizations, scholarly societies, and the business sector;

- Mobilize adult volunteers to assist students in a variety of settings (for example, summer, after-school, and weekend programs; contests);

- Develop printed and Internet-based supporting materials as guides for volunteers; and

- Encourage highly visible local and national events and activities that engage the community.

In other activities designed to **build public understanding**, the Department and the Foundation will:

- Sponsor a national convocation on middle school mathematics to initiate a continuing dialogue on:

  - what we should expect our students to be able to achieve in mathematics by eighth grade and beyond;
  - exemplary practices in professional development, curricula, instructional materials, and technologies; and
  - opportunities for parental involvement and community support to help students meet high expectations.

- Seed the continuing national dialogue by providing a wide variety of sample items illustrating the level of expectations set in State and national standards, examples of student work, and information on curricula, instructional methods and technologies that support high standards.

- Create an easy-to-use mathematics Web site providing information on national standards; standards-based instructional units for teachers; information on the national test, including sample problems and examples of student solutions; and all the other materials developed or identified as part of this action strategy.

Additional **partnership activities** will take advantage of connections the Department and the Foundation maintain in the course of their on-going work. The agencies will:

- Facilitate the connection of national organizations having interests in helping to raise levels of achievement in mathematics and science (for example, professional societies of mathematicians, scientists, and engineers) with State, local and community-based organizations having similar purposes.

- Develop systematic mechanisms for the headquarters and field offices of relevant Federal agencies to participate in the partnerships.

The Department of Energy's STEM Initiative

DOE plays an important role in science education due especially to its premier national laboratories, which have a history of staff working in cooperation with the Nation's education system and other agencies. By opening DOE's laboratories to students and teachers, agency staff offer hands-on research opportunities and technical support for developing Internet and other technical tools to enhance educational experiences. The Department is in the process of creating a National Energy Laboratory Research Participation Program that will coordinate such activities across all DOE laboratories.

Among the Department's goals for science, technology, engineering and mathematics education, two are particularly relevant to this action strategy:

- Develop Internet based education technologies for elementary through college students and faculty; and
- Enhance DOE's community outreach activities for education at its R&D facilities and sites.

DOE strongly supports the revitalization of educational activities consistent with its energy and defense missions. An effort is underway to coordinate the use of DOE resources in promoting the public's understanding of science and ensuring a diverse workforce for the Nation's science and technology infrastructure.

VII. CONCLUSION

The time is ripe for a concerted effort to improve the achievement of U.S. students in mathematics and science. Recent results from international testing have raised the consciousness of the American public about the importance of establishing and meeting high standards in mathematics and science. As the test results have made clear, too many of our schools are failing to provide the instructional experiences that will enable our students to achieve at the levels we should expect from them.

By focusing our immediate attention on improving performance for middle school mathematics, we will be able to give local, State, and Federal educational agencies a target for action that is substantive, timely, and sufficiently constrained that it is reasonable to anticipate progress. As well as addressing an area of current concern, we can develop models for future action across disciplines and grades.

The interagency cooperation stimulated by the effort to produce this action strategy should have a lasting impact on the effectiveness of Federal programs and activities that support improving achievement in mathematics and science education. In addition to bringing the two agencies with the most extensive programming in this area together, the effort spurred further contact with other potential Federal partners, both those that have a tradition of strong presence in mathematics and science education and those that are new to such efforts.

The effort has been particularly timely in view of the growing interest among mathematicians, scientists and engineers in helping K-12 schools to improve the performance of their students in mathematics and science. The Department of Education, with its links to State and local education agencies and community groups, and the Federal science and technology agencies, with their ties to mathematicians, scientists, and engineers and their national professional organizations, can help make important connections to spur the development of effective partnerships.

A New Federal Education Partnership Program at the Department of Transportation

Magnetic levitation trains, highways that provide constant updates on traffic conditions ahead and geopositioning satellites that enable travelers to determine where they are anywhere on earth at any time: these are transportation "dreams" well on their way to becoming realities. Such dreams can lead to highly-paid jobs for those with the appropriate skills. Too many students, ill-prepared for such jobs, must leave the dreaming to others.

Through the new Garrett A. Morgan Technology and Transportation Futures Program, the Department of Transportation (DOT) will stimulate public-private partnerships to help students and their families understand the importance of mathematics and science for future careers and to make math and science relevant and exciting for students inside and outside the classroom. Such partnerships will encompass interagency collaboration, government-industry cooperation and community involvement. Sample activities include:

- With the Department of Education and its business and community partners, encouraging the transportation community to participate in the America Goes Back to School program, to build support for mathematics, science, and technology achievement.
- Helping to change public perceptions about the importance of studying mathematics and science by creating awareness of the wide variety of exciting jobs in transportation that require those skills.
- Building upon DOT's 300+ adopted schools to provide mentors, tutors, career information, and other forms of support for math literacy;
- Encouraging staff to support student mathematics achievement in their local communities, by supporting summer, after-school and weekend activities that help students learn or by serving as "telementors," helping students with homework over the Internet.
- Bringing together private sector sponsorships and expertise and nationally recognized teachers to develop exciting materials with a transportation focus for teaching mathematics, science, and technology.

But the action strategy is only the beginning of the effort. The interagency cooperation must continue and move to the substantive agenda of implementation. The Department of Education and the National Science Foundation are committed to meeting the challenge of continuing cooperation so that their programs work in concert. They will enable the development of appropriate mechanisms to keep other agencies and the professional scientists, mathematicians and engineers with whom they work actively involved in improving achievement in mathematics and science education. Perhaps most importantly, they will keep the goal of raising the achievement of all American students in mathematics and science at the forefront of their attention.

see suggested edits on p. 95-3 — some language.

APPENDIX 1

PRESIDENTIAL DIRECTIVE

March 6, 1997

MEMORANDUM FOR THE:
SECRETARY OF EDUCATION
DIRECTOR OF THE NATIONAL SCIENCE FOUNDATION

SUBJECT: Preparing Students to Meet National Standards of Excellence in Eighth Grade Math and Improving Math and Science Education

Since the early 1980's, U.S. elementary and secondary school students have begun taking tougher courses, and we are starting to see the results. National Assessment of Educational Progress scores have improved in math and science, with gains in mathematics equal to at least one grade level. On the SAT, average math scores are at their highest in 25 years, even as the number and diversity of test-takers have increased. However, the eighth-grade results of the 41-Nation Third International Math and Science Study (TIMSS), released this fall, show that the U.S. is below average in math and just above average in science. That isn't acceptable; in this technology-rich information era, our students need to perform much better in both subjects, but especially in math, if they are to excel at higher level math and science courses that are the gateway to college and to citizenship, productive employment, and lifelong learning.

The first step in raising achievement is lifting expectations and setting high standards for what students should know and be able to do. TIMSS, our National Assessment of Educational Progress, and the standards developed by the National Council of Teachers of Mathematics give us a solid framework to build on. Last month, to help parents and teachers learn who needs help, what changes in teaching to make, and which schools need to improve, I asked the Secretary of Education to develop a voluntary national test for individual eighth-grade students based on widely-accepted, challenging national standards in mathematics. The national test will be available to states and local school districts to give to their students in the spring of 1999, and will measure whether students have reached a high level of mathematics proficiency.

The primary responsibility for achieving high standards rests with students, teachers, parents, and schools in local communities across America. However, it is imperative that we work to ensure that federal resources support student success as well. We must ensure that federal programs, research, and human resources are used as effectively as possible to help improve teaching and learning.

Therefore, I direct the Department of Education and the National Science Foundation, together with other agencies identified in cooperation with the Office of Science and Technology Policy and the Domestic Policy Council, to develop an action strategy for using key federal resources to assist states and local school systems prepare students to meet challenging math standards in eighth grade, and for involving the mathematics, scientific, and technical communities in support of these efforts.

The action strategy should include recommendations for the use of federal resources to help states, local school districts and schools to improve teaching, upgrade curriculum, integrate technology and high-quality instructional materials into the classroom, as well as motivate students and help them understand how math concepts are applied in the real world. The strategy should identify significant federal programs, activities, and partnerships available to improve teaching and learning, ensure that these resources are appropriately focused on helping students reach challenging math standards, and determine how these resources can best support state and local reforms. In developing this strategy, the inter-agency group should review the current status of improvements in math education, and identify and address critical areas of need, drawing on research and input from educators and professional organizations.

Because teaching and learning in math and science are so integrally related, and because success in both subjects is vitally important in this information era, the working group should also review how federal resources and partnerships with other organizations can help improve student achievement in science.

The working group should make its recommendations and submit its action strategy to me within 90 days.

WILLIAM J. CLINTON

cc: ASSISTANT TO THE PRESIDENT FOR DOMESTIC POLICY
ASSISTANT TO THE PRESIDENT AND DIRECTOR OF THE OFFICE OF SCIENCE AND TECHNOLOGY POLICY

Working DRAFT: 10/24/97

APPENDIX 2

Voluntary National Tests in Reading and Math: A Strategy to Master the Basics and Reach High Standards

Clear standards of achievement are essential to help instill the skills, American values, and encouragement for hard work that our children need to succeed in school and in life. Toward that end, meaningful standards for what students should be expected to learn and achieve in the basic subjects of reading and mathematics are critical. Reading well by grade 4 and mastering mathematics -- including the foundations of algebra and geometry -- by grade 8 are the gateways for further learning and achievement.

Parents need to know that students have mastered the basics no matter where they live or move in this country. And they have the right to know how well their children are doing compared with students in other schools, states, and countries. To help give parents this information, the U.S. Department of Education is offering every state and school district the opportunity to use voluntary national tests of 4th grade reading and 8th grade mathematics, beginning in 1999. 2000

These rigorous tests will provide parents, for the first time, scores for individual students, measured against widely accepted national and international standards of excellence. They will give states, local communities, teachers and parents the kind of accurate information they need to help students master basic and advanced skills and strengthen academic performance. Most importantly, they can galvanize a national effort to improve the odds for students and help ensure that all students master reading and math.

The tests will be modeled on the National Assessment of Educational Progress (NAEP) in 4th grade reading and 8th grade mathematics, and in the case of mathematics will be linked to the Third International Math and Science Study. The NAEP standards reflect a national consensus of what students should know and be able to do when they reach these crucial stages of learning.

The current NAEP is designed to assess how well a sample of students across the entire nation and individual states perform in reading and mathematics. A very small percentage of students participate in NAEP, and no parents know how their own children do on this test. In contrast, the voluntary national tests will provide students, parents, and teachers with meaningful scores to compare individual student performance to widely accepted national and international standards and to identify students and schools that need extra help. These standard measures of excellence will help parents hold schools accountable for improved performance, help teachers and principals improve curriculum and instruction, and give students a guide for charting their own progress.

The Department of Education recently submitted proposed legislation to Congress that would have the National Assessment Governing Board (NAGB) develop the tests. NAGB is a bipartisan, independent board created by Congress to oversee the NAEP. NAGB is expected to seek guidance in test development from a wide range of sources, including the most successful mathematics and reading teachers, parents, governors, and local and state education, civic and business leaders. Individual test scores will not be collected by the federal government; state and local school districts will decide how to use the data. Each test will require approximately 90 minutes of total testing time. States and school districts can administer the tests as part of their local testing programs.

APPENDIX 3

THE INTERAGENCY WORKING GROUP

In response to the memorandum from the President, the Department of Education and the National Science Foundation formed an interagency working group comprised of staff experienced in the areas under review. Officials of the Office of Science and Technology Policy, the Domestic Policy Council, and the Office of Management and Budget provided oversight.

Consistent with the directive, the interagency group immediately began a review of current Federal efforts in mathematics and science education with particular attention to mathematics education in kindergarten through eighth-grade. (See Appendix 4 for a summary of relevant programs in the two agencies.) In addition, as the memorandum instructed, the interagency group drew on research and input from educators and professional organizations, by reaching out to the broader mathematics and education community for advice and guidance. (See Appendix 5 for a summary of these outreach efforts, including a list of organizations with which the working group consulted.) The interagency group also consulted with appropriate staff in other agencies that have, or are interested in establishing, activities in elementary and secondary-level mathematics or science education. (See Appendix 6 for a list of the agencies consulted and a summary of their input.)

Early in its deliberations, the working group recognized the importance of developing an appropriate focus for the action strategy. Based on the results of the Third International Mathematics and Science Study (TIMSS) and the desire that students have proper preparation for the President's proposed national voluntary test in mathematics, the group concluded that in the near term, the action strategy should focus on mathematics in the middle grades (5-8). Thus, while the action strategy is designed to improve achievement in science and mathematics at all grade levels, it addresses that goal by concentrating on improving achievement in middle school mathematics first. To be fully effective in achieving the long term goals, this effort must broaden to include mathematics and science in all grades once the immediate concerns for mathematics in grades 5-8 have been addressed.

Participants in the Interagency Process

Secretary Richard Riley of the Department of Education and Neal Lane, Director of the National Science Foundation convened the interagency working group. Their acting deputies, Marshall Smith and Joseph Bordogna, respectively, provided guidance through regular interaction with the working group, as did Luther Williams, Assistant Director for Education and Human Resources at the National Science Foundation.

Several members of the staff of the Executive Office of the President were instrumental in the work of the interagency group, including: Michael Cohen, Domestic Policy Council; Clifford Gabriel, Office of Science and Technology Policy; Mary Cassell and Anne Tenney, Office of Management and Budget; and Daniel Goroff, Office of Science and Technology Policy. William Kincaid of the Domestic Policy Council and Daryl Chubin of the Office of Science and Technology Policy were particularly important to developing the action strategy and to keeping the working group on track.

Members of the Working Group

Co-Chairs

Thomas M. Corwin
Director, Division of Elementary, Secondary, and Vocational Analysis
Budget Service
Department of Education

Judith Sunley
Assistant to the Director for Science Policy and Planning
National Science Foundation

Committee Members

Carol Chelemer
Office of Educational Research and Improvement
Department of Education

Margaret Cozzens
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Division of Elementary, Secondary, and Informal Education
National Science Foundation

Eric Hamilton
Program Director, Educational System Reform
National Science Foundation

Christine Jackson
Senior Program Officer, Eisenhower Professional Development Program
Department of Education
(replaced Clare Banwart 4/97)

Deborah Spitz
Program Analyst
Office of the Undersecretary
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Diane Spresser
Program Director, Teacher Enhancement (Mathematics)
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Robert Stonehill
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Department of Education

Larry Suter
Acting Director, Division of Research, Evaluation, and Communication
National Science Foundation

Judy Wurtzel
Director of the Mathematics Initiative
Office of the Acting Deputy Secretary
Department of Education

APPENDIX 4

RELEVANT ACTIVITIES OF THE DEPARTMENT OF EDUCATION AND THE NATIONAL SCIENCE FOUNDATION

DEPARTMENT OF EDUCATION

The Department of Education provides flexible support, technical assistance, and research-based materials to assist state and local education agencies in improving teaching and learning. This year, the Department has identified seven national priorities that will guide its activities building on President Clinton's Call-to-Action over the next four years. The first three focus on specific results that all students should achieve: reading independently by the end of third grade; mastering challenging mathematics (including the foundations of algebra and geometry) by the end of eighth grade; and being prepared for and able to afford college by 18 years of age. The remaining four priorities address key strategies to enable students to achieve these goals: challenging standards and accountability for every school; a talented, dedicated, and well-prepared teacher in every classroom; Internet access in every classroom with technologically literate students; and strong, safe, and drug-free schools. The following programs provide valuable support to States and schools in their efforts to reach the goal of providing high-quality education in mathematics for all students.

for American Education

Flexible Support to States, Communities, and Schools to Improve Teaching and Learning:

The **Title I Education for the Disadvantaged** program is the Federal Government's largest program that supports elementary and secondary education, with current funding of almost $7.2 billion for grants to local educational agencies. Title I provides funds to help low-achieving children, particularly those in high poverty schools, learn to high standards. Title I can give disadvantaged children the benefit of, for example, more individualized and accelerated instruction, extended-day programs, and learning laboratories in mathematics, science, and computers. Mathematics has always been a major focus of the Title I program: according to the most recent data, 48 percent of 9 million participating children receive some instruction in mathematics.

The 1994 reauthorization of Title I emphasizes holding students participating in Title I to the same high standard as all students. By the 1997 - 1998 school year, all States must adopt challenging standards in reading and mathematics. By 2001, States must implement high-quality assessment systems aligned to the standards to assess the performance of Title I schools in relation to State standards.

Schools that serve an area in which the percentage of children living in poverty exceeds 50 percent may use their Title I funds, in combination with other Federal, State, and local funds, to upgrade the school's entire instructional program. These programs are called "school-wide programs." Other schools use the money to help those children most in need of supplementary services. In addition, the Title I statute emphasizes the professional development of educators; every local educational agency participating in the Title I program must provide high-quality professional development, geared to challenging State standards, to improve teaching of academic subjects.

Goals 2000: Educate America Act -- currently funded at $476 million, is the primary Federal program supporting standards-based state education improvement. All 50 States now participate. Goals 2000 provides flexible funding to the States to enable them to

develop and implement their own strategies for achieving the National Education Goals (including the goal of becoming first in the world in mathematics and science). With funding from the program, States are establishing challenging academic standards with which they are aligning their student assessment programs, teacher preparation and licensure requirements, parental and community involvement, and other aspects of their education systems.

Professional development is also an important component of Goals 2000. Program funds allow States to make competitive subgrants for activities to improve pre-service teacher education and support intensive, sustained professional development for educators and other school personnel. Many States and school districts are also using Goals 2000 funds to support effective use of educational technology.

Professional Development in Mathematics and Science:

Eisenhower Professional Development State Grants, currently funded at $310 million, support a wide array of professional development activities in the core academic subjects. By statute, at least $250 million of the Eisenhower funds must be spent on professional development in mathematics and science. The strengths of the program are its reach -- funds flow to States and school districts by formula, and the vast majority of local educational agencies participate -- and the flexibility it provides to State and local administrators to carry out program activities that meet particular State and local needs. The 1994 program reauthorization established requirements that the program fund only professional development that is tied to challenging State content standards and is of sufficient intensity and duration to have a positive and lasting impact on teachers' classroom performance. In fiscal year 1998, the program should reach almost 350,000 educators.

The **Eisenhower Professional Development Federal Activities** program supports an array of national professional development initiatives. The Eisenhower program supports the National Board for Professional Teaching Standards (NBPTS), which establishes national standards of excellence in teaching and recognizes teachers attaining these standards through a rigorous assessment process. The Department has requested increased funding to enable 105,000 teachers to become board certified by the year 2006 on average, one for every elementary and secondary school in the nation. The Department's proposed budget would also speed the development of certification frameworks and assessments so that by 2002, certificates for 25 teaching fields will be available. Eisenhower also supports nine state-wide projects across the nation that are working on improving preservice education, licensure requirements and the experience of teachers during their first three years of teaching.

The **Telecommunications Demonstration Project** (PBS Mathline) uses the professional teaching standards of the National Council of Teachers of Mathematics (NCTM) as the basis for its year-long professional development program called the Elementary School Mathematics Project. This project, which complements Mathline's already-successful Middle School Mathematics Project, allows teachers to learn at times and locations they find convenient. It uses a series of 20 videos, each accompanied by a guide that includes lesson plans, ideas for extending the lesson, additional resources, and discussion topics relating the video content to the NCTM standards. Teachers also participate in a year-long, online learning community of 25-30 fellow teachers, with an accomplished practicing teacher serving as mentor and facilitator. Over the course of three years, PBS Mathline has provided more than 4000 teachers of K-8 mathematics in 36 states

with in-depth, standards-based training and has been recognized by the NCTM as an effective professional development program.

Technical Assistance and Information Sharing:

The **Eisenhower Mathematics and Science Regional Consortia** provide professional support to help teachers teach to high standards. The ten Regional Consortia have three primary objectives: 1) to collaborate and form coalitions with other organizations involved in mathematics and science education improvement; 2) to provide technical assistance and facilitate the use of technology as a tool for instruction and professional development; and 3) to identify and disseminate materials on exemplary instruction in mathematics and science.

The **Eisenhower National Clearinghouse for Mathematics and Science Education** (ENC), funded under Eisenhower Federal Activities, collects a wide range of materials in mathematics and science and makes them available on-line and on CD-ROM. As of September 1996, which concluded its fourth year of operation, ENC had collected a total of 7,055 records and was in the process of identifying over 4,500 more. Between October of 1995 and June of 1996, the Clearinghouse reported over three million "hits" to its Web site. ENC Online (www.enc.org) has been recognized as an exemplary Internet site by Classroom Connect, Syllabus Magazine, Geometry Forum, Education Index, and Multimedia Schools. ENC also works with the Regional Consortia to create demonstration sites throughout the country, where educators can interact with the latest technological developments.

Information is also disseminated through the **Educational Resources Information Center** (ERIC), a national system of specialized clearinghouses that maintain and provide access to the world's largest electronic database of education-related materials.

Research, Statistics, and Assessment:

The **National Research Center on Achievement in School Mathematics and Science** is housed at the Wisconsin Center for Education Research at the University of Wisconsin. The Center is a collaboration with the Technical Education Research Center (TERC), Vanderbilt University/Peabody College, the University of Pittsburgh, and the University of Massachusetts-Dartmouth. The Center's mission is to create and validate a set of principles for designing classrooms that promote student understanding in mathematics and science.

Data relating to education are collected, analyzed, and reported by the **National Center for Education Statistics** (NCES). In collaboration with the National Science Foundation, NCES is currently reporting the results of the Third International Mathematics and Science Study (TIMSS), and providing follow-up information on those results. Other NCES studies collect detailed, reliable information on the conditions of schools, teachers, and students throughout the nation. The National Assessment of Educational Progress (NAEP) measures the progress of the nation's students in core subjects, including mathematics and science.

NATIONAL SCIENCE FOUNDATION

Since its inception in 1950, the National Science Foundation (NSF) has served the Nation by investing in research and education in science, mathematics, technology, and engineering. NSF's goals for education and training require attention to needs at every level of schooling and access to quality science, mathematics, engineering, and technology educational opportunities for all members of society.

PreK-12 Systemic Reform

Systemic refers to fundamental, comprehensive, and coordinated changes made in science, mathematics, technology, and engineering education through attendant changes in policy, financing, governance, management, content, instruction, and assessment. Systemic reform occurs when all essential features of institutions and systems are engaged and operating in concert; when policy is aligned with a clear set of goals and standards; and when the improvements and innovations become an intrinsic part of the ongoing educational system for all participants and are incorporated in budgets.

PreK-12 systemic reform is supported through NSF state, urban, local, and rural systemic initiatives. The implementation of high-quality, standards-based instructional materials, assessment systems, and professional development are keys to success of all initiatives. Essential components to the immediate and long-term sustainability of the reform activities include: (1) development and administration of coherent policies and legislation to support science and mathematics education; convergence of resources to support a single, unitary program; (2) promotion of effective partnerships with the private sector and higher education institutions; (3) achievement of support from the community, parents in particular; collection, interpretation and effective use of data, including student achievement; and (4) cohesive, coherent strategic planning to ensure the improvement of all students' achievement. Since 1996, the systemic initiatives have begun to make the transition from building an infrastructure to supporting science and mathematics education reform to the classroom implementation of standards-based curricula, instruction, and assessment. Extensive leveraging of funds from business, industry and other federal agencies occurs in all systemic initiatives, in some case as much as 4 to 1 with NSF dollars.

The Statewide Systemic Initiative (SSI) Program has supported a total of 25 states and the Commonwealth of Puerto Rico to establish comprehensive changes in mathematics and science education through the implementation of K-12 standards-based instructional programs, professional development, and assessment systems; new policies; and effective partnerships. A total of 20 eligible cities with the largest numbers of school-age children living in poverty have been funded under the Urban Systemic Initiative Program (USI). A total of four rural, economically disadvantaged regions are implementing programs to promote high-quality science, mathematics, and technology education through the Rural Systemic Initiatives (RSI). RSI programs have focused on the implementation of instruction through the use of advanced telecommunications networking and distance delivery of quality programs and professional development.

Building Blocks of System Reform:

Systemic reform is built on a foundation of quality instructional materials, initial education and professional development of teachers in both content and pedagogy, new strategies for the assessment of student learning, a diverse teacher population, and appropriate use of

technology. Thus a major focus of activities and budget at NSF is assuring that these building blocks are available and in place.

Teacher Education: Teachers must have a high level of content knowledge and pedagogical skills and be prepared to utilize the most effective instructional materials, assessment strategies, and educational technologies. Teacher education includes both preservice and inservice education.

Over 40,000 teachers in 1,930 schools, reaching over 1.3 million students annually, participate in intensive professional development activities through the **Local Systemic Change (LSC) Initiatives**. Teachers of mathematics or science receive a minimum of 100 hours of professional development (for K-8 teachers) or 130 hours (for teachers in grades 7-12) and receive ongoing support through the academic year. They implement quality standards-based instructional materials and reform the mathematics and science programs in their schools as a whole. Extensive leveraging of Title 1, Eisenhower, district, and industry funds occurs in at least an amount equivalent to the NSF award in each LSC project. In addition to the Local Systemic Change projects, the Teacher Enhancement Program supports **leadership projects** that train teachers and other professionals to deliver quality professional development. NSF supports the enhancement of approximately 60,000 teachers annually, of whom, at this time, fewer than half are teachers of mathematics. Only about 10,000 are middle school teachers of mathematics.

Comprehensive Partnerships for Mathematics and Science Achievement projects provide students and teachers with standards-based curriculum reform for K-12, teacher enhancement, strategic use of resources, student enrichment activities, and summer research experiences and related activities. Approximately 5,000 teachers are affected annually.

The **NSF Collaboratives for Excellence in Teacher Preparation** (CETP) support efforts to achieve comprehensive change in the undergraduate education of future teachers and to increase the quality and number of teachers in science and mathematics. All of the activities are characterized by strong collaboration between discipline-based faculty in schools of science/engineering and faculty from schools of education. Participating institutions of higher education vary from tribal colleges to major research institutions. CETP projects will affect 78,000 future teachers in 110 participating institutions over a five year period, and approximately 30% of the CETP collective effort is focused on future teachers of K-12 mathematics.

Instructional Materials: Instructional and assessment materials influence what students are taught and how teachers and faculty teach. An innovative, comprehensive, and diverse portfolio of instructional materials and assessment tools that implement standards-based reform in mathematics, the natural and social sciences, engineering, and technology education are required for preK-12 education. These materials must be of sufficient quality to be widely adopted and used in schools nationally.

The development of sixteen sets of comprehensive standards-based mathematics instructional materials for K-12 students was begun in 1990, These materials were completed and became available for use beginning in 1996. A report describing the success of these materials in field test sites was released by the University of Chicago, The Success of Standards-Based Mathematics Curricula for all Students, a Preliminary Report in FY 1996. Extensive evaluation data of student achievement in the field testing of these new materials demonstrates improved performance for students using them.

Assessment: NSF supported research and development in assessment of student learning during the mid-1990's through 20 projects. Each of these projects has come to completion. The tools they developed and the increased understanding of student learning that resulted are now being used by schools throughout the country. The Balanced Assessment in Mathematics Project was among the projects funded to develop assessment tools for middle school mathematics. The tools and test items the project generated have become the central component of the New Standards Mathematics assessments now used in numerous schools throughout the country. NSF continues to fund new assessment projects.

Technology: Research efforts in technology are developing new methodology and pedagogy for improving the achievement of students in science and mathematics, especially those who have not been well served by the education system. The new methodologies will make use of advances in technologies such as visualization and simulation that build on different learning styles among students. Funded projects successfully create new forms of visualization of scientific and mathematical concepts. NSF has supported more than 20 projects that successfully create new forms of visualization such as graphics, and simulations. Full and sustainable integration of technology into the fabric of the educational system is required for these to have wide impact on education systems.

Informal Science Education: The Informal Science Education sector reaches out to all segments of population to engage them in self-directed learning in the areas of science, mathematics, and technology. Because, over a lifetime, people spend more hours learning out of school than they do in school, a strong informal science education program is critical in the comprehensive education of our citizens. Members of the public who participate in informal science education learn about the process of science and scientific thinking; are motivated to participate in science and mathematics activities; are aware of the relevance of science, mathematics, and technology in their everyday lives; and increase their knowledge about specific topics and about scientists and careers in the sciences.

Support is provided for informal learning science, mathematics, and technology projects designed to reach large numbers of the general public through television and radio series; public films on the process and substance of science and mathematics; exhibits or other educational activities at science and natural history museums, science-technology centers, aquaria, nature centers, botanical gardens, arboreta, zoological parks, and libraries; and educational programs and activities at community and youth centers.

APPENDIX 5

CONSULTATION WITH EXTERNAL ORGANIZATIONS

In the course of developing this action strategy, the interagency working group solicited input from a wide range of interested organizations. The mathematics and mathematics education communities in particular are well organized to respond to the President's challenge. The working group met with two umbrella organizations that provided access to many sources of input from these communities: the Mathematical Sciences Education Board (MSEB) of the National Research Council (NRC) and the Conference Board of the Mathematical Sciences (CBMS), Each organization includes stakeholder representatives ranging from school teachers to university mathematicians and from educational researchers to those in industry using mathematics on a daily basis. Their recommendations to the working group are summarized below.

In addition, both the National Science Foundation and the Department of Education consulted with a wide range of potential stakeholders, including informal discussion with winners of the Presidential Award for Excellence in Mathematics and Science Teaching, meetings with the Eisenhower Regional Consortia. meetings of advisory committees, and meetings of professional organizations of teachers, principals, superintendents, mathematicians, scientists, and engineers.

While the working group focused its information gathering on strategies to support improving achievement toward high standards in mathematics, many of the individuals and organizations that provided input were keenly interested in the nature of the voluntary national test. Thus, the discussions with these groups included the exchange of information about the test of mathematics in eighth grade as well as about the working group's objectives. This interest in the test is reflected in the recommendations made. The working group was reminded, both implicitly and explicitly, that the voluntary national test is ~~only a means to an end~~. ~~The~~ end must be kept in sight, ~~both in test development and in~~ the strategies the working group might develop ~~to improve achievement~~.

In addition to meeting with these groups, the working group asked MSEB for a letter report addressing the issues raised in the President's Directive. MSEB offered three overarching recommendations:

1. Construct and sustain a Federal effort that brings together, in a coherent framework for decision-making, the various National Science Foundation and U.S. Department of Education programs that will significantly influence K-8 mathematics education.

2. Devise a long-term plan (8-10 years, offset from political cycles) of interactive development involving test redesign and strategy adjustment, with ongoing monitoring and oversight.

3. Invest in a sustained agenda of basic research to better understand what mathematical thinking is, how to foster it through curricular choices and instructional practice, and how to support teachers in doing so.

Within the framework of the President's Directive, all groups emphasized the importance of teacher education (both initial preparation and subsequent professional development), with both MSEB and CBMS highlighting this area in their written input. CBMS and MSEB emphasized the need for establishing certification programs for middle school teachers in mathematics. They cited the importance of an enhanced role for higher education in preparing teachers and in providing support for teachers through on-going professional development.

MSEB and CBMS also pointed to the emergence of new and innovative middle school mathematics curricula. They urged that the action strategy include ways to publicize, promote, and provide adoption guidance concerning model programs. They also agreed that technologies ranging from the Web to calculators have potential to help improve mathematics education. However, MSEB noted the importance of technical support for use of technology in the classroom and of equity issues in the use of that technology.

The outside groups also recognized the value of a public information campaign that can, in the words of the MSEB letter report, highlight "the importance of mathematics in applications, the beauty of mathematics as a field, and the role of mathematics as a gateway to careers and to higher education." Several of the mathematics and mathematics education organizations stand ready to assist in the development of such a campaign. MSEB recommends that public information efforts address coordination of the national test with associated action strategies.

APPENDIX 6

FEDERAL AGENCY ACTIVITIES THAT SUPPORT K-12 MATHEMATICS EDUCATION

The Department of Education (ED) and the National Science Foundation (NSF) have principal responsibility, among the Federal agencies, for K-12 education and for science and mathematics, respectively. However, a dozen other departments and agencies sponsor activities that relate to, and could promote, standards-based education that improves students' mathematics and science learning and overall academic performance.

Executive Order 12821 of November 16, 1992, instructs those Federal departments and agencies with scientific missions, employees, or laboratories to "assist in the mathematics and science education of our Nation's students, teachers, parents, and the public by establishing programs at their agency to provide for training elementary and secondary school teachers to improve their knowledge of mathematics and science." Many agencies had such programs in place even before this Order was issued. On April 17, 1996, it was superseded by Executive Order 12999 on *Educational Technology*, which "streamlines the transfer of excess and surplus Federal computer equipment to our nation's classrooms and encourages Federal employees to volunteer their time and expertise to assist teachers and to connect classrooms." The Eisenhower National Clearinghouse catalogues current programs in its "Guidebook of Federal Resources for K-12 Mathematics and Science" (see www.enc.org/reform/guidebk).

The working group met with designated representatives from 11 agencies (the Departments of Agriculture, Commerce, Defense, Energy, Interior, Transportation, and Veterans Affairs, EPA, NASA, NIH, and the Smithsonian) to discuss relevant programs and activities sponsored by their agencies. In general, the agencies focus far more on science than mathematics, and commit modest resources to improving K-12 education. Most offer staff and facilities, often on a volunteer basis, to support local schools and teachers. And all have developed and are sharing supplementary instructional materials on their Web sites. Some examples of works in progress can be cited. For more extended, specific examples, see sidebars in the report.

- NASA has completely revamped its educational programs to reflect the development of the National Council of Teachers of Mathematics' (NCTM) standards for mathematics and the more recent standards for science developed through the National Research Council (NRC). The agency has developed supplementary instructional materials in conjunction with NCTM that provide sample problems based on space-related examples.

- The Department of Defense schools have redesigned curriculum and teacher professional development to incorporate standards-based approaches. Other parts of DoD have outreach programs that stress the importance of mathematics to national security.

- The Department of Energy, NIH, and USDA are conducting an inventory of their activities, identifying their impacts and exploring opportunities to expand. Among ideas that warrant further consideration are virtual teacher training based at DOE's Lawrence Berkeley Lab in partnership with the University of California system; USDA's 4-H Clubs as an after-school, weekend, and summer vehicle for promoting math skills; EPA's use of the training-of-trainer model for teacher development in environmental education; and NIH's middle-school curriculum supplements, to be developed among three Institutes and the NRC.

- The Department of Transportation is about to embark on an extensive effort to improve K-12 education in mathematics and science, including participation of staff as volunteers. The Smithsonian Institution has both formal and informal ties into schools. Other agencies are ready to play an appropriate role in improving K-12 education, and are looking for guidance on how best to proceed.

We must learn more quickly and more systematically about approaches and innovations that support students and teachers of mathematics both in and outside of schools, taking into account high standards like those of the NCTM and the NRC to reference, guide, coordinate, and set priorities among the many educational programs managed by Federal agencies. Continued coordination among all of the agencies involved in the working group's deliberations, and others that might be brought in over time, can set the stage for more effective use of Federal resources. The Department of Education and the National Science Foundation will work to ensure such coordination in the future.

UNITED STATES DEPARTMENT OF EDUCATION

OFFICE OF THE DEPUTY SECRETARY

FOB-10 Rm 6251

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MESSAGE:

U.S. Department of Education
Washington, DC

National Science Foundation
Arlington, VA

The President
The White House
Washington, DC 20500

Dear Mr. President:

We are pleased to transmit the report of the U.S. Department of Education-National Science Foundation joint working group on mathematics and science education.

As you know, since the early 1980's, U.S. elementary and secondary school students have begun taking tougher courses, and we are starting to see the results. National Assessment of Educational Progress scores have improved in math and science, with gains in mathematics equal to at least one grade level. On the SAT, average math scores are at their highest in 25 years, even as the number and diversity of test-takers have increased. However, the eighth-grade results of the 41-Nation Third International Math and Science Study (TIMSS) show that the U.S. is below average in mathematics and just above average in science. That isn't acceptable; in this technology-rich information era, our students need to perform much better in both subjects, but especially in mathematics, if they are to excel at higher level mathematics and science courses that are the gateway to college and to citizenship, productive employment, and lifelong learning.

Because mathematics and science provide many of the underpinnings necessary for students and society to navigate this ever changing technological and information age, in a March 6 Presidential Directive, you asked us to convene a working group to develop an "action strategy" for using Federal resources to assist State and local school systems to prepare students to meet challenging mathematics standards in the eighth grade and for involving the mathematics, science, and technical communities in those efforts. You asked that the action strategy include recommendations for using Federal resources to help States, local educational agencies, and schools to improve teaching, upgrade curriculum, and integrate technology and high-quality instructional materials into the classroom, and to motivate students and help them understand how mathematics concepts are applied in the real world. You asked the working group to review the current status of improvements in mathematics education and to identify and address critical areas of need, drawing on research and input from educators and professional organizations.

Finally, you asked us to explore how Federal resources and partnerships with other organizations can help improve student achievement in mathematics and science.

We believe that the enclosed action strategy meets those objectives in all respects. Consistent with your Directive, and with the results of the Third International Mathematics and Science Study (TIMSS), the strategy focuses most prominently on the improvement of middle-school (grade 5-8) mathematics, but also addresses broader needs in all of elementary and secondary mathematics and science education. More specifically, the strategy proposes a new Federal effort focusing on middle school mathematics, with an extension to other areas of mathematics and science in future years.

Also consistent with your Directive, the strategy focuses on three principal areas where Federal investments can achieve maximum leverage and impact: upgrading teaching, improving curriculum and instructional materials, and building parent and public awareness and engagement. In each of these areas, the strategy seeks to maximize the potential benefits obtainable through the programs of our two agencies, that is, the competitive grant programs administered by NSF and the formula and competitive grant programs of the Department of Education. It also acknowledges the potential contributions of other Federal agencies to this effort.

The joint working group identified many areas where we can make progress with existing resources and programs. In fact, the Department and the Foundation have now committed to launching, in fiscal year 1998, a new set of planning grants for local reform and improvement of middle-school mathematics instruction. These grants will, in particular, help middle schools that enroll large concentrations of children from low-income families to use all relevant Federal, State, and local resources in a way that produces meaningful gains in mathematics achievement. In addition, our agencies have committed to launching a new public information and engagement campaign during the current fiscal year.

While we will initiate these efforts this year, the potential for bringing about significant improvements in the mathematics education of the Nation's 13.5 million middle school students, and in elementary and secondary mathematics and science education more broadly, will depend on the level of resources the Federal Government commits to this effort. In order to benefit a significant number of schools, teachers, and students in the coming years, we have included additional funds for activities linked to the action strategy in our respective fiscal year 1999 budget requests to the Office of Management and Budget. Without these increases, the impact of our efforts will necessarily be limited; on the other hand, the additional funding, if we can obtain it, should have a synergistic impact because our new activities should result in more effective use of the existing investments that the Federal Government now makes available to schools for mathematics and science education and for related education purposes.

Thank you for providing the stimulus that has resulted in a closer working relationship between our agencies and in the new activities set forth in the action strategy. We are prepared to do our part to bring the ideas in the strategy to fruition.

Yours sincerely,

Neal Lane

Richard Riley
Secretary of Education

Neal Lane
Director, National Science Foundation

AN ACTION STRATEGY FOR IMPROVING ACHIEVEMENT IN MATHEMATICS AND SCIENCE

EXECUTIVE SUMMARY

A solid foundation in mathematics and science is increasingly necessary to navigate this changing technological and information age. To address this important concern, on March 6, 1997, the President issued a memorandum (Appendix 1) directing the Secretary of Education and the Director of the National Science Foundation to form an interagency working group to develop an action strategy for using Federal resources to assist States and local school systems in preparing students to meet challenging mathematics standards in the eighth grade, and for involving the mathematical, scientific, and technical communities in support of those efforts.

The Presidential directive specified that the action strategy include recommendations for the use of Federal resources to help States, local school districts, and schools improve teaching, upgrade curriculum, integrate technology and high-quality instructional materials into the classroom, and motivate students to help them understand how mathematical concepts are applied in today's global workplace. The directive called for the interagency group to review the status of improvements in mathematics education and identify critical needs, drawing on research and input from educators and professional organizations. In addition, it called for the working group to review how Federal resources and partnerships with other organizations can help improve student achievement in science.

The request was based, in part, on results of the Third International Science and Mathematics Study (TIMSS), which demonstrated a clear need to focus on improving mathematics achievement in grades 5-8. American students scored above the international average at the fourth grade, but fell to below the international average at eighth grade. The President's proposed voluntary national test in mathematics at grade 8 provided an additional stimulus. The action strategy targets mathematics in grades 5-8, building on a strong foundation of activity underway across the country to improve elementary and secondary mathematics and science education.

The action strategy:

- Challenges the Department of Education and the National Science Foundation to work together more closely and to build partnerships with other Federal agencies and with State and local educational agencies to strengthen the impact of Federal investments in mathematics and science education.
- Challenges State and local-level school superintendents, mathematics supervisors, school boards, principals, teachers and other educators to take a fresh, critical look at curricula, instructional materials, and professional development strategies (and the use of Federal resources in these areas) in light of TIMSS and other recent research results and to be prepared, as needed, to reformulate current approaches so as to improve effectiveness.
- Challenges the Nation's colleges and universities to develop rigorous new programs for teacher preparation, stressing both subject matter expertise and pedagogical mastery. These institutions will also need to take a far more active role in enhancing the skills

and knowledge of the teachers of today and tomorrow, working closely with States, local school districts, and schools in the process.

- Challenges professional organizations in mathematics, science, engineering, and technology to join with teachers, schools, colleges, parents, students, community organizations, and business and industry in developing a strong network of local partnerships aimed at raising student achievement.
- Challenges U.S. families to provide strong support and encouragement for their children to reach high standards of achievement in mathematics and science.

Based on the Federal role in improving achievement in K-12 education, the priorities of the action strategy focus Federal investment on:

- Assisting States, local school districts, and the Nation's colleges and universities to provide the skills and knowledge that equip teachers in grades 5-8 to teach challenging mathematics content in effective ways, with high expectations for their students;
- Assisting States and local school districts to select and implement high-quality, standards-based curricula and instructional materials, including making effective use of educational technologies; and
- Building public understanding of the need for challenging mathematics in grades 5-8, and gaining public support for raising student achievement toward high standards.

The bulk of the Federal resources for improvement in K-12 mathematics and science education flows from the programs of the Department of Education and the National Science Foundation. A coherent approach to strengthening the impact of Federal resources used to improve mathematics achievement in grades 5-8 must begin with these programs. Drawing on the resources of other Federal agencies in an effective manner can then follow.

The Department of Education and the National Science Foundation plan a set of joint activities that are the synergy-producing elements of the action strategy. These activities include:

- Competitive planning grants to accelerate the strategic use of resources in improving achievement in mathematics;
- A National Convocation on middle school mathematics that will initiate an on-going dialogue among all stakeholders;
- The Public Understanding and Engagement Mathematics Initiative, a mechanism to involve parents and the public more directly in mathematics education;
- Coordinated research and informational activities; and
- Systematic involvement of other agencies.

Other elements of the action strategy draw on the individual strengths of Federal agency programs aimed at improving mathematics education.

The time is ripe for a concerted effort to improve the achievement of U.S. students in mathematics and science. By focusing our immediate attention on improving performance for middle school mathematics, we will be able to give local, State, and Federal educational agencies a call for action that is substantive, timely, and sufficiently targeted that it is reasonable to anticipate progress. As our effort to address this area of greatest concern gets underway, we can develop models for future action across disciplines and grades.

But the action strategy must be only the beginning of the effort. The interagency cooperation must continue and move to the substantive agenda of implementation. The Department of Education and the National Science Foundation are committed to meeting the challenge of continuing cooperation so that their programs work in concert. The two agencies will develop appropriate mechanisms to keep other agencies and the professional scientists, mathematicians, engineers, and others with mathematical skills and knowledge with whom they work actively involved in improving achievement in mathematics and science education. Perhaps most importantly, they will keep the goal of raising the achievement of all American students in mathematics and science at the forefront of their attention.

AN ACTION STRATEGY FOR IMPROVING ACHIEVEMENT IN MATHEMATICS AND SCIENCE

I. INTRODUCTION

On March 6, 1997, the President issued a memorandum (Appendix 1) directing the Secretary of Education and the Director of the National Science Foundation to form an interagency working group to develop an action strategy for using Federal resources to assist States and local school systems in preparing students to meet challenging mathematics standards in the eighth grade, and for involving the mathematical, scientific, and technical communities in support of those efforts.

The Presidential Directive

The Presidential directive specified that the action strategy include recommendations for the use of Federal resources to help States, local school districts, and schools improve teaching, upgrade curriculum, integrate technology and high-quality instructional materials into the classroom, and motivate students to help them understand how mathematical concepts are applied in today's global workplace. The directive called for the interagency group to review the status of improvements in mathematics education and identify critical needs, drawing on research and input from educators and professional organizations. In addition, it called for the working group to review how Federal resources and partnerships with other organizations can help improve student achievement in science.

The Need for Action

The Third International Mathematics and Science Study

The need for this effort to improve mathematics and science education in eighth grade was made clear by the Third International Mathematics and Science Study (TIMSS). Results of tests administered in 1995 to students in grades 4 and 8 are now available. The fourth grade results show U.S. students above the international average in both

The Third International Mathematics and Science Study (TIMSS)

TIMSS is the largest and most ambitious of a series of international comparative studies of educational achievement. The Department of Education and the National Science Foundation sponsored the U.S. testing, conducted in 1995 at grades 4, 8, and 12, and the subsequent analysis.

TIMSS involved more than half a million students in 45 countries. 30,000 U.S. students took part. While the relative performance of U.S. students in comparison to students of other countries improved over performance on similar international comparisons of earlier years, there were signs of problems, particularly at grade 8. U.S. students performed above average at grade 4 and below average at grade 8 in mathematics, the only country with such a pattern in either science or mathematics. Grade 12 results will be announced shortly.

While collecting achievement data in each participating country, TIMSS researchers also developed a wealth of information about teachers and teaching, about curricula and instructional materials, about classroom lessons and interactions, and about student attitudes and habits outside the classroom. For example, TIMSS results show that

- US student performance increases more slowly between elementary and middle school years than in most other countries;
- The U.S. curriculum is not as well focused on topics that would propel students toward more advanced levels of understanding as are curricula in other countries;
- U.S. teachers work longer hours, have less time during the day for preparing classes, and experience more disruption in their classrooms than do their counterparts in other countries.

Thus, the TIMSS results have become a source of constructive motivation for mounting an action strategy, taking the issue well beyond the simple comparison of scores in international test taking.

science and mathematics. In science, U.S. students were outperformed only by those in Korea. However, the eighth grade results show lackluster performance by U.S. students, with scores only a bit above the international average in science, and below the international average in mathematics.

TIMSS results for the fourth grade are much more positive than the results of similar international comparisons in the past. They demonstrate that it is possible to make significant progress in international comparisons over time, and that U.S. students can compete favorably with those of other nations in mathematics and science achievement. Our National Education Goals proclaim our dedication to making U.S. students first in the world in mathematics and science achievement by the year 2000. In the early grades, we are making demonstrable progress toward that goal. These results clearly indicate that mathematics and science education in the middle school years should be an important focus for national efforts to help ensure that our students meet world-class standards.

Opportunities for the Future

Eighth grade is a critical point in mathematics education. Achievement at that stage lays the foundation for students to take the advanced high school mathematics and science courses that are keys to college entrance and well-paid jobs. Today, too many students enter high school without this solid grounding in mathematics and, unfortunately, they never gain it, closing doors to opportunities for the future. Often students and their families do not even know that the doors are closing, leading to a mismatch between their expectations for the future and their actions in the present. This is particularly true for students from disadvantaged backgrounds. It is a factor in perpetuating inequities both in participation in advanced education and in lifetime income.

A Voluntary National Test in Mathematics

The President has proposed a voluntary national test in mathematics, to be taken near the end of eighth grade, as a very visible part of an ambitious, sustained drive for higher, more challenging standards of learning for all students. The test will be based on the framework of the National Assessment of Educational Progress (NAEP). It will be available by the spring of 2000. Parents and teachers will receive the results for each student, with scores linked to national and international benchmarks. Every year, all items on the test will be released so teachers, parents, and students can review performance on individual test items. For more information, see Appendix 2.

The voluntary national test is only one element of the comprehensive effort needed to accomplish the objective of having all students achieve challenging national standards for performance. This effort will require many individuals -- students, parents, teachers, college faculty, employers, professional associations, and community leaders -- working in concert with a common understanding of what they want to see happen. The test, in combination with a national effort to boost achievement, will provide a powerful lever to amplify the effects of existing efforts at local, State, and national levels to improve student achievement in mathematics and science.

Plan of Action: Place Immediate Focus on Mathematics

The TIMSS results show the need for an immediate focus on mathematics education in grades 5-8, where the serious drop from above to below international norms in mathematics threatens achievement in both mathematics and science at higher grade levels. The President's proposed national voluntary test in mathematics in eighth grade provides a tool to measure progress and also challenges us to provide students with the mathematics in grades 5-8 that will enable them to perform well on it. The National Council of Teachers of Mathematics (NCTM) has developed sets of standards for content, teaching, and assessment that provide a strong footing for raising standards in curriculum and instruction.

The action strategy targets grades 5-8, building on a strong foundation of activity underway across the country to improve elementary and secondary mathematics and science education. It requires that these activities continue, at all levels in both mathematics and science, and lays the groundwork in both substance and process for expanded activities in the future.

Raising Achievement for Disadvantaged Students

Efforts to raise student achievement in mathematics and science must be particularly intensive in high-poverty communities and schools. The National Assessment of Educational Progress (NAEP) in mathematics shows that students from poor families perform significantly less well than other students. In 1996, the average score on the 500 point NAEP scale was 252 for 8th graders who are eligible for free and reduced price lunch as compared to 280 for ineligible students. Students from poor families are also less likely to take algebra, geometry, and more advanced courses in high school.

On July 25, 1997, fifteen urban school districts, including the nation's three largest, pledged to participate in the voluntary national test. They sent a clear signal that students in inner city schools can and should be held to the same challenging standards that are being set for all students throughout the nation. These communities recognize that setting high standards is a prerequisite for improved teaching and learning. Research and experience shows that students can meet high standards, and that low expectations lead to low achievement.

Challenges for All Parties

The goal of the action strategy is for all American students to leave eighth grade prepared to pursue the higher-level mathematics and science courses that are the gateway to college, productive employment, lifelong learning, and effective citizenship. Reaching this goal will require action in five areas:

- High expectations, held by teachers, school administrators, parents, the broader community, and students themselves, for student performance in mathematics and science;
- Challenging standards for content of curriculum, teaching, assessment, and student achievement;
- Instructional materials and technology of high quality that incorporate these challenging standards;
- Teachers with the pedagogical skills and rigorous knowledge of mathematics and science needed to teach these subjects effectively; and
- Activities outside the classroom that reinforce the classroom experience by drawing on the support of parents, the professional communities of mathematicians, scientists, and engineers, business leaders, and the broader public.

Thus, the action strategy:

- Challenges the Department of Education and the National Science Foundation to work together more closely and to partner with other Federal agencies and with State and local educational agencies to strengthen the impact of Federal investments in mathematics and science education.
- Challenges State and local school superintendents, mathematics supervisors, school boards, principals, and other educators to take a fresh, critical look at curricula, instructional materials, and professional development strategies (and the use of Federal resources in these areas) in light of TIMSS and other recent research results and to be prepared, as needed, to reformulate current approaches to improve effectiveness.
- Challenges the nation's colleges and universities to develop rigorous new programs for teacher preparation, stressing both subject matter expertise and pedagogical mastery. These institutions will also need to take a far more active role in enhancing the skills

and knowledge of today's teachers and principals, working closely with States, local school districts, and schools in the process.

- Challenges professional organizations in mathematics, science, engineering and technology, health, accounting, transportation, and other fields to partner with schools, parents, students, community organizations, and business and industry in developing a strong network of local partnerships aimed at raising student achievement.
- Challenges U.S. families to provide strong support and encouragement for their children to reach high standards of achievement in mathematics and science.

These challenges are focused on the immediate, urgent need to improve mathematics education in grades 5-8. But to be fully effective, this effort must broaden to include both mathematics and science in all grades once the immediate needs have been addressed.

II. PRIORITIES FOR ACTION

Consistent with the President's directive, this action strategy identifies steps that Federal agencies, along with their partners, can take to help students reach challenging standards in mathematics in grades 5-8 and to ensure that Federal resources will effectively support State and local reforms. It is based on the efforts of the interagency working group, which reviewed the current state of mathematics education, consulted with other Federal agencies and with outside organizations, and reviewed Federal programs before identifying three priority areas for action. (See Appendices 3-6 for more detailed information.)

The Federal Role

While education is a national priority, it is primarily a State and local responsibility. The Federal role is to provide good information, effective tools, and financial support that will assist States and local communities in ensuring that all of their students have the mathematical skills they need to succeed in the workplace as productive citizens. This includes promoting effective partnerships that mobilize support from the community -- students, parents, educators, business leaders, volunteers, and concerned citizens from all walks of life -- to that end.

Priorities for Action

Therefore, the priorities of this action strategy will focus Federal investment on:

- Assisting States, local school districts, and the nation's colleges and universities to provide the skills and knowledge that **equip teachers in grades 5-8 to teach challenging mathematics** content in effective ways, with high expectations for their students;
- Assisting States and local school districts to **select and implement high-quality, standards-based curricula** and **instructional materials**, including effective use of educational technologies; and
- **Building parent and public understanding** of challenging mathematics in grades 5-8, and **gaining public support** for raising student achievement toward high standards.

Scope and Scale

In grades 5-8 there are approximately 13.5 million students taught by about 320,000 teachers of mathematics. These students and teachers are distributed among 34,000 schools in close to 15,000 districts. Many of these schools and districts are already actively involved in setting high standards for instruction and student achievement and are implementing plans to achieve them.

The core of this action strategy is assisting all schools and districts to make more effective use of Federal resources in their efforts to address these priorities with respect to mathematics in grades 5-8. The Department of Education and the National Science

Foundation will provide opportunities for districts to accelerate their progress toward improved achievement in this area through incentives for enhanced coordination, planning, and implementation. Districts that serve large numbers of disadvantaged students will receive particular attention. The number of districts, schools, teachers, and students served will depend largely on the level of resources that can be devoted to the acceleration effort and the readiness of districts to respond.

At the same time, an effort at public information and engagement provides a much-needed complementary mechanism to reach a broader base of students and their families in a more timely fashion than can be accomplished through these core activities. The participating Federal agencies, with their ties into the science, mathematics, engineering, and technology communities, are well-positioned to encourage these communities to cooperate in spurring such an effort.

Finally, it is not enough to address only today's teachers and implementation of instructional materials and technologies available now. Approximately 30,000 new teachers of mathematics in grades 5-8 are needed each year. At the same time, development of learning technologies is extremely rapid, and adaptation of curricula to accommodate this pace is a continuing concern. Addressing these issues is also an important part of the action strategy.

Progress in any one of the three priority areas -- teachers, instructional materials and technology, and parent and public information and engagement -- will often depend on and demand improvement in others. For instance, the introduction of high-quality instructional materials will have little impact if teachers are not trained to use those materials effectively. The action plan must work on all fronts in order to make progress toward improved student achievement. The action plan below first provides an orientation to existing resources and specific new joint activities. The final sections are organized around the three priority areas.

III. ACTIONS TO STRENGTHEN THE IMPACT OF FEDERAL RESOURCES

The bulk of the Federal resources for improvement in K-12 mathematics and science education flows from the programs of the Department of Education and the National Science Foundation. (See Appendix 4 for a summary.) Developing a coherent approach to strengthening the impact of Federal resources used to improve mathematics achievement in grades 5-8 begins with these programs. Drawing on the resources of other Federal agencies in an effective manner can then follow.

Current Federal Resources

In FY 1997, the National Science Foundation invested $377 million in K-12 science and mathematics education, including investments in the undergraduate preparation of teachers. The funds go largely to colleges and universities, State and local educational agencies, and nonprofit organizations. They are awarded through competitive review of proposals for funding of specific projects. Over the past few years, the Foundation has placed a high priority on system-wide reform of mathematics and science education. It asks local and State educational agencies to align resources of all types, including those obtained through other Federal programs, to effect change. The Foundation highlights specific areas of emphasis within broader programming, establishes clear priorities for funding within the criteria for selection of awards, and holds grantees accountable for performance. Over the years, projects aimed specifically at mathematics in grades 5-8 have been comparatively scarce.

The Department of Education allocated approximately $8 billion in FY 1997 through three major formula grant programs (Goals 2000: Educate America Act; Eisenhower Professional Development State Grants; and Title I: Education for the Disadvantaged) that include improved achievement in mathematics and science among their objectives. Goals 2000 aids States and school districts to develop and implement challenging academic standards and upgrade teaching and learning

in order to reach the National Education Goals, including the goal of becoming first in the world in mathematics and science. The Eisenhower program places an explicit focus on science and mathematics. Of the $310 million appropriated for FY 1997, $250 million was required to be used for staff development in mathematics and science.

The 1994 reauthorization of Title I placed new emphasis on helping disadvantaged students meet the same challenging academic standards expected of all children. States are currently developing standards and standards and assessments in reading and mathematics consistent with that emphasis. The Department of Education works actively with States and school districts to identify actions that can be taken to achieve significant change, provides information and examples, and makes technical assistance available as needed.

Title I Schoolwide Programs

The 1994 reauthorization of Title I gave the program an entirely new purpose, namely, to teach disadvantaged students to the same high standards to which all other students are held. States are now in the process of establishing assessment mechanisms to measure students' progress against such standards, in at least reading and mathematics. In addition, the reauthorization lowered the eligibility threshold for Title I schoolwide programs. Schools with at least 50 percent of students from low-income families may now use their Title I funds (along with other Federal, State, and local funds) to make comprehensive improvements in the instructional program of the entire school, rather than providing discrete services to individual children. This change gives those schools the flexibility, for instance, to use Title I funds to upgrade the mathematics curriculum for all students.

A dozen other departments and agencies sponsor activities that relate to, and could promote, standards-based education that improves students' mathematics and science learning and overall academic performance. In general, these agencies focus far more on science than mathematics, and commit modest resources to improving K-12 education. In general, their activities are related to their missions. For example, the U.S. Environmental Protection Agency makes awards to schools, state agencies, nonprofit agencies and universities for activities that focus on environmental education. Most agencies offer staff and facilities, often on a volunteer basis, to support local schools and teachers and have developed and are sharing supplementary instructional materials on their Web sites.

Mathematics Education and the Department of Defense

Two agencies within the Department of Defense (DoD) offer complementary approaches to introducing rigorous national standards in their educational activities.

The DoD Education Activity (DoDEA) provides education for military and civilian dependents overseas (DoD Dependents Schools or DoDDS) and on some military bases in the U.S. (DoD Domestic Elementary and Secondary Schools or DDESS). DoDDS is essentially an autonomous school system that has developed a mathematics curriculum based on the NCTM standards, adopted standards-based instructional materials for use throughout all the overseas schools, and is continually training teachers in these materials and strategies using teacher-leaders. DDESS schools operate independently and cooperate with local education areas in addressing standards. As the DoDEA structure solidifies, there will be system-wide commonality in curriculum, instructional materials, and student assessment aligned with the NCTM standards.

The National Security Agency established a Mathematics Education Partnership Program (MEPP) in 1991. MEPP sponsors over a thousand talks per year to schools and colleges through its Speakers Bureau. It donates excess computers to classrooms, sponsors seminars and inservice teacher training, and conducts extended summer workshops for teachers at all levels. These MEPP activities, including projects such as collaboration with the University Corporation for Atmospheric Research's *Project SkyMath*, are all informed by the NCTM Standards, which are an explicit subject of study and reference at MEPP's Summer Institutes for Teachers. For a description, see www.nsa.gov.8080/programs/mepp.

Strengthening the Impact of Federal Resources

Using Existing Programs

The first step in moving forward is to make the most of existing programs aimed at improving student achievement through rigorous standards across all subject areas and all grade levels. Such programs provide a fundamental level of information and opportunity important for progress, but currently have limited focus on mathematics in grades 5-8.

Within those existing programs, the participating agencies will promote means of emphasizing high-quality, standards-based mathematics in grades 5-8. For example, the competitive programs at the National Science Foundation can incorporate priorities for work in this area in selection criteria, and the Department of Education can enhance the level of technical assistance it provides to State and local educational agencies. Expanding the scale of such programs will also help, as will the development of new programs in the individual agencies, but issues of scope and synergy remain.

Creating Synergy

The programs of the Department of Education and the National Science Foundation have different approaches and strengths. The Department generally provides large-scale, flexible support directly to State and/or local educational agencies for improving teaching and learning to high standards, coupling this support with technical assistance. NSF's portfolio is much smaller in scale, is targeted at improving mathematics, science, and technology education, and is established through competitive processes. To create synergy, this action strategy combines the agencies' strengths, permitting those involved with upgrading mathematics professional development and instruction through major Department of Education programs to draw on NSF's competitive programs to step up the pace of change.

The work of improving student achievement must be done at the State and local level, and, most fundamentally, within individual schools. State and local educational agencies can maximize the impact of Federal resources by choosing to use them in a coordinated, concentrated way. Thus, the National Science Foundation and the Department of Education will champion State and local educational agencies in the strategic use of all types of Federal, State and local funds toward improving mathematics achievement, offer examples of effective coordination in the use of such funds, and provide incentives to initiate effective improvements. At the same time, they will work together to encourage the nation's colleges and universities to do a better job in educating future teachers for the work they will do in the schools and will combine with other agencies in a broad program of public information and engagement.

Pooling Resources to Enhance Student Achievement

Kenton Elementary School in Portland Oregon, and 12 other schools in the region decided to place a high priority on student achievement using Title I and other resources. During the 1995-96 school year, the schools held full-day, weekly workshops on best teaching practices as identified by the school principals. The principals developed a regional Title I plan and, with the help of consultants, have all staff working together to implement it. Title I staff worked with regular classroom teachers on new strategies, and Kenton staff agreed to use Title I benchmarks and assessments for all students.

Kenton's curriculum emphasizes interactive writing and vocabulary development, and uses innovative mathematics materials. Teachers use cooperative learning and peer tutoring to help students grow toward proficient and advanced levels, and students are encouraged to analyze, evaluate, and interpret information. Kenton teachers regularly meet with small groups of students outside of class to give extra help in mathematics, reading, or writing. Teachers also train the school's many volunteers to support the benchmarks while working with students. Assessments indicate some success in the early years of this effort to improve instruction. The percentage of third-graders scoring in the advanced category in mathematics increased from 15 percent to 35 percent.

New Joint Activities

The Department of Education and the National Science Foundation plan a set of joint activities that are the synergy-producing elements of the action strategy. They will include the other participating agencies to the extent possible.

- **Competitive planning grants to accelerate strategic use of resources in improving achievement in mathematics.**

  The Department and the Foundation jointly will provide competitive planning grants to jump-start intensive, coherent efforts to upgrade mathematics instruction that use Federal, State, and local funds to sustain long-term improvements and provide models for the future. Funds may be used to initiate planning and to contribute toward one-time costs of initiating a coherent set of activities. A principal target for the agencies' cooperative activities will be middle schools with schoolwide Title I programs and districts with many such schools. This focus permits large numbers of disadvantaged students to benefit from the enhanced synergy of Department and Foundation programs.

  To support the joint effort, the Department of Education will provide active encouragement and support, opportunities to pool resources originating in the Department through waivers, consolidated programming, and information and technical assistance, as appropriate. The National Science Foundation will emphasize support for development and implementation of State and local strategies for improving mathematics education in grades 5-8.

  The Department and NSF will convene a national conference of key actors in determining how Federal resources are used by States and local districts. Participants will include state and local leaders of Title I, Goals 2000, Eisenhower, and State, urban and rural systemic initiative activities.

Texas Statewide Systemic Initiative

The NSF-supported Texas Statewide Systemic Initiative (SSI) also operates the U.S. Department of Education's Comprehensive Assistance Center for Elementary and Secondary Act Programs in Texas, bringing into one unit the state's leadership both in science and mathematics education and in Title I technical assistance. In the past two years, the SSI has provided incentive grants and technical support in integrating their Title I, Eisenhower, and professional development activities in mathematics and science to more than 100 Title I schools serving more than 100,000 Title I students. In July, 1995, the SSI held an intensive summer institute designed to support Title I schools in (1) reconceptualizing the use of formula funds, (2) adopting mathematics curricula keyed to high standards, and (3) adopting effective schoolwide program models. As a result of the SSI/Title I collaboration, state mathematics and science leaders are now active members of school support teams engaged in mentoring over 700 Texas Title I schools. At the same time, increasing numbers of teachers in high poverty/high minority schools are being trained as SSI mathematics, science, and technology specialists.

- **National Convocation on middle school mathematics.**

  The two agencies will sponsor a national convocation on middle school mathematics to initiate a continuing dialogue on what students need to know and be able to do at this level and what this means for effective classroom practice.

- **Public Understanding and Engagement Mathematics Initiative.**

  NSF and the Department will support a joint, multi-year effort to create a large-scale, national public education effort that is coupled with extensive opportunities for active engagement of students, parents, and the larger community in the support of mathematics education.

- **Coordinated research and informational activities.**

  The Department and NSF will undertake a coordinated set of research and informational activities around mathematics in grades 5-8. These activities include release of a TIMSS resource kit that contains specific tools for professional development, curriculum analysis, and achievement benchmarking; readministering TIMSS in the spring of 1999 to get updated information on our international standing; a program of research informing continued development of the eighth grade national test over time; and a sustained agenda of basic research in teaching and learning of mathematics, including research on the use of learning technologies.

- **Systematic involvement of other agencies.**

  The Department and the Foundation will work systematically with other agencies to enhance the impact of Federal resources by upgrading their activities to reinforce an approach based on high standards for mathematics in grades 5-8.

Each of the specific items above will be aimed at mathematics in grades 5-8, reflecting the urgent need to raise achievement at this stage of the educational process. However, the activities described above can also serve as models for more effective approaches to educational change in the broader arena of mathematics and science education. The working group strongly endorses the idea of future efforts that would encompass additional aspects of K-12 mathematics and science education.

PRIME in Pittsburgh

The Pittsburgh Reform in Mathematics Education (PRIME) project supports teachers in the classroom implementation of standards-based mathematics instruction and assessment in grades K-12 through the use of exemplary materials. PRIME provides teachers with a broad knowledge base in both the mathematics content and the successful mathematics pedagogy needed to implement the new materials successfully.

Funded under National Science Foundation guidelines as a project of *Local Systemic Change through Teacher Enhancement in Mathematics*, PRIME provides all 924 Pittsburgh public school teachers of mathematics with a range of experiences that include summer workshops; release-day professional development workshops; and individualized, in-class support provided by demonstration teachers within each school. Teachers of grades 6-12 receive 234 hours of professional development, and teachers of grades K-5 receive 102-132 hours. By equipping *all* Pittsburgh mathematics teachers with the knowledge, skills, and support necessary for using exemplary materials and assessment, PRIME is designed to ensure that *all* students experience a coherent mathematics program that is expected to yield high achievement at *all* levels.

This four-year project, funded for over $ 3 million, is a model for its ability to leverage an additional $ 6.7 million in cost-sharing from district funds and commitments from Eisenhower and other Federal dollars.

IV. EQUIP TEACHERS TO TEACH CHALLENGING MATHEMATICS

In grades 5-8, students should begin to move from mastering the basics of arithmetic to using arithmetic in solving complex problems and learning the foundations of geometry, algebra, probability, and statistics. Teachers must know substantial mathematics and have strong pedagogical skills if they are to be effective in helping their students make this transition and meet high standards. Practices in teacher education, licensure and certification, and in-service teacher enhancement do not always reflect these needs.

Over the next ten years, approximately 2 million new teachers will enter the workforce. It is essential that these future teachers receive adequate preparation in mathematics content and pedagogy and in the use of contemporary technological tools before they enter the classroom. And many of the approximately 320,000 teachers who are already teaching mathematics in grades 5-8 would benefit from upgrading their math content knowledge and teaching skills.

Quantitative Literacy Program for Alabama K-12 Teachers

The Quantitative Literacy Program for Alabama K-12 Teachers, a project administered by the University of Alabama and supported by the Eisenhower Professional Development program, assists elementary and secondary teachers in implementing the probability and statistics goals for grades K-12 as outlined in the National Council of Teachers of Mathematics standards. The program's workshops teach quantitative concepts in the context of solving meaningful problems, with content taught in reference to teaching strategies that participants use when they return to their classrooms. The program includes a pre-workshop orientation, an intensive one-week training workshop, and two follow-up sessions. In the follow-up sessions, teachers describe how they planned, taught, and assessed their own Quantitative Literacy units. They also present examples of their students' projects. The project is currently operating in 14 of the 67 counties of the State.

This action strategy addresses both the professional development of teachers who are already in the classroom and the preparation of new teachers. In order to assist current teachers, the strategy promotes sustained and intensive professional development activities that are based on mastery of mathematical content and tied to high-quality instructional materials and technology. Teacher preparation activities will aim at preparing future teachers of grades 5-8 to teach effectively the challenging mathematics content geared to national standards of excellence.

The increased demand for high-quality professional development generated by these plans could, without action now, exceed the capacity of those individuals and organizations currently supplying it. Thus, an essential component of fully equipping teachers will be ensuring the presence of a sufficient cadre of individuals and institutions skilled in providing professional development. This will require working with the mathematics communities, institutions of higher education, and other Federal agencies to help ensure the capacity to respond effectively.

To address **professional development needs of current teachers**, the National Science Foundation and the Department of Education will:

- Stimulate state and local educational agencies to implement comprehensive programs of sustained, intensive, high-quality professional development for teachers of mathematics in grades 5-8. The two agencies will make such efforts the cornerstone of their new competitive planning grants, with emphasis on incorporating resources from Title I schoolwide programs and on involving all teachers in target schools. They will continue existing programs that provide resources for districts to implement professional development programs, incorporating priorities for activities involving teachers of mathematics in grades 5-8, where feasible.

- Initiate a short-term effort to strengthen the pool of talented, committed individuals able to provide exemplary professional development for classroom teachers. The agencies will provide opportunities for competitive support of projects that will provide intensive training experiences for those who will lead future teacher training efforts.

- Support the creation of materials for professional development of teachers of mathematics in grades 5-8 that are grounded in the NCTM standards, are tied to newly emerging educational materials and technologies, appropriately reflect the rigor of the NAEP and TIMSS assessments, and assist teachers to link mathematics to real-world skills and applications.

- Support wider opportunities for teachers to help one another with content knowledge and teaching skills through such activities as dissemination of information about effective forms of professional development and encouraging the development of master teachers (including those recognized through the Presidential Awards for Excellence in Mathematics and Science Teaching and the National Board for Professional Teaching Standards Certification), mathematics specialists, and teacher networks.

Improving Teaching Through Distance Learning

The Department of Education's Star Schools Program provides quality, cost-effective instruction through distance education technologies to more than 1,640,000 learners annually in 50 states and U.S. territories. Although the program began with small rural schools in 1988, it is now equally valuable to schools in large urban areas.

The *Star Schools: The Next Generation* project of Oklahoma State University and Northern Arizona University delivers the "Getting Ready for Algebra" program, which provides simultaneous student instruction and teacher training to middle school students and teachers. Its units are student-centered and activity-oriented and emphasize learning by discovery. They focus on the big ideas common to arithmetic and algebra.

Similarly, the United Star Distance Learning Consortium project, led by Education Service Center--Region 20 in San Antonio, Texas, offers the *Algebra and Geometry Applications for Teachers* program, inservice training. The project models worthwhile mathematical tasks and helps teachers improve their ability to develop these tasks. The focus of the project is on mathematical topics that illustrate connections to real-life problems and exciting mathematics.

To promote **improved preparation of future mathematics teachers for grades 5-8**, the Department of Education and the National Science Foundation will:

- Prepare and disseminate widely a study on State licensure requirements, focusing particularly on requirements for middle school teachers of mathematics, comparisons to other nations, and the impact of licensure requirements on the knowledge of mathematical concepts that teachers bring to their work in the classroom.

- Provide incentives for appropriate organizations to develop voluntary national standards for the preparation of teachers of mathematics.

- Support the development of materials for preparation of K-8 mathematics teachers that are grounded in the NCTM standards, are tied to newly emerging instructional materials and educational technologies, and reflect the rigor of the NAEP and TIMSS assessments.

- Challenge the Nation's colleges and universities to step up to the needs for preparing a new generation of teachers for the 21st century by encouraging, supporting, and funding the development of teacher preparation approaches that:
  - more tightly link college departments of mathematics and schools of education;
  - include courses focusing on developing the background concepts for the rigorous mathematical content that future teachers of mathematics in grades 5-8 will teach;
  - demonstrate effective classroom practices; and
  - involve local K-12 schools in the design of teacher preparation requirements.

New Initiatives in Teacher Preparation

President Clinton has proposed a $350 million initiative to attract talented people of all backgrounds into teaching at low-income schools across the U.S., and to improve dramatically the quality of training and preparation given to our future teachers, with an emphasis on mathematics and reading. Under the initiative, new scholarships would help bring nearly 35,000 outstanding new teachers into high-poverty schools in urban and rural areas over the next five years. These scholarships could cover costs of tuition, room, board, and other teacher preparation expenses -- and could help fund additional preparation during the first two years of teaching.

The initiative will also provide competitive five-year grants to 10-15 national lighthouse models of excellence -- institutions of higher education that operate the highest quality teacher education programs. Each institution receiving a lighthouse grant will use most of these resources to assist several other institutions of higher education improve their teacher preparation programs, helping to strengthen the preparation of future teachers at an estimated 150 institutions of higher education across the nation.

Teacher Preparation in Louisiana

What began as a movement to change the way mathematics is taught in grades K-8 in the Louisiana State Systemic Initiative has grown into a program that addresses the way in which teachers are taught. The Louisiana Collaborative for Excellence in the Preparation of Teachers is producing future teachers who will transform teaching practice in the state. Initiated with NSF funding, the Collaborative is also using funds from the Eisenhower Professional Development Program to support the participation of teachers in its activities.

In the first three years of the program, over 100 college faculty (both mathematics faculty and education faculty) on 15 campuses across the state have been involved in the project, 69 courses for future teachers have been revamped, and approximately 20,000 future teachers have been affected.

The central principle is to incorporate in the education of future teachers the new methods of teaching mathematics that they will be expected to implement in the classroom. Examples of these methods include working in small groups on challenging problems and using technology resources such as calculators or the Internet.

V. IMPLEMENT CURRICULA, INSTRUCTIONAL MATERIALS, AND EDUCATIONAL TECHNOLOGIES IN CLASSROOMS

The TIMSS results showed that the content of curricula and instructional materials used in U.S. classrooms in the middle school years in 1995 differed from those in high performing countries in significant ways. The content taught in most U.S. eighth-grade mathematics classrooms would be found in the seventh grade in high-performing nations. Our low expectations for student performance are also shown by the fact that only about 25 percent of U.S. eighth grade students are enrolled in algebra courses, while in high-performing nations virtually all students have the opportunity to master the foundations of algebra and geometry by the end of eighth grade.

In addition, TIMSS noted that middle school mathematics materials covered more topics and were less focused in the U.S. than in leading countries. For example, typical American eighth grade mathematics textbooks in 1995 covered as many as 35 major topics compared to as few as 10 such topics in Japanese textbooks, leaving little time for teaching for student mastery and depth of understanding.

New, comprehensive mathematics instructional materials, linked with high standards for mathematical content and pedagogy and aligned with the NCTM standards, are now emerging from development and reaching the market. These materials provide a range of different approaches to classroom instruction, while focusing on 15 or fewer topics per year.

Supplementary materials can permit teachers to tailor instruction to particular classrooms, facilitating the transition to new curricula. They can be particularly helpful in taking advantage of new and emerging learning technologies and in providing examples from real life for new concepts.

Selection of comprehensive curricular materials usually takes place at the district or even the State level, whereas the choice of supplementary materials is more likely to be made at the school level. Speeding the transition to more appropriate instructional materials, while tying in professional development for teachers, will have a significant impact on student achievement.

Open *CESAME!*

Northeastern University's Center for the Enhancement of Science and Mathematics Education (CESAME), through its Statewide Implementation Program (SIP), demonstrates how school districts can successfully implement challenging standards-based instructional materials. Through a contractual agreement, the project provides districts in Massachusetts with multi-year funding, technical assistance, professional development guided by curriculum developers, and linkages to statewide reform efforts. SIP also conducts research to determine the most effective model for disseminating such materials. Throughout, SIP works to make districts accountable by collecting data and continually focusing on achieving a sustained, high-quality materials implementation.

Funded by the National Science Foundation's Teacher Enhancement program, SIP provides expertise in implementing high quality materials to any Massachusetts district engaged in mathematics and science reform, and leads one of the five regional centers of the Massachusetts Statewide Systemic Initiative (SSI). This five-year project, funded for over $4.4 million, has leveraged an additional $3.8 million in cost-sharing from district funds, Northeastern University, and the Noyce Foundation.

To assist schools, districts, and States in choosing and implementing effective curricula and instructional materials for mathematics in grades 5-8, the National Science Foundation and the Department of Education will:

- Encourage and support coordinated efforts aimed at:
  - purchasing new instructional materials geared to rigorous standards;
  - providing high quality professional development connected to implementation of new materials; and
  - employing highly skilled mathematics specialists who are prepared to teach the new materials and guide others in their implementation.

Each of these, for example, would be eligible for use of Title I funds, and could be part of the coordinated plans described in applications for the planning grants discussed above.

- Develop and disseminate guides to help interested schools and school districts select instructional materials and software most appropriate for their local needs and undertake the necessary steps to effective implementation. This effort will include reviews of instructional materials and software designated by experts as promising or exemplary.

- Provide technical assistance for schools and school districts in putting new mathematics instructional materials to work in the classroom. NSF-supported curriculum implementation sites dedicated to mathematics materials for grades 5-8 will work with broader technical assistance providers, including the Department's Eisenhower Regional Consortia and National Clearinghouse, as needed.

- Provide teachers and other educators with information on how they might use assessment in planning instructional improvement strategies. These materials will include information on how best to use results from the voluntary national mathematics test -- to interpret them to students and parents, place them in appropriate context, and improve mathematics instruction.

- Seed research and development of powerful models for integrating technology into classroom practice and informal learning environments. This will include support for critical expansion and evaluation efforts preceding commercialization of these models. K-8 mathematics will be a high priority in the near term.

Eisenhower Regional Consortia for Mathematics and Science Education

The mission of the ten Eisenhower Regional Consortia is to provide a field-based national infrastructure for systemic improvement of science and mathematics education. Projects provide information on curriculum, assessment, and teaching practice; conduct workshops and training; and serve as advisors to the field.

One example of the work of the consortia is the 1996 publication by the WestED consortium of Tales From the Electronic Frontier. This is a collection of ten teachers' narratives regarding their use of the Internet to enhance science and mathematics instruction and create opportunities for their own professional growth. The accounts describe using this resource for project-based learning, for making abstract scientific principles more concrete, and for promoting deeper understanding. Each story provides information on related resources and programs, and concludes with a section of questions and issues to stimulate further thought and discussion.

"Hoop Happenings" is the tale of a mathematics communication project between students at the Drexel Hill School in Philadelphia, Pennsylvania, and senior education majors at Iowa State University. During their teaching methods class for elementary mathematics, each student at Iowa State is paired with a group of students at the elementary school in Philadelphia with whom she interacts (via e-mail) over a math problem she defines each week. The interactive discussion provides the education majors with insight into children's thinking; for the children the project strengthens their abilities to solve problems and to discuss their problem solving approaches.

Tales can be found on WestED's WWW site at http://www.wested.org/tales.

- Continue competitive support for the development of supplementary materials, with new priority for efforts aimed at mathematics in grades 5-8, to assist schools and districts in making the transition to standards-based comprehensive materials.

While several other Federal agencies have long worked to support educational improvement efforts, in the past, few other agencies have contributed to the development of standards-based instructional materials in mathematics and science. This is changing, and there are significant contributions that other agencies can make in this area, consistent with their primary missions. The development of supplementary materials with mission-oriented situations that generate real-life problems and the delivery of such materials through technology are key potential contributions.

- Agencies will work in cooperation with NASA and NCTM to develop standards-based materials along the lines of NASA's "Mission Mathematics." These materials illustrate the use of mathematics in engaging, real world examples related to the agency mission.

- The Department of Education is chairing a Federal Government-wide working group that has already begun to promote and develop -- and make it easier for teachers and others to find -- high-quality educational materials, including instructional units and related materials, for use on the Internet. This group's role is to take the rich informational resources of organizations such as the Census Bureau or the U.S. Geological Survey, and make them easier for teachers and others to find and use. The first priority will be to identify materials that support teaching of challenging mathematics.

- The Departments of Defense and Education and the National Science Foundation are leading an interagency review of Federal activities related to research in learning technologies in order to establish effective practices for their use.

Each of these efforts could make new types of materials and capabilities possible in the future. Activities that enable students to achieve to high standards play an important role in all these Federal activities.

NASA's Mission Mathematics

The recent production of "Mission Mathematics" by NASA demonstrates how an agency can base its educational work on national standards. These three volumes of problems and activities are the descendants of NASA's first mathematics curriculum supplement, "Space Mathematics: A Resource for Teachers," published in 1972. That popular title was updated repeatedly over the years. "Mission Mathematics," however, is totally revamped to accord with national standards. Indeed, the subtitle is now "Linking Aerospace and the NCTM Standards." The three volumes are divided into K-6, 5-8, and 9-12, and the contents of each are keyed not only to NCTM's curriculum standards, but also to those for teaching and for student assessment. Examples of activities include calculating orbits, collecting and analyzing specimens, and planning for spaceflight needs.

This linking to standards was accomplished by making "Mission Mathematics" a joint project of NASA and NCTM. Writing teams included teachers, supervisor, and university professors working in consultation with NASA representatives. Their drafts were field-tested by classroom teachers and reviewed by NCTM's Educational Materials Committee. The results are attractive and modestly priced, with publicity, marketing, and distribution through NCTM's established network.

VI. BUILDING PUBLIC UNDERSTANDING AND SUPPORT.

American students should leave eighth grade prepared to pursue the higher-level mathematics and science courses that are the gateway to college, good citizenship, productive employment, and lifelong learning. In realizing this vision, it is essential that educators, parents, the broader community, and students themselves understand what high standards in mathematics look like, why they are important, and how they can work to achieve them. This outcome requires activities and information that reinforce the classroom experience and convey the importance of mathematics achievement. Such activities should draw on the support of parents, the professional community of mathematicians, scientists, and engineers, business, academia, and the broader public.

This section of the action strategy includes two complementary elements. The first consists of efforts to make high standards fully and clearly understood. If parents and students and teachers don't know where they should be headed -- what they agree students should know and be able to do -- it is hard to pull together to get there. Schools must have a clear sense of what they are doing and be able to communicate effectively with parents as well as work to invite active parental participation.

The second element builds on the first through partnerships that bring together the many groups that can contribute to helping students achieve high standards in mathematics. These partnerships will elevate the importance of mathematics achievement and provide clear avenues through which interested members of the mathematics, science, engineering, business and education communities, as well as parents and interested citizens, can contribute to efforts to raise mathematics achievement.

Saturday Schools Provide Tutoring Boost

The George B. Thomas Sr. Learning Academy Inc. (known as Saturday School), with modest support from the National Science Foundation, has provided free tutoring and mentoring to minority students in Montgomery County (MD) for nearly 11 years. Spearheaded by members of the Mu Nu chapter of the Omega Psi Phi fraternity, the program began in a public housing community's day-care center, but is now located at Sherwood High School (Olney, MD) and Springbrook High School (Silver Spring, MD).

About 180 students and 100 tutors--engineers, mathematicians and others (including high school students fulfilling Maryland's community service graduation requirement)--are registered at the centers; there is often a waiting list of pupils because there aren't enough tutors. Saturday School views itself as a partner with the students' schools; principals refer students to the program and teachers advise tutors on where students need help. Montgomery County Public Schools contributes classrooms, supplies, and training for tutors and parents. The sessions last 2 or more hours; tutors work with students on a wide range of mathematical topics and help students prepare for the Scholastic Assessment Test. Parental participation is required; about one-fifth of the parents tutor, with the remainder providing support and assistance in other ways.

The Department of Education, the National Science Foundation, and other Federal agencies will foster the partnerships by promoting a national dialogue on improving mathematics, acting as a clearinghouse for information and proven approaches to action, helping partners to develop exemplary materials that can be used in their State and local efforts, and mobilizing staff and resources to support local partnership efforts. Effective partnerships must build upon and complement what goes on in the schools. Thus, teachers and school administrators must be vital participants, either formally or informally.

In order to support these strategies, the Department of Education and the National Science Foundation have taken the initial steps to move forward on the ***Public Understanding and Engagement Mathematics Initiative***, an activity designed to create a large-scale, national public education effort that is coupled with extensive opportunities for active engagement of students, parents, and the larger community in the support of mathematics education.

Collectively, the projects selected through this initiative will:

- Use simple and compelling messages to tell the public what middle school students should know and be able to do in mathematics, illustrating the points through sample problems and student work;
- Emphasize important mathematics and interesting problems that engage both middle school students and the public;
- Illustrate the relevance of achievement in challenging mathematics to success in college and a wide range of careers;
- Create well-designed products that will engage the public in doing mathematics;
- Target a variety of media through a plan for disseminating the products;
- Support active partnerships to engage parents and the community, including those with professional organizations, scholarly societies, colleges and college students, and the business sector;
- Mobilize adult volunteers to assist students in a variety of settings (for example, summer, after-school, and weekend programs; contests);
- Develop printed and Internet-based supporting materials as guides for volunteers; and
- Encourage highly visible local and national events and activities that engage the community.

In other activities designed to **build public understanding**, the Department and the Foundation will:

- Sponsor a national convocation on middle school mathematics to initiate a continuing dialogue on:
  - what we should expect our students to be able to achieve in mathematics by eighth grade and beyond;
  - exemplary practices in professional development, curricula, instructional materials, and technologies; and
  - building partnerships for parental involvement and community support to help students meet high expectations.
- Seed the continuing national dialogue by providing a wide variety of sample items illustrating the level of expectations set in State and national standards, examples of student work, and information on curricula, instructional methods and technologies that support high standards.
- Create an easy-to-use mathematics Web site providing information on national standards; standards-based instructional units for teachers; information on the national test, including sample problems and examples of student solutions; and all the other materials developed or identified as part of this action strategy.

Additional **partnership activities** will take advantage of connections the Department and the Foundation maintain in the course of their on-going work. The agencies will:

- Facilitate the connection of national organizations having interests in helping to raise levels of achievement in mathematics and science (for example, professional societies of mathematicians, scientists, and engineers) with State, local and community-based organizations having similar purposes.

- Develop systematic mechanisms for the headquarters and field offices of relevant Federal agencies to participate in the partnerships.

The Department of Energy's STEM Initiative

DOE plays an important role in science education due especially to its premier national laboratories, which have a history of staff working in cooperation with the Nation's education system and other agencies. By opening DOE's laboratories to students and teachers, agency staff offer hands-on research opportunities and technical support for developing Internet and other technical tools to enhance educational experiences. The Department is in the process of creating a National Energy Laboratory Research Participation Program that will coordinate such activities across all DOE laboratories.

Among the Department's goals for science, technology, engineering and mathematics education, two are particularly relevant to this action strategy:

- Develop Internet based education technologies for elementary through college students and faculty; and
- Enhance DOE's community outreach activities for education at its R&D facilities and sites.

DOE strongly supports the revitalization of educational activities consistent with its energy and defense missions. An effort is underway to coordinate the use of DOE resources in promoting the public's understanding of science and ensuring a diverse workforce for the Nation's science and technology infrastructure.

- Encourage and support efforts by business and professional organizations to use the Internet as a new tool for providing on-going tutoring, homework help, and motivation to students.

- Challenge colleges and universities to partner with middle and high schools to help ensure that students know what it takes to go to college and that they have access to a rigorous college preparatory mathematics curriculum.

VII. CONCLUSION

The time is ripe for a concerted effort to improve the achievement of U.S. students in mathematics and science. Recent results from international testing have raised the consciousness of the American public about the importance of establishing and meeting high standards in mathematics and science. As the test results have made clear, too many of our schools are failing to provide the instructional experiences that will enable our students to achieve at the levels we should expect from them.

By focusing our immediate attention on improving performance for middle school mathematics, we will be able to give local, State, and Federal educational agencies a target for action that is substantive, timely, and sufficiently constrained that it is reasonable to anticipate progress. As well as addressing an area of current concern, we can develop models for future action across disciplines and grades.

The interagency cooperation stimulated by the effort to produce this action strategy should have a lasting impact on the effectiveness of Federal programs and activities that support improving achievement in mathematics and science education. In addition to bringing the two agencies with the most extensive programming in this area together, the effort spurred further contact with other potential Federal partners, both those that have a tradition of strong presence in mathematics and science education and those that are new to such efforts.

A New Federal Education Partnership Program at the Department of Transportation

Magnetic levitation trains, highways that provide constant updates on traffic conditions ahead and geopositioning satellites that enable travelers to determine where they are anywhere on earth at any time: these are transportation "dreams" well on their way to becoming realities. Such dreams can lead to highly-paid jobs for those with the appropriate skills. Too many students, ill-prepared for such jobs, must leave the dreaming to others.

Through the new Garrett A. Morgan Technology and Transportation Futures Program, the Department of Transportation (DOT) will stimulate public-private partnerships to help students and their families understand the importance of mathematics and science for future careers and to make math and science relevant and exciting for students inside and outside the classroom. Such partnerships will encompass interagency collaboration, government-industry cooperation and community involvement. Sample activities include:

- With the Department of Education and its business and community partners, encouraging the transportation community to participate in the America Goes Back to School program, to build support for mathematics, science, and technology achievement.
- Helping to change public perceptions about the importance of studying mathematics and science by creating awareness of the wide variety of exciting jobs in transportation that require those skills.
- Building upon DOT's 300+ adopted schools to provide mentors, tutors, career information, and other forms of support for math literacy;
- Encouraging staff to support student mathematics achievement in their local communities, by supporting summer, after-school and weekend activities that help students learn or by serving as "telementors," helping students with homework over the Internet.
- Bringing together private sector sponsorships and expertise and nationally recognized teachers to develop exciting materials with a transportation focus for teaching mathematics, science, and technology.

The effort has been particularly timely in view of the growing interest among mathematicians, scientists and engineers, and business and professional organizations in helping K-12 schools to improve the performance of their students in mathematics and science. The Department of Education, with its links to State and local education agencies and community groups, and the Federal science and technology agencies, with their ties to mathematicians, scientists, and engineers and their national professional organizations, can help make important connections to spur the development of effective partnerships.

But the action strategy is only the beginning of the effort. The interagency cooperation must continue and move to the substantive agenda of implementation. The Department of Education and the National Science Foundation are committed to meeting the challenge of continuing cooperation so that their programs work in concert. They will enable the development of appropriate mechanisms to keep other agencies and the professional scientists, mathematicians and engineers with whom they work actively involved in improving achievement in mathematics and science education. Perhaps most importantly, they will keep the goal of raising the achievement of all American students in mathematics and science at the forefront of their attention at a time when a strong foundation in mathematics and science for all students has never been more important.

APPENDIX 1

PRESIDENTIAL DIRECTIVE

March 6, 1997

MEMORANDUM FOR THE:
SECRETARY OF EDUCATION
DIRECTOR OF THE NATIONAL SCIENCE FOUNDATION

SUBJECT: Preparing Students to Meet National Standards of Excellence in Eighth Grade Math and Improving Math and Science Education

Since the early 1980's, U.S. elementary and secondary school students have begun taking tougher courses, and we are starting to see the results. National Assessment of Educational Progress scores have improved in math and science, with gains in mathematics equal to at least one grade level. On the SAT, average math scores are at their highest in 25 years, even as the number and diversity of test-takers have increased. However, the eighth-grade results of the 41-Nation Third International Math and Science Study (TIMSS), released this fall, show that the U.S. is below average in math and just above average in science. That isn't acceptable; in this technology-rich information era, our students need to perform much better in both subjects, but especially in math, if they are to excel at higher level math and science courses that are the gateway to college and to citizenship, productive employment, and lifelong learning.

The first step in raising achievement is lifting expectations and setting high standards for what students should know and be able to do. TIMSS, our National Assessment of Educational Progress, and the standards developed by the National Council of Teachers of Mathematics give us a solid framework to build on. Last month, to help parents and teachers learn who needs help, what changes in teaching to make, and which schools need to improve, I asked the Secretary of Education to develop a voluntary national test for individual eighth-grade students based on widely-accepted, challenging national standards in mathematics. The national test will be available to states and local school districts to give to their students in the spring of 1999, and will measure whether students have reached a high level of mathematics proficiency.

The primary responsibility for achieving high standards rests with students, teachers, parents, and schools in local communities across America. However, it is imperative that we work to ensure that federal resources support student success as well. We must ensure that federal programs, research, and human resources are used as effectively as possible to help improve teaching and learning.

Therefore, I direct the Department of Education and the National Science Foundation, together with other agencies identified in cooperation with the Office of Science and Technology Policy and the Domestic Policy Council, to develop an action strategy for using key federal resources to assist states and local school systems prepare students to meet challenging math standards in eighth grade, and for involving the mathematics, scientific, and technical communities in support of these efforts.

The action strategy should include recommendations for the use of federal resources to help states, local school districts and schools to improve teaching, upgrade curriculum, integrate technology and high-quality instructional materials into the classroom, as well as motivate students and help them understand how math concepts are applied in the real world. The strategy should identify significant federal programs, activities, and partnerships available to improve teaching and learning, ensure that these resources are appropriately focused on helping students reach challenging math standards, and determine how these resources can best support state and local reforms. In developing this strategy, the inter-agency group should review the current status of improvements in math education, and identify and address critical areas of need, drawing on research and input from educators and professional organizations.

Because teaching and learning in math and science are so integrally related, and because success in both subjects is vitally important in this information era, the working group should also review how federal resources and partnerships with other organizations can help improve student achievement in science.

The working group should make its recommendations and submit its action strategy to me within 90 days.

WILLIAM J. CLINTON

cc: ASSISTANT TO THE PRESIDENT FOR DOMESTIC POLICY
ASSISTANT TO THE PRESIDENT AND DIRECTOR OF THE OFFICE OF SCIENCE AND TECHNOLOGY POLICY

APPENDIX 2

Voluntary National Tests in Reading and Math: A Strategy to Master the Basics and Reach High Standards

Clear standards of achievement are essential to help instill the skills, American values, and encouragement for hard work that our children need to succeed in school and in life. Toward that end, meaningful standards for what students should be expected to learn and achieve in the basic subjects of reading and mathematics are critical. Reading well by grade 4 and mastering mathematics -- including the foundations of algebra and geometry -- by grade 8 are the gateways for further learning and achievement.

Parents need to know that students have mastered the basics no matter where they live or move in this country. And they have the right to know how well their children are doing compared with students in other schools, states, and countries. To help give parents this information, the U.S. Department of Education is offering every state and school district the opportunity to use voluntary national tests of 4th grade reading and 8th grade mathematics, beginning in 2000.

These rigorous tests will provide parents, for the first time, scores for individual students, measured against widely accepted national and international standards of excellence. Each year, all test items will be released so that parents, teachers, and students can review all aspects of performance, giving states, local communities, teachers and parents the kind of accurate information they need to help students master basic and advanced skills and strengthen academic performance. Most importantly, the tests can galvanize a national effort to improve the odds for students and help ensure that all students master reading and mathematics.

The tests will be modeled on the National Assessment of Educational Progress (NAEP) in 4th grade reading and 8th grade mathematics, and in the case of mathematics will be linked to the Third International Mathematics and Science Study. The NAEP standards reflect a national consensus of what students should know and be able to do when they reach these crucial stages of learning.

The current NAEP is designed to assess how well a sample of students across the entire nation and individual states perform in reading and mathematics. A very small percentage of students participate in NAEP, and no parents know how their own children do on this test. In contrast, the voluntary national tests will provide students, parents, and teachers with meaningful scores to compare individual student performance to widely accepted national and international standards and to identify students and schools that need extra help. These standard measures of excellence will help parents hold schools accountable for improved performance, help teachers and principals improve curriculum and instruction, and give students a guide for charting their own progress.

The National Assessment Governing Board (NAGB) is responsible for the development of the tests. NAGB is a bipartisan, independent board created by Congress to oversee the NAEP. NAGB will seek guidance in test development from a wide range of sources, including the most successful mathematics and reading teachers, parents, governors, and local and state education, civic and business leaders. Individual test scores will not be collected by the federal government; state and local school districts will decide how to use the data. Each test will require approximately 90 minutes of total testing time. States and school districts can administer the tests as part of their local testing programs.

National Science Foundation

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NATIONAL SCIENCE FOUNDATION
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OFFICE OF THE
ASSISTANT DIRECTOR
FOR EDUCATION AND
HUMAN RESOURCES

December 11, 1997

Mrs. Yvonne W. Larsen
President, California State Board of Education
721 Capitol Mall, Room 532
Sacramento, CA 95814

Dear Mrs. Larsen:

California appeared poised to make an important contribution to the national discussion regarding the appropriate balance of mathematical problem-solving, procedural skills, and critical thinking with the September, 1997 proposal of the Commission for the Establishment of Academic Performance and Content Standards. Instead, the decision last week by the California State Board of Education, with little or no public input, to adopt alternative standards vacates any serious commitment to elevating problem-solving and critical thinking skills in K-7 mathematics standards. The Board action is, charitably, shortsighted and detrimental to the long-term mathematical literacy of children in California.

The wistful or nostalgic "back-to-basics" approach that characterizes the Board standards overlooks the fact that the approach has chronically and dismally failed. It has excluded youngsters from engaging in genuine mathematical thinking and therefore true mathematical learning, and has produced a disproportionately mathematically illiterate citizenry.

The National Science Foundation currently maintains a portfolio exceeding $50 million in awards to six public school systems in California (East Side Union, Fresno, Los Angeles, Oakland, Paramount, San Diego). These districts are undertaking systemic initiatives to offer their students much greater opportunities to learn and achieve in high-quality, rigorous, mathematics and science. These awards, though only moving into their second and third years of implementation, are beginning to stimulate significant gains in mathematics and science achievement. A growing body of research also shows significant learning gains elsewhere. You must surely understand that the Foundation cannot support individual school systems that embark on a course that substitutes computational proficiencies for a commitment to deep, balanced, mathematical learning.

We view the Board action in California with grave disappointment and as a lost opportunity for the cities we support -- indeed, for the entire state. We have followed the debate closely. We

obviously share your stated interest in improving the rigor of the mathematics instruction in the state. We disagree, decisively, with the Board's decision to systematically remove components from the standards that focus on problem solving and other elements of the rigorous and powerful use and learning of mathematics.

Sincerely,

Luther S. Williams

Luther S. Williams
Assistant Director

cc: Delaine Eastin
Superintendent for Public Instruction