

DOEd-NSF Working Group on Improving Math and Science Education

FAX COVER SHEET

Date: May 15, 1997

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FROM: *Judy Sunley*

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Remarks:

ED/NSF Working Group Members

Here is a very rough, not-quite-complete draft of what our report might look like. I wanted to get it into your hands for comment because Judy Wurtzel, Tom, and I are likely to be showing it to higher-ups in the agency over the weekend or first thing next week.

Thanks are due to Daryl Chubin for the front end of the front end, to Tom for his reworking of the original front end, and to Daryl, Bill, Judy, and Dan Goroff for the material on Objective 4. Tom is responsible for much of the initial work of turning Objective 1 to narrative. I worked from his material, converting to the format you see now, and added Objective 2. Objective 3 will follow later today.

You will note that the format currently includes several options under many of the actions. In some instances, the options reflect different ways of pursuing the action or different levels of effort. In others, they provide a range of possible subactions. I presented it this way because I thought it was important that we get the range of our discussion on the table before people committed themselves to one course of action or another. In our final report, we will need to limit to just those things we are recommending.

Tom, Judy and I need your comments as quickly as possible. What looks possible? What options are really not feasible? To what extent does the likelihood of Congressional reaction limit our choices? To what extent does the nature of the mathematics community and the educational reform already underway influence our choices? etc.

Please try to get back to us with your comments no later than 10:30 tomorrow morning so that we can turn around another version tomorrow, if needed.

Thanks for you help.

Judy Sunley
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ACTION STRATEGY:

PREPARING STUDENTS TO MEET NATIONAL STANDARDS OF EXCELLENCE IN EIGHTH-GRADE MATH, AND IMPROVING MATH AND SCIENCE EDUCATION

The *Atlantic Monthly* web site recently posed a question to its readers on educational standards. Sixty percent of the respondents agreed that "Enacting serious academic standards is the only way to improve student performance and to force parents to realize that their children's education is inadequate." What can we learn from this response from an admittedly nonscientific sample of Americans?

For one, the issue of standards and whether children in the United States are measuring up -- or are being given the chance to learn, for example, rigorous mathematics science -- is penetrating the public consciousness. Having the President of the United States feature education in his State of the Union message as vital to the Nation's preparation for life in the 21st century (well beyond workforce productivity and global economic competitiveness) sends a strong message indeed. But leadership is more than the adroit use of the bully pulpit. The national consciousness has been raised about the importance of education, and especially reading and mathematics. How can improvement in the teaching and learning of those and other academic subjects at all grade levels become a national priority for action?

For one, the involvement of all citizens is needed. Everyone has a vested interest in what children know and can do. Each can become an advocate, an expert resource, a tutor, a catalyst for teaching and learning to the highest national and international standards. How that is done is a matter of personal and local community choice. Awareness must precede action.

A recent review of literature on the major factors that account for parents' decision to become involved in the education of their children points to three:

- " parents' beliefs about what is important, necessary, and permissible for them to do with and on behalf of their children;
- " the extent to which parents believe that they can exert positive influence on their children's education; and
- " parents' perceptions that the child and school want them to be involved.

(American Educational Research Association, Apr. 18, 1997).

In this report, we respect these and other findings in recommending an action strategy -- actions based on knowledge of what works, what is already in place, and who is willing to step forward and exercise leadership in raising student aspiration and achievement. We all need opportunities to learn -- 8th graders and those seasoned in a job and working on second and third careers. That is the spirit of this report.

Background

On March 6, 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 and develop an action strategy for using Federal resources to assist States and local school systems to meet challenging math standards in the eighth grade, and for

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involving the mathematics, scientific, and technical communities in support of those efforts. This 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, and integrate technology and high-quality instructional materials into the classroom, and to motivate students to help them understand how math concepts are applied in the real world. The directive called for the interagency group to review the current status of improvements in math education and identify and address critical issues of need, 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 directive gave the working group 90 days to complete these tasks.

Response of the Department of Education and the National Science Foundation to the Presidential Directive

Appendix

Pursuant to the memorandum from the President, ED and NSF promptly formed an interagency working group, chaired by Judith S. Sunley, Assistant to the Director for Science Policy and Planning, National Science Foundation, and Thomas M. Corwin, Director, Division of Elementary, Secondary, and Vocational Analysis, Budget Service, Office of the Under Secretary, Department of Education. The working group was comprised of staff experienced in the areas under review (mathematics, professional development, curriculum, educational technology, and student motivation and public outreach) in the Offices of the Under Secretary, Educational Research and Improvement, and Elementary and Secondary Education in ED and the Directorate for Education and Human Resources in NSF. Officials of the White House Offices of Science and Technology Policy and Domestic Policy, as well as the Office of Management and Budget, provided oversight. (A complete listing of the members of the interagency group is attached as Appendix 2).

Necessary?

The interagency group immediately began a review of current Federal efforts in mathematics and science education -- but primarily, consistent with the directive, in mathematics education at the kindergarten through eighth-grade level. In addition, consistent with the memorandum's instructions for the interagency group to draw on research and input from educators and professional organizations, the group reached out to the broader mathematics and educational community for advice and guidance. On two occasions, the group met with representatives of the Conference Board of the Mathematical Sciences (CBMS), a collaborative of 14 organizations of mathematicians and math educators, to discuss the proposed nationwide test and the action plan and to seek their recommendations; CBMS submitted formal recommendations to the group on May 7. The group also arranged for preparation of a "letter report" by the Mathematical Sciences Education Board of the National Research Council making additional recommendations on the action plan. Representatives of the interagency group attended the National Council of Teachers of Mathematics annual conference in April and a meeting of the Committee on Science Policy of the American Mathematical Society to discuss the proposed nationwide test and the actions that might support schools, parents and students in preparing for it.

The Presidential directive clearly intended the interagency group to review all Federal resources and potential strategies for improving math and science education, not just the resources and strategies available through ED and NSF. Therefore the interagency group consulted with appropriate staff in other agencies that have activities, or are interested in establishing activities, in elementary and secondary-level mathematics or science education.

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The group met with representatives of the following Federal agencies:

- " Department of Agriculture
- " Department of Commerce
- " Department of Defense
- " Department of Energy
- " Department of the Interior (U.S. Geological Survey)
- " Department of Transportation
- " Department of Veterans Affairs
- " Environmental Protection Agency
- " National Aeronautics and Space Administration
- " Smithsonian Institution

The group has incorporated the programs and plans of these additional agencies within the action plan as appropriate.

The Context for a New Federal Action Plan on Excellence in Eighth-Grade Math and, More Broadly, in Math and Science Education

The interagency group believes that any new action plan must build on the work already accomplished by, or underway in, the Federal agencies and in the broader math, science, and education communities. It must also be guided by a vision that all children can succeed in education, the same vision that undergirds Goals 2000, Title I, and other ED programs and the education programs of NSF. More specifically, the group has adopted the following vision statement as the template for its efforts:

All American students will leave eighth grade prepared to excel at higher-level mathematics and science courses that are the gateway to college, citizenship, productive employment, and lifelong learning.

To pursue this vision, we must ensure that all students have access to high-quality, standards-based learning environments that permit them to demonstrate what they know and are learning in mathematics. This type of learning involvement must include:

- " **High expectations**, held by educators and students themselves, for student performance;
- " **Challenging standards**, for content, materials, teaching, assessment, and proficiency;
- " **Classrooms** where teachers have content background appropriate to the level of instruction and can effectively employ standards-based curricula and instructional materials and integrate technology into instruction; and
- " **Activities outside the classroom** that reinforce the classroom experience by drawing on the support of parents, the professional community of mathematicians, scientists, and engineers, and the broader public.

While achievement of our national objectives in math and science education will rely on each of these elements, progress in one area will often depend on improvement in others. For instance, the introduction of high-quality instruction materials will have little impact if teachers are not trained to use those materials effectively. Effective instruction during the school day will have limited results if parents do not have high expectations for their

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children and are not committed participants in the process of education reform. What we are saying, in short, is that systemic K-12 education reform, to which both our agencies have dedicated themselves for a number of years, should remain the guiding principle behind any new initiatives in the area of mathematics and science. All elements of the educational process -- standards, curriculum and technologies, professional development and licensure, assessments, and support from parents and the public -- must be aligned around the critical reforms. No

Building on Strength

A new Federal action plan should build on the considerable efforts underway, both within and outside of the Federal Government, to reform and improve elementary and secondary math and science education. Some of these activities began almost a decade ago. Taken together, they provide a solid foundation for new initiatives. Some of the most important current or completed activities include the following:

- " The National Council of Teachers of Mathematics (NCTM) standards for curriculum, evaluation, teaching, and assessment in mathematics, since their introduction in 1990, have provided strong guidance to States and localities in their efforts to improve mathematics education and have shown the way for the development of education standards in other content areas. (As is appropriate in any standards-based process, NCTM is now reviewing the math curriculum and evaluation standards and plans to update them over the next few years.)
- " All States [are we sure it's all?] have adopted frameworks for mathematics curricula, guided largely by the NCTM and often supported by ED curriculum framework grants or NSF State Systemic Initiative awards.
- " A new generation of standards-based mathematics curricula, with development funded largely by NSF, is beginning to appear in classrooms. By the fall of 1997, we project that these materials will account for 25 percent of all curriculum adoptions, and that figure should grow in succeeding years.
- " Professional development programs supported by NSF, ED, NASA and other agencies provide _____ teachers annually with instruction in how to teach math and science to high standards. Because of changes made in ED legislation in 1994, our expectation is that this professional development is increasingly delivered in a manner sufficiently intensive to have a significant impact on classroom behavior.
- " With funding from ED, NSF, and other public and private resources, more and more schools are wiring to the Internet, using distance learning and advanced technologies to convey challenging instruction, and otherwise increasing their use of educational technology. {Insert tangible data?}
- " The Federal Government, through the NSF systemic initiatives, Goals 2000, the reauthorized Elementary and Secondary Act, and other ED and NSF programs, has spurred States to undertake comprehensive systemic reforms. States that were in the forefront of reforms are now beginning to enjoy the benefits in improved student outcomes.

[Note from JS: I am concerned about the last three bullets. In my original version, the bullets were short and covered more territory. While some were not specific to mathematics, the overall context was mathematics. I am concerned that the added detail is not necessarily detail that is specific to our target population. That could be confusing.]

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Also, perhaps TIMMS and the information it gives us are worth mentioning in this set of bullets.]

Thus, for much of the action strategy, the foundation is already in place. Moving ahead will often be a matter of getting information into appropriate hands, accelerating a planned staging of activities, or increasing the scale of activity. Much of the additional effort can be accomplished directly by the Federal Government, in cooperation with States and localities or the private sector, at moderate additional cost. On the other hand, more significant expenditures will be required if we are to "go to scale" with some elements of the strategy - particularly professional development of teachers and accelerated implementation of high-quality, standards-based curricula.

Parameters around the Strategy

Consistent with the thrust of the President's memorandum, our proposed plan of action focuses fundamentally on actions Federal agencies, along with other partners, can take to help prepare students for the new eighth-grade math test. Because the test will provide a snapshot of student performance at grade 8, but will reflect students' math preparation in all the years leading up to the eighth grade, we have explored current activities and potential actions that would affect math education from kindergarten through the eighth grade. However, the memorandum also encourages a broader look at strategies that would improve all of elementary and secondary mathematics and science education; as a secondary goal, we have taken that broader view as well.

In the following pages, we lay out issues and recommendations in the four areas set forth in the directive: (1) teacher preparation; (2) curriculum and instructional materials; (3) educational technology; and (4) activities that can motivate students or generate public and non-governmental support for educational improvements. While these four categories of activity provide a useful framework for describing a strategy, they are also interlocking and overlapping. Some activities could often fit within one category as easily as another. A few of our proposals don't seem to fit within the categories, and we describe them at the beginning or end of the paper. For each of our recommendations, we provide an initial estimate of the costs and a recommendation of the appropriate Federal agency or other entity to assume lead responsibility.

Cross-Cutting Action

Our first recommended cross-cutting action is to:

Establish a national dialogue on middle school mathematics education around which vital partnerships can form.

The initiator for this national dialogue would be a national convocation, to be held in the fall of 1997. Elements of the dialogue include:

- " Vision for 8th grade math achievement;
- " Standards for K-8 mathematics with emphasis on middle school years;
- " Examples of student work that illustrate standards at work;
- " Implications for change needed in middle school mathematics education;
- " TIMSS, NAEP, and the new test.

Periodic regional meetings would keep the dialogue going, and a second convocation would be held following the first administration of the new nationwide test

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Objective 1: Ensure that teachers have the content knowledge and pedagogical skills necessary to teach standards-based, challenging mathematics to all students, so that, by the end of eighth grade, they have laid the foundations for the study of more advanced mathematics.

CURRENT FEDERAL ACTIVITIES

The Department of Education administers the Eisenhower Professional Development State Grants program, currently funded at \$275 million, which supports educator professional development in the core academic subjects. By statute, at least \$250 million of the Eisenhower funds must be spent on professional development in math and science. Eisenhower appropriations flow to States and school districts by formula, and the States and districts have major flexibility in spending those funds. In the past, the Eisenhower program has been criticized for supporting short-duration, one-time training experiences that were unlikely to have a significant impact. In response, the 1994 program reauthorization established requirements that the program fund 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; for FY 1998, ED will reaffirm these requirements by promulgating "principles of effectiveness" that all local Eisenhower activities will have to meet. In 1998, the program should reach almost 350,000 educators.

The National Science Foundation supports professional development for math and science teachers primarily through the teacher enhancement program. This program, currently funded at \$ 96 million, supports professional development projects that broaden and deepen the disciplinary and pedagogical knowledge of K-12 teachers of mathematics and science. The teacher enhancement portfolio in mathematics (approximately 20% of the total) consists of over a hundred active, multi-year projects that range from planning grants (under \$ 50,000) to very large-scale efforts (over \$ 5 million). Support is for long-term (in excess of 100 hours) professional development of teachers, intensive leadership development of teachers, and materials for professional development of teachers. A new feature of the program is the Local Systemic Change (LSC) projects. LSC projects provide sustained professional development for ALL mathematics teachers in targeted schools/districts and clear linkages with classroom use of high quality instructional materials. Congress has challenged NSF to provide professional development for over 2/3 of the nation's 600,000 targeted teachers of mathematics and science between 1993 and 1998.

NSF's Division of Educational Systemic Reform has funded 26 State Systemic Initiatives, of which 15 are still operating; 18 Urban Systemic Initiatives; and four Rural Systemic Initiatives. To varying degrees, each of the large-scale systemic initiatives provides professional development in mathematics. In addition, NSF's Collaboratives for Excellence in Teacher Preparation (CETP), funded by the Division of Undergraduate Education, have supported improved preparation of future K-12 teachers of mathematics.

The National Aeronautics and Space Administration funds educator professional development activities based on the NCTM and NAS content standards and linked to NASA's scientific mission (aeronautics, human exploration and development of space, space science, and the "Mission to Planet Earth"). Approximately _____ educators participate annually.

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Issue 1.1: There are only limited opportunities for the planned, long-term programs of professional development that are essential to high-quality, standards-based instruction in K-8 mathematics.

Action 1.1.1: Disseminate information on the most effective models for standards-based teacher professional development for K-8 mathematics so that existing sources of funding can be used most effectively. Develop and distribute guidelines for selection among professional development options.

(Cost of developing information packages and guidelines within current funding levels; dissemination through Eisenhower Consortia and the Comprehensive Regional Assistance Centers could require up to \$10M in additional funds for 2-3 years; impact could be significant in terms of informed selection of professional development.)

Action 1.1.2: Expand availability of exemplary, long-term professional development in mathematics teaching, particularly for teachers in grades 4-8.

The following options provide a range of activity levels that will have different levels of impact on the nation's classrooms.

Option 1.1.2.a: Use conferences, program directives, newsletters, and other mechanisms to encourage ED's Eisenhower and Title 1 programs to use professional development funds as above. NSF's teacher enhancement and systemic initiative programs would continue to support such professional development with priority for K-8 mathematics. (No additional cost; impact on the margin; no leverage beyond isolated instances of current examples; can be implemented in FY 1998, perhaps even partially in FY 1997.)

Option 1.1.2.b: In addition to Option 1.1.a, place 10% additional funds in the ED Eisenhower and NSF teacher enhancement programs that can only be used to enhance the current base for such professional development in K-8 mathematics. (Cost about \$35M per year; would increase NSF effort in targeted area by about 100%; would increase Eisenhower effort in targeted area by about x%, provided approval for directed funding could be obtained; NSF and ED efforts essentially distinct; implementation before FY 1999 would require revised FY 1998 budget request.)

Option 1.1.2.c: In addition to Option 1.1.a, place additional funds in the ED Eisenhower and NSF teacher enhancement programs that would create a pool for a joint competitive program aimed at planned, long-term, standards-based professional development in K-8 mathematics teaching that assumes significant leverage of other available professional development funds, such as the basic Eisenhower or Title 1 funds. (Cost about \$40M per year for at least five years; begin to leverage other funding pools with potential for significant impact; NSF and ED efforts more coordinated; implementation before FY 1999 would require revised FY 1998 budget request.)

The Working Group recommends Option 1.1.2.c as providing significant impact with minimal additional resources. Within each of these options, we recommend increasing ties to exemplary professional development opportunities now available through other agencies such as NASA, NIH, DOE, and other, and to the enhancement of these efforts by other agencies.

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Action 1.1.3: Leadership for and the supply of exemplary long-term programs of professional development aimed at K-8 mathematics are limited at present. Develop a leadership cadre and expand the capability to deliver high-quality, standards-based professional development.

The following options provide a range of activity levels that will have different levels of impact on the nation's classrooms because of their differential ability to support expansion of teacher professional development in mathematics for K-8 teachers.

Option 1.1.3.a: Let the market provide what is necessary to meet the increased demand with no Federal action. (No additional cost.)

Option 1.1.3.b: Support opportunities for mathematics professionals to receive intensive training on standards-based instructional methods and materials for K-8 mathematics so they can become leaders in the delivery of K-8 teacher professional development. Use NSF competitive mechanisms, NSF program or joint NSF/ED activity. (Cost would be approximately \$10M per year for a mixture of summer and academic year training opportunities; some preliminary funding could be available as early as FY 1997 through adjustment of existing NSF programs; full program of activity by FY 1999; impact in terms of quality of professional development available could be significant.)

Option 1.1.3.c: Expand Option 1.2.b to include opportunities for science and engineering professionals and broaden to K-8 science as well as mathematics with an emphasis on the interaction between math and science. (Cost increases to about \$20M per year; impact in terms of quality of professional development available could be significant.)

Option 1.1.3.d: Expand Option 1.2.b to include opportunities for development of master teachers who can provide on-site professional development in their home schools. (Add \$10M per year to Option 1.2.b.)

The Working Group believes that Option 1.1.3.a does not provide a sufficient guarantee of the capacity to provide quality in professional development. This is an action whose impact is for the long term. The most immediate need is to expand professional development opportunities in mathematics education. Therefore, the Working Group recommends limiting to mathematics for the near term. Some combination of Option 1.1.3.b and Option 1.1.3.d would significantly increase the impact in the near term. Once these activities are firmly established, moving to the broader Option 1.3.c would be appropriate.

Action 1.1.4: Fund professional development projects in K-8 mathematics that feature the use of networks for long-term interaction of participants. Use ED's National Writing Project and NSF's TEECH project as models. Both ED and NSF programs could encourage this feature. Note that master teachers proposed in Option 1.1.3.d above could be the core of such a network.

(Cost would be about \$5M per year in addition to the more traditional professional development based on ED experience with the National Writing Project; impact could be significant)

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Issue 1.2: Preservice teacher education is often considered a very weak link in the professional development system. Few prospective teachers (particularly elementary- and middle-school level) receive a solid grounding in mathematics or math education. State licensure requirements do not ensure that teachers are prepared to teach math (or science) to high standards. Teachers are on their own immediately rather than being seen as in training and requiring continued support during their first few years on the job.

Action 1.2.1: Develop and implement more appropriate mathematics and science courses and models for preservice education of K-8 teachers who will teach mathematics.

Several options are provided below. More than one could fit into the strategy effectively, perhaps being reframed as separate actions under this issue.

Option 1.2.1.a: Recognize institutions that do an outstanding job of preservice teacher education and enable them to work with other institutions of higher education in improving practice through HEA Title V reauthorization. Ensure a strong partnership between education departments or schools and arts and sciences programs and between the institutions and K-12 schools. (ED program; cost about \$25M annually; long term, collateral impact on K-8 mathematics education.)

Option 1.2.1.b: Focus recognition as in Option 1.2.1.a on K-8 mathematics and science preservice education. (NSF program; cost about \$10M annually; long term; impact on K-8 math and science more direct.)

Option 1.2.1.c: Challenge institutions to change their models for preservice education of K-8 teachers and modify their coursework accordingly. Emphasize mathematics. Provide grants for the development, replication and adaptation of exemplary models and courses. (NSF program, on model of undergraduate curriculum activities; cost about \$5M annually for five years, perhaps less if combined with the Math Across the Curriculum activity; may be linked to Action 1.2.2 below as licensure affects what academic institutions offer in preservice education.)

Option 1.2.1.d: Challenge institutions to develop "clinical" models for preservice teacher education, using K-8 mathematics and science as drivers. Include attention to the first few years of classroom teaching (intern model). Provide grants for development of exemplary models and the coursework embedded in them. (ED program, with NSF partnership for the K-8 math and science components; may be linked to Action 1.2.2 below as licensure affects what academic institutions offer in preservice education.)

Option 1.2.1.e: Define and promulgate standards for exemplary classrooms for siting of student teachers. (ED, NSF and professional societies; minimal cost; indirect impact on K-8 math and science.)

Option 1.2.1.f: Provide grants for the development of good materials for K-8 mathematics preservice instructional purposes. These should be linked to the standards and tailored to use by mathematics departments and schools or colleges of education. It may be appropriate to link them to newly emerging instructional materials at the K-12 level. (NSF has vehicles appropriate to such an effort. If ED does as well, program could be joint. This would be an enabling activity for Option 1.2.1.c. and could be accommodated with an addition of \$2M to that effort.)

To keep the focus on K-8 math and science education, Options 1.2.1.b, 1.2.1.c and 1.2.1.f would seem most appropriate.

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Action 1.2.2: Draw national attention to licensure by commissioning and disseminating the results of a study of math and science licensure requirements for K-12 teachers across states and in other countries, with emphasis on requirements for math for grades 4-8. Support national efforts to strengthen teacher licensure requirements.

(Cost should be minimal; ED could handle; immediate impact low; long-term impact could be more significant.)

Issue 1.3: Institutions of higher education are responsible for the education of future teachers, provide much of the formal teacher professional development, and offer the courses paid for by in-service teachers as part of their advancement in their profession. Yet they are largely disengaged from the on-going activity in America's schools, both in their colleges and schools of education and in the content areas.

Action 1.3.1: Promote partnerships among states, school districts, schools, and higher education for pre-service and in-service education and training.

More than one of the following options could fit into the strategy effectively, perhaps being reframed as separate actions under this issue.

Option 1.3.1.a: Draw K-12 schools into the process of reformulating preservice teacher education as part of Action 1.2.1 above. (No cost above action 1.2.1; emphasis on mathematics could significantly affect resources available for teachers.)

Option 1.3.1.b: Encourage development of courses in institutions of higher education explicitly designed to assist grade 4-8 teachers in gaining competencies for instructional methods and content for standards-based mathematics teaching. Draw local K-12 schools into the development process. This is likely to be an NSF activity if seed grants are to be made for course development. It could be tied to restructuring of preservice models or to expanding availability of professional development for active teachers. (Cost would be minimal, say \$2M per year, in that mode; could have significant impact.)

Option 1.3.1.d: Request proposals for funding of partnerships among states, school districts, schools, and higher education for pre-service and in-service education and training. Emphasize the role of science, mathematics and engineering professionals in working with schools to promote achievement in challenging mathematics in grades K-8. Funding is to provide the connection between previously unconnected activities. (Cost could vary depending on extent of partnerships and their number, could also be tied into the profession development and preservice activities as part of the those efforts; say an additional \$20M per year, distributed through a joint, competitive NSF/ED program modeled after the EPSCOR program; impact could be significant, but major impact probably 5 or more years in the future.)

Options under Action 1.3.1 provide the opportunity for institutions of higher education and K-12 schools to develop models of preservice and inservice education for beginning teachers that are similar to those used in medical schools or in cooperative education programs. By pairing students early in their preservice education with master teachers in schools where they are most likely to work, it is possible to enrich the educational experience and extend it into an inservice "internship."

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Objective 2: Ensure that all schools, teachers, and students have access to high quality, standards-based instructional materials in their classrooms.

Issue 2.1: New, comprehensive mathematics curricula and instructional materials tied to high standards for content and instructional methods are now emerging from development and reaching the market. These materials need to get to the classroom.

Action 2.1.1: Provide good information about materials and how to choose among them to those responsible for selection. Elements of this action include review activities to identify promising and exemplary materials (underway at ED and NSF with first products due January 1998) and development of guidance on selecting among such exemplary materials with models for analysis (ED's TIMSS toolkit is due out in July with other ED and NSF products to follow.).

(Plans for development and dissemination of such information are being accelerated within existing programming as part of the action strategy. Impact is likely to be significant.)

Action 2.1.2: Provide good information about mathematics standards and their embodiment in new materials to the public with an emphasis on parents. The content and instructional methods embodied in the mathematics standards are different from the experience of most parents. It is critical that they understand the importance for student achievement of high-quality curricula and materials in the classroom and begin to demand the selection of such materials by their schools.

(This would be a new activity linked to Action 2.1.1 and to the national dialogue suggested as a cross-cutting action. ED and NSF could undertake it in partnership with the PTA, Urban League and other community action groups. The cost would be marginal.)

Action 2.1.3: Many school systems do not anticipate purchase of new materials in the near term, largely because of cost. Accelerate adoption of new materials identified as promising or exemplary by addressing the issue of cost.

Option 2.1.3.a: Use conferences, program directives, newsletters, and other mechanisms to encourage adoption of new materials. As adoptions increase, costs may come down. (Cost would be marginal; impact would develop only over time.)

Option 2.1.3.b: Permit and encourage use of Title 1 funds for purchase of new materials identified as promising or exemplary in designated schools or systems. (No additional cost; impact uncertain.)

Option 2.1.3.c: Use the power of the presidency to encourage publishers to reduce costs so as to accelerate adoption of new materials identified as promising or exemplary. Increases in adoptions should help offset publisher costs. (No cost; impact uncertain.)

Option 2.1.3.d: Develop a pool of funds to leverage use of Title 1 funds for purchase of new materials identified as promising or exemplary in designated schools or systems. Work in conjunction with publishers to obtain discounts. (Cost (?); impact could be immediate and significant, when combined with implementation strategies found under Issue 2.2.)

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Issue 2.2: The promising and exemplary new materials in mathematics are characterized by demanding content and new approaches to instruction. They require significant change in the classroom to support their implementation.

Action 2.2.1: Provide guidance on what is necessary for effective implementation of new materials in the classroom and assistance with implementation.

Option 2.2.1.a: Prepare guides for teachers, principals, superintendents, state supervisors, etc., distributing through and in cooperation with appropriate professional organizations and existing bodies such as the ED Regional Laboratories and Eisenhower Consortia and the NSF systemic initiatives. Focus on K-8 classrooms. (Acceleration of current plans at no added cost; preliminary guidance could be available almost immediately; impact once new materials are adopted could be significant.)

Option 2.2.1.b: Provide implementation resources for those thinking about or in the process of adopting new mathematics materials. ED's Regional Laboratories and Eisenhower Consortia provide some assistance now in the context of their broader efforts on professional development in math and science. NSF plans to fund one implementation site in mathematics at each of grades K-4, 5-8 and 9-12. This option would permit greater focus on assistance with K-8 mathematics in the ED activities and intensification of effort at the NSF implementation sites. (No additional cost; impact may be greatest by intensifying NSF implementation sites in K-8 math area as more broadly aimed activities are stretched too thin to devote the significant attention needed for greater impact on K-8 math.)

Option 2.2.1.c: Provide additional resources to NSF and ED to expand access to technical assistance for implementation of new K-8 math materials. Increase the number of NSF implementation sites dedicated to K-8 math to 8, with appropriate connection to the broader ED centers, labs and consortia. (Cost is approximately \$8M per year, split between NSF and ED, in addition to current plans; impact could be significant in schools and systems implementing new curricula and materials.)

The Working Group recommends Option 2.2.1.c as the one best suited to providing needed focus on K-8 mathematics.

Action 2.2.2: Provide professional development opportunities for teachers that are directly linked to the implementation of promising and exemplary new mathematics materials in the classroom.

Option 2.2.2.a: Use conferences, program directives, newsletters, and other mechanisms, including the new Eisenhower Principles of Effectiveness to encourage Eisenhower and Title 1 programs to train educators in using the new materials. NSF teacher enhancement programs now give priority to such activity. (Cost is minimal; could be combined with elements under Objective 1 for added impact.)

Option 2.2.2.b: Support the creation of professional development packages tied to promising and exemplary new curricula and materials so that schools and systems can combine materials selection with immediate training for their teachers. Publishers and developers of the curricula and materials have the rudiments of such packages already. A competitive program to create comprehensive professional development packages would accelerate the implementation of the materials. (Cost is about \$4M for two to three years; impact could be significant if aimed at, for example, Title 1 schools and tied to the increased funding of professional development opportunities recommended under Action 1.1.2.)

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Option 2.2.2.c: Add to Option 2.2.2.b more funding to increase the availability of professional development opportunities beyond what is recommended under Action 1.1.2. (Cost might be an additional \$10M.)

Action 2.2.3: Encourage preservice education programs to use exemplary instructional materials in educating future K-8 teachers of mathematics. Tie this to Actions 1.2.1 and 2.2.2. (No funds needed beyond what is planned in Actions 1.2.1 and 2.2.2.)

Issue 2.3: Supplementary materials, particularly those that place K-8 mathematics in a real world context are needed to complement comprehensive curricula and materials.

Action 2.3.1: Support the development of high quality supplemental materials, including technology-based materials and materials incorporating links to science and social studies.

Option 2.3.1.a: Refocus NSF's instructional materials development programs away from development of comprehensive materials toward exemplary supplementary materials, with priority given to K-8 mathematics materials. (No added cost; already in progress; priority on K-8 math materials will accelerate progress in that area.)

Option 2.3.1.b: Recognize the "Mission Mathematics" materials developed jointly by NASA and NCTM. Support development of similar sets of materials through cooperation of NCTM and other agencies such as DOT, USDA, NIH, DOE, etc. (Cost to be absorbed by agencies involved; could have significant impact in development of real world examples that are ready for use in standards-based classrooms.

The Working Group endorses both these options. It does not recommend dramatically increasing funds going toward development of supplementary instructional materials at this time.

Objective 3: Ensure that all schools, teachers, and students have access to technologies that facilitate high-quality communications and delivery of standards-based instruction and that all teachers have the ability to integrate these technologies effectively into standards-based classroom instruction in mathematics and science.

Issue 3.1: Technology-based materials available for integration in the classroom are of varying quality, and it is difficult to know in advance just how the materials might be most effectively used.

Action 3.1.1: Carry out Presidential Directive that agencies make high-quality education materials and lesson plans available on the Internet. ED is to chair an interagency working group with all agencies participating. The group will need to review materials for appropriateness and maintain the website(s). ED will encourage K-8 mathematics materials in early stages of implementation. (Cost is absorbed by agencies in implementation of the Directive.)

Action 3.1.2: Support expert reviews of existing software to identify promising and exemplary materials and widely disseminate results. ED will support an expert panel review process with NSF collaboration. First reviews will be available in 18 months. (Acceleration of existing plans; costs can be absorbed.)

Action 3.1.3: Develop guidance on choosing K-8 instructional technology and software with models for analysis. ED and NSF through grantees and contractors, including NSF implementation sites, to develop materials. (Can be accommodated in existing budgets or increments amounting to about \$3M per year in budgets of implementation sites.)

Issue 3.2: Currently available technology frequently is not tied to standards-based instructional methods and content or is difficult for teachers to use in the classroom.

Action 3.2.1: Seed additional research and development of powerful models for integrating technology in education, including support for critical scale-up testing and evaluation steps preceding commercialization of these models. NSF (and ED?) programs are already addressing these issues. Expansion of those activities and focus on K-8 mathematics could speed appropriate use in the classroom. (Additional cost could be \$3M per year.)

Action 3.2.2: Address these issues in the upcoming NSTC review of Learning Technology Research and Development, making additional recommendations as needed.

Issue 3.3: In general, K-8 teachers are not comfortable with the use of technology for instructional purposes in the classroom.

Action 3.3.1: Provide professional development opportunities for teachers that are directly linked to the implementation of promising and exemplary new technologies for mathematics instruction. Options comparable to Action 2.2.2, either folding use of technologies into the materials-oriented

professional development at little or no additional cost or treating it separately at comparable levels of cost for comparable impact.

Issue 3.4: Too frequently, students have access to technology only during school hours.

Action 3.4.1: Support the expansion and/or development of strategic planning partnerships for access to learning technologies, focusing on involving municipal governments, community organizations, libraries, telephone companies, internet service providers (ISPs), housing authorities, parent organizations, higher education organizations, museums, and other partners. Assure interoperable networking. Stimulate the extension of learning environments to include home and other parts of the community, beyond classroom boundaries, and involving a broad range of educational partners. It promotes basic planning that effectively participates in the provisions of the Telecommunications Act and E-rate requirements. It promotes informed communities of parents who will be able to demand and assure standards-based mathematics teaching by the schools.

(This could build on the Technology Challenge Fund, tying into the National Partnership described under Objective 4. Cost could be considerable, but partnerships with state and local governments and the private sector could leverage smaller amounts.)

Action 3.4.2: Initiate "Moonlight Math" partnerships where municipal governments, community organizations, libraries, businesses, housing authorities, parent organizations, higher education organizations, museums, and other partners open their facilities at times they are otherwise not being used to permit active mathematical learning opportunities outside the schools in supervised situations. In combination with Action 3.4.1 and the partnership activities described under Objective 4, this effectively ties the entire local community to the effort to improve mathematics education.

(Cost could be considerable, but partnerships with state and local governments and the private sector could leverage smaller amounts.)

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Objective 3: Ensure that all schools, teachers, and students have access to technologies that facilitate high-quality communications and delivery of standards-based instruction and that all teachers have the ability to integrate these technologies effectively into standards-based classroom instruction in mathematics and science.

[Note from JS: I have been promised some material in this area, but I do not yet have it. I will send it on as soon as it is completed.]

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Objective 4: Engage students, parents and the general public by building widespread understanding of the necessity of mastering challenging mathematics as a gateway to future educational opportunities and jobs. Emphasize that all students are capable of such mastery.

A National Partnership

To increase awareness and mobilize community support for connecting mathematics skills to the world of work demands a national **Partnership for Resources to Improve Mathematics Education (PRIME)**. Such a partnership would draw on all segments of the public and serve as an umbrella organization sponsoring a variety of activities directed at raising U.S. math achievement extend that well beyond local schools and preparing for the national eighth grade test.

The National Partnership will bring together the math and science community, businesspeople, and local educators in support of students and parents in a national campaign to improve math education. All participants in the National Partnership will make a broad commitment to helping and encouraging young people improve math achievement. Partners may also be asked to make a specific commitment to get involved in one of the initial areas of partnership activity.

The Partnership will have a 10-to-20 member national steering committee, with initial membership comprised of leading representatives of key organizations, business supporters, and Federal agencies, in addition to distinguished math educators. The umbrella of the Partnership may include specific categories of members (including business members, local educators, Federal agencies, and so on) and task forces focused on particular near-term activities. But membership in the partnership will be open equally to organizations both large and small, national and local. The Partnership will also have a high-profile honorary chair who will work tirelessly to spread the word about the urgency of improving our nation's math teaching and learning.

The Partnership seeks to connect resources of all kinds with target audiences who wish to learn, apply, and understand mathematics not just as an academic subject, but as a life skill in the 21st century. Initial activities that represent distinct strategies in making the Partnership a national campaign include: (1) a summer 1998 volunteer math initiative (built on the Department of Education's successful "Read*Write*Now" program), (2) a nationwide community-based public service campaign that boosts awareness of the importance and excitement of math (modeled on "Math Is Power"), (3) National Conversation Tools to promote public discussion of mathematics and mathematics education, (4) activities that connect math in the classroom with both higher education faculty and agency mathematicians, scientists, and engineers, and (5) activities that connect math in the classroom to math in the workplace (a business-led campaign).

Partnership Activities

1. *America Counts: Summer Math Coaches*

A summer math effort beginning in the summer of 1998 would build on the success of the Department of Education's "Read*Write*Now" summer reading effort. Families, business, community based organizations, schools, churches, and others are working together to help over one million K-3 grade students keep reading over the summer. The

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effort encourages adult "reading partners" to assist children in reading -- everything from getting a library card and using it to fun word games -- and provides materials to help get started.

"America Counts" will build on existing networks and resources to create a summer volunteer reading and math initiative focused on students in grades 4-8. This new emphasis on mathematics will tap the energies of the many professionals and organizations that use mathematics in their work -- engineers, accountants, high technology companies -- as well as support parents in their efforts to help their children get excited about and improve their math skills. Adults would serve through churches, schools, and other community organizations as math coaches for students and work with them on engaging math activities and games.

ED, in conjunction with other agency partners, would develop and distribute summer activity guides (as it does now in the reading initiative) to be used by students and their coaches. Other Federal agencies, such as NASA, Energy, and Transportation with missions that apply math to real-world problems, would be also play key roles America Counts. For example, one set of materials could focus on the mathematics used in farming. The Department of Agriculture could assist in developing the materials, and its extension offices and 4H clubs could serve as organizational hosts for these and other summer materials.

2. *More "Math Is Power": A Public Service Information Campaign*

Improving academic achievement in mathematics begins with the public expectation that responsibility for learning is shared by all in the community. Such an attitude will motivate students and parents to get more information about why math is important as a set of skills and as a foundation for future learning. Thus, one aspect of the National Partnership is a public service information campaign.

Such a campaign has been devised to increase student awareness about coursework in math and science as it relates to getting a good job, having a career, making money, and being a community leader. "Math Is Power" (The Power to Learn, The Power to Earn) speaks to students and parents about the power of learning. Developed by the National Action Council for Minorities in Engineering (NACME), with creative support by the Advertising Council and funding from IBM, NSF, the Annenberg/CPB Math and Science Project, and DOE, this campaign epitomizes public-private partnership in harnessing the power of radio, TV, print, and outdoor advertising, as well as producing a "kit" of direct response materials for students and parents, including a pop-up polyhedron and a poster. Through an 800 number (650 calls per week) and a web site (both cleverly noted on the polyhedron), the campaign provides information about math and science materials and activities sponsored by NCTM, MSEB, the National Urban Coalition, and NSTA. It urges parents to become actively involved in their children's education by contacting organizations such as the ASPIRA Association and the National Coalition of Title I/Chapter I Parents. Another example of an organization that not only does outreach like NACME but also produces video programming is FASE, the Foundation for Advancements in Science and Education.

Phase 2 of Math Is Power calls for local and specialized distribution to create endorsement and publicity opportunities for city, state, and community organizations, and an interactive web site that helps engage the education media and policy communities.

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Phase 2 funding, excluding advertising, will require \$250 K, which a Federal grant could provide. To date, an estimated \$26 M has been donated in public service advertising.

Math Is Power was created to establish a link between mathematics and career opportunities, to empower students and their parents to demand advanced mathematics, and to provide motivation and support for mathematics as an indispensable part of education for the 21st century world of work. Its goals are those of the Administration. Market-tested and already achieving positive results, it forms a base for building national participation in a grassroots campaign of public awareness and informed action.

3. *National Conversation Tools: Public Fitness Exercises*

Inspired by the "public service announcement" approach, everyone from parents to school board members and from teachers to state legislators, must consider what role they can play. We need an ongoing "national conversation" about mathematics, its importance, and how we can improve our efforts. To help initiate those conversations, ED and NSF will work with key organizations to develop "national conversation tools" that raise important questions for each community member to consider. There are many ways to accomplish this. Disseminating information, test items, and student work will help establish expectations so that, for example, school board members and other local decision makers can see and calibrate their programs to TIMSS, NAEP, and National Mathematics Exam questions.

One particular tool for promoting such conversations would be to create Public Fitness Exercises in thinking, reasoning, and mathematics. Asking how we can tell the public about high standards for mathematics education is, in a sense, the wrong question: those standards themselves contend that people learn much more from active engagement and feedback than from just being told. If it is a question of educating the public, consistency demands we provide opportunities to see and do high quality mathematics as part of our campaign.

The same argument applies to science as well, but it is even more critical in connection with the National Mathematics Examination. Teachers, students, and parents will all need to see examples of test items in advance if that examination is going to affect classroom practice. So for the year leading up to the first administration, we should reserve space each week in newspapers, magazines, and on the web to post Presidential Fitness Exercises in Mathematics.

Well-known public figures, starting with the President and Vice President, would choose and introduce one such exercise from a large bank of potential test items. These celebrities, industrial leaders, and scientists could, with a little help, act as trainers and coaches by coming up with a few motivational sentences about why a particular kind of exercise appeals to them personally, and how it opens into important activities in the real world. Companies may even wish to sponsor such postings featuring their own employees. The athletic analogy plays out with America's hosting of the International Mathematics Olympiad in 2001.

This strategy takes mathematics from the confines of school and puts it out for everyone to try. Recreational mathematics has, at certain times and in certain countries, been the subject of books, magazines, clubs, and competitions with widespread popularity. Moreover, children learn best what is socially reinforced. Kids often see people reading and then talking about their reading, but it is harder to observe people thinking or reasoning and then talking about their problem-solving strategies. If quantitative literacy is important

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for everyone, then we can and should place good mathematics problems before the public to solve and discuss.

Perhaps the most powerful way of doing this would be if individuals besides eighth graders not only worked on selected problems, but actually took the national examination. By achieving a sufficiently high score, they could not only impress potential employers but also become eligible for licensing as tutors to help others prepare for it. (See, for example, what MCI is calling "the first-ever Internet proficiency test. The Great American Net Test is a multiple-choice exam at www.nettest.mic.com. The site contains links to the answers and is scored based on correct answers and the time taken to determine them.) In this way, the math test itself becomes a "national conversation tool" by serving as a "numeracy" yardstick for all citizens.

Educational research and standards underscore the role of high expectations. Public exercises should help convey such expectations to all. For teachers, even more is needed to develop consensus about the relationship between standards in the abstract and students in their classes. The fact that the Advanced Placement Examination has been highly effective in generating such a consensus (for better and for worse) about high school calculus is often attributed to the practice of having so many teachers involved with grading and discussing open response questions. Perhaps seventh and eighth grade teachers could join Math Circles together with at least one mathematical professional for this same purpose. The teachers would agree to assign the publicly promoted exercise to their students every other week, then exchange papers with another member of their Circle to grade, write comments on, and discuss. During the week in between these assignments, outstanding solutions along with extensions to harder problems would be published in the same places that the original exercise appeared.

Because of the decision to publish each National Mathematics Examination after it is administered, there will eventually be a large collection of items available on the Web in any case. Each National Fitness Exercise in the series we propose would use a celebrity or businesses to call attention to one such problem in advance from a bank of potential items. In fact, that bank itself could also be available to the public. This is how certain competency tests, like the FAA's, already run. As consensus grows about the test framework, perhaps testers could accept and acknowledge suggestions from teachers of exercises to add to this bank. There could also be awards recognizing the best teacher suggestions and the best student solutions for the publicly promoted exercises.

4. *Connecting Math in the Classroom to Mathematicians and Scientists*

Professional mathematicians and scientists have special roles to play in the National Partnership. Representing the leadership of the mathematics education community from kindergarten onwards, organizations such as MSEB and CBMS have expressed their eagerness to inform and participate in outreach efforts. Through membership organizations, federally sponsored projects, and as individuals, scientists and mathematicians are already active in many ways from adopting schools to telementoring, and from working with alumni parents to reforming teacher education.

From the point of view of public awareness specifically, perhaps the most important message academic mathematicians and scientists can deliver concerns their own responsibilities rather than those of others: namely, higher education should make explicit their expectations for prospective college students in all fields, indicating how their admissions criteria and entry-level courses align with high K-12 standards. Professors

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would also be needed to organize, train, and supervise undergraduates to serve as coaches for the "America Counts" summer program.

5. *Connecting Math in the Classroom to Math at Work*

The business community is acutely aware of the need to link mathematics concepts and skills to applications demanded by the future world of work. The involvement of business and industry as partners with local schools, as suppliers of equipment, and as expert sources of information on careers has been a social movement for at least a decade. The Business Roundtable was among the first organizations to call for high content and performance standards and for improving the preparation of reading, math, and science teachers. As with the academics, it would be a public service for businesses to make explicit their expectations for prospective employees and how these might relate to quantitative literacy as measured by the National Mathematics Examination.



Judy_Wurtzel @ ed.gov

05/13/97 10:06:00 PM

Record Type: Record

To: William R. Kincaid

cc:

Subject: Strategy insert

Bill-- Please forward to Daryl and Danny because I am not sure I have the right email addresses for them. Thanks.

Sorry this is so rough-- but I hope it helps. I will be out of the office all morning and then in and out in the afternoon. If you need me try Vicky at 401-4160 and she can track me down. Thanks.... Judy

1. Summer Math Coaches

A summer math effort beginning in the summer of 1998 would build on the success of the Department of Education's Read*Write*Now summer reading effort in which families, business, community based organizations, schools, churches, and others are working together to help over one million K-3 grade students keep reading over the summer. The effort encourages adult "reading partners" to assist children in reading -- everything from getting a library card and using it to fun word games -- and provides materials to help get started.

A summer math effort would build on the these existing networks and resources to create a summer reading and math effort -- with a strong mathematics focus for students in grades 4-8. Creating a new emphasis on mathematics will tap the energies of the many professionals and organizations that use mathematics in their work -- engineers, accountants, high technology companies -- as well as support parents in their efforts to help their children get excited about and improve their math skills. Adults would serve as math coaches for students and work with them on fun, mathematics-filled activities and games. ED, in conjunction with other agency partners, would -- as it does now in the reading initiative -- develop and distribute summer activity guides to be used by students and their coaches.

A key part of the effort is the involvement of other agencies. For example, one set of materials could focus on the mathematics of farming and the Department of Agriculture could assist in developing the materials and its extension offices and 4Hs could commit to promoting summer math efforts using these and other summer materials.

2. materials to be included in your listing:

National Conversation Tools -- in order to improve mathematics

education, all those involved from parents to school board members and from teachers to state legislators, must consider what role they can play. We must have a national conversation about mathematics, its importance, and how we can improve our efforts. TO help start those conversations, ED and NSF will work with key organizations to develop "national conversation tools" that raise important questions that each community member should consider. [E.g., show school board members a TIMSS question and have them ask the superintendant whether kids in their district can do this]

What students should know and be able to do in 8th grade mathematics -- a critical element of improving student performance in K-8 mathematics is having a clear understanding of what students should be able to do by the end of 8th grade. We will be developing and widely disseminating examples of what mathematics students should be able to do and examples of student work.

Mathematics website-- would gather in easily accessible place best information about the voluntary national test in mathematics, what mathematics students need to master by the end of 8th grade, best practices in mathematics education, etc....

3. After we talked I came up with a college idea. Spring is the time kids are choosing highschool courses -- we are already planning a campaign around "think college early"- one message of which is that you need to choose to take math courses if you want to go on to college. Colleges (including -perhaps particularly- community colleges) could play an important role in their communities by working with local high schools to let kids know what math is needed for college and in particular for specific majors (pre-med, engineering, computer science, etc...).

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Math-Sci Staff m 5/27

re. Bonus
2001
idea

Professional Development

How many need to reach
in what way?

Grade level focus -

Single -

4-8) math

K-8

K-8 Science

9-12 Math/Science

NSF program -

10,000 4-8 math 10000/yr

goal 750,000 → 800,000

Systemic -

> 1/2 work

work K-8

≈ 10,000

NSF ≈ 25,000

Using USI as a lever on Title I.

AN ACTION STRATEGY FOR

IMPROVING ACHIEVEMENT IN MATHEMATICS AND SCIENCE

On March 6, 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 and develop, within 90 days, an action strategy for using Federal resources to assist States and local school systems to meet challenging math standards in the eighth grade, and for involving the mathematics, 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, and integrate technology and high-quality instructional materials into the classroom, and to motivate students to help them understand how math concepts are applied in today's global workplace. It called for the interagency group to review the current status of improvements in math education and identify and address critical issues of need, 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.

One of the immediate inspirations for this re-examination and rededication to high standards in mathematics and science education is the Third International Mathematics and Science Study (TIMSS). Results released in the Fall of 1996 show lackluster performance by U.S. 8th graders, with scores significantly below the international average in mathematics. There is evidence that our 4th graders do substantially better than the international average. Clearly we must focus attention on what we are and are not doing in middle school

mathematics.

Beyond indicating a need to focus emphasis on middle school grades (4-8),

*still too general
lots of details
good ideas missing*

*continue to
double-check
against my
list*

TIMSS also provides clues about how to go about the process of improving. This is because researchers not only collected achievement data in each participating country, but also much information about teachers and teaching, about curricula and instructional materials, about classroom lessons and interactions, and about attitudes and habits outside the classroom. Thus, 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.

Response of the Department of Education and the National Science Foundation to the Presidential Directive

Pursuant to the memorandum from the President, ED and NSF promptly formed an interagency working group comprised of ED and NSF staff experienced in the areas under review (mathematics, professional development, curriculum, educational technology, and student motivation and public outreach). Officials of the White House Offices of Science and Technology Policy and Domestic Policy, as well as the Office of Management and Budget, provided oversight. (A complete listing of the members of the interagency group is attached as Appendix 2).

The interagency group immediately began a review of current Federal efforts in mathematics and science education -- primarily, consistent with the directive, in mathematics education at the kindergarten through eighth-grade level. In addition, consistent with the memorandum's instructions for the interagency group to draw on research and input from educators and professional organizations, the group reached out to the broader mathematics and educational community for advice and guidance. (See Appendix 2 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 activities, or are interested in establishing activities, in elementary and secondary-level mathematics or science education. (See Appendix 2 for a list of the agencies consulted and a summary of their input.)

The Context for a New Federal Action Plan on Excellence in Eighth-Grade Math and, More Broadly, in Math and Science Education

The interagency group believes that any new action plan must build on the work already accomplished by, or underway in, the Federal agencies and in the broader math, science, and education communities. It must also be guided by a vision that all children can succeed in education, the same vision that undergirds Goals 2000, Title I, and other ED programs and the education programs of NSF. More specifically, the group has adopted the following vision statement as the template for its efforts:

All American students will leave eighth grade prepared to pursue higher-level mathematics and science courses that are the gateway to college, citizenship, productive employment, and lifelong learning.

To realize this vision, we must ensure that all students have access to high-quality, standards-based learning environments that permit them to demonstrate what they know and are learning in mathematics. This type of learning involvement must include:

" High expectations, held by educators, parents, and students themselves for student performance;

" Challenging standards, for content, materials, teaching, assessment, and proficiency;

" Classrooms where teachers have content background appropriate to the level of instruction and can effectively employ standards-based curricula and instructional materials and integrate technology into instruction; and

" Activities outside the classroom that reinforce the classroom experience by drawing on the support of parents, the professional community of mathematicians, scientists, and engineers, and the broader public.

While achievement of our national objectives in math and science education will rely on each of these elements, progress in one area will often depend on improvement in others. For instance, the introduction of high-quality instruction materials will have little impact if teachers are not trained to use those materials effectively. Effective instruction during the school day will have limited results if parents do not have high expectations for their children and are not committed participants in the process of education reform. What we are saying, in short, is that systemic K-12 education reform should remain the guiding principle behind any new initiatives in the area of mathematics and science. All elements of the educational process -- standards, curriculum and technologies, professional development and licensure, assessments, and support from parents and the public -- must be aligned around the critical reforms.

Building on Strength

A new Federal action plan should build on the considerable efforts underway, both within and outside of the Federal Government, to reform and improve elementary and secondary math and science education. Some of these activities began almost a decade ago. Taken together, they provide a solid foundation for new initiatives. Some of the most important current or completed activities include the following:

The National Council of Teachers of Mathematics (NCTM) standards for curriculum, evaluation, teaching, and assessment in mathematics, since their introduction in 1990, have provided strong guidance to States and localities in their efforts to improve mathematics education and have shown the way for the development of education standards in other content areas. (As is appropriate in any standards-based process, NCTM is now reviewing the math curriculum and evaluation standards and plans to update them over the next few years.)

All States have adopted frameworks for mathematics curricula, guided largely by the NCTM and often supported by ED curriculum framework grants or NSF State Systemic Initiative awards.

A new generation of standards-based mathematics curricula, with development funded largely by NSF, is beginning to appear in classrooms. By the fall of 1997, we project that these materials will account for 25 percent of all curriculum adoptions, and that figure should grow in succeeding years.

TIMSS and other new assessment and research tools provide means of identifying critical factors for improving achievement in mathematics and science and acting upon them.

With funding from ED, NSF, and other public and private resources, approximately 65% of all schools are now wired to the internet, providing the opportunity for communication on improving mathematics and science education and for the use of distance learning and advanced technologies in the delivery of instruction.

The Federal Government, through the NSF systemic initiatives, Goals 2000, the reauthorized Elementary and Secondary Act, and other ED and NSF programs, has spurred States to undertake comprehensive systemic reforms. States that were in the forefront of reforms are now beginning to enjoy the benefits in improved student outcomes.

(See Appendix 3 for a complete identification of significant Federal programs, activities, and partnerships available to improve teaching and learning.)

Parameters around the Strategy

Consistent with the thrust of the President's memorandum, our proposed plan of action focuses fundamentally on actions Federal agencies, along with other partners, can take to help students reach challenging mathematics standards and assure that their resources will support State and local reforms effectively. Through its consultation and active review of current Federal programs, the working group has established two areas of critical need:

Preparing K-8 teachers to teach challenging mathematics content in effective ways with high expectations for their students.

Implementing high-quality, standards-based, K-8 mathematics curricula and instructional materials and technology in the classroom

Focusing Federal resources on addressing these areas is the core of the program action plan described below. In addition to this program action plan, the working group also recognizes the importance of providing information and providing a venue for the formation of partnerships. Action plans for these areas are also described below.

An Action Strategy for Effective Use of Existing Federal Resources

The action plans provided below assume that activities are being undertaken within the framework of current five-year runouts of ED and NSF budgets. Activities of other agencies could also be accommodated within existing budget projections.

Program Action Plan: Focus Federal resources that could be used to improve teaching and learning in K-8 mathematics on the two areas of critical need.

ED will make clear to recipients of ED Eisenhower, Title I, and Goals 2000 funds that coherent, coordinated approaches to the critical areas of need for improvement of K-8 math education are regarded as a very high priority by ED, that requests for waivers to accommodate such approaches will be considered positively, and that movement in this direction is expected by the agency.

NSF will make coordinated, coherent approaches to the critical areas of need for improvement of K-8 math education a high priority of its programming and provide incentives for effective use of ED formula funds in conjunction with NSF competitive awards.

Other agencies will enhance teacher professional development and instructional materials development activities, tying them to NCTM standards and emphasizing K-8 mathematics, where appropriate.

ED and NSF will arrange a meeting for agency personnel and state and local leaders of ED's Eisenhower, Title I, and Goals 2000 activities and NSF's systemic initiatives to set the stage for implementation of the elements above.

Preparing K-8 teachers to teach challenging mathematics content in effective ways with high expectations for their students.

Activities in this area of critical need will address both in-service teacher professional development and pre-service teacher preparation. For

in-service professional development, the focus will be on intensive professional development activities infused with standards-based content that will make a difference in the classroom. Links to high-quality instructional materials and appropriate incorporation of technology will be encouraged. Pre-service teacher preparation activities will be aimed at preparing K-8 teachers to teach challenging mathematics content in line with the NCTM standards. A high priority will be placed on preparing teachers who can learn and adapt to the new learning environments that the incorporation of new technology will create.

The coherent, coordinated use of funding from ED programs envisioned above should make significant new resources available for K-8 teacher professional development in mathematics. NSF incentives (e.g., planning grants to create coherent, coordinated programs of K-8 teacher professional development in mathematics making use of ED, state and local funds to jump-start the effort and systemic efforts that explicitly leverage such sources of funds) should help diffuse mathematics education reform activities across the country.

NSF will work with the mathematics communities, institutions of higher education, and other agencies to assure appropriate response to increased demand for high-quality, standards-based professional development of in-service teachers and for preservice teacher preparation.

ED and NSF will support the creation of sets of professional development and teacher preparation tools for K-8 mathematics, tied to new curricula and instructional materials and technologies, where appropriate.

NSF will seed additional activities aimed at preparation of K-8 teachers that reflect the mathematics they will need to teach in the standards-oriented schools of the future.

ED will work with state education authorities on issues of state licensure and mathematics requirements for K-8 teachers.

NSF and ED will use the improvement of K-8 mathematics education to stimulate greater interaction and cooperation among institutions of higher education and K-12 schools through partnerships for teacher education and professional development, with particular emphasis on the transition to active in-service teaching.

Implementing high-quality, standards-based, K-8 mathematics curricula and instructional materials and technology in the classroom

New comprehensive mathematics curricula and instructional materials tied to high standards for content and instructional methods are now emerging from development and reaching the market. These materials need to get to the classroom. Supplementary materials that permit teachers to tailor instruction to particular classrooms, particularly those that place K-8 mathematics in a real world context and/or take advantage of new and emerging learning technologies, are needed to complement the comprehensive materials.

ED and NSF will develop and disseminate reviews of new curricula and materials designated as promising or exemplary by an expert panel and tools for use in selection of materials for classroom use. Similar reviews and guidance for software tools for K-8 mathematics will follow.

NSF will add one or two sites for assistance in implementation of K-8 mathematics instructional materials. These sites will connect with ED technical assistance mechanisms to assure the broadest possible access to implementation assistance.

ED will encourage schools with Title I school-wide programs to purchase new materials, where needed, and to obtain concomitant professional development aimed at their implementation using their Title I funds.

NSF will direct its instructional materials development programs away from development of comprehensive materials toward exemplary supplementary materials, with priority given to K-8 mathematics.

Other agencies will work in cooperation with NASA and NCTM to develop materials such as NASA's "Mission Mathematics." These materials illustrate the use of mathematics in real world examples related to the agency mission.

NSF will continue to seed additional research and development of powerful models for integrating technology, including support for critical scale-up testing and evaluation steps preceding commercialization of these models. K-8 mathematics will be a high priority in the near term.

ED and NSF will play lead roles in a review of Federal support for learning technology research and development. ED will lead activities related to a Presidential Directive that agencies make high-quality education materials and lesson plans available on the Internet. All agencies will participate. In both efforts, particular attention will be addressed to use of learning technologies in K-8 mathematics.

Information Action Plan: Serve as an information resource for those making decisions with respect to improving mathematics and science education, with particular attention to K-8 mathematics.

ED and NSF support state and local education entities and support education reform in other ways than providing direct or indirect financial support. Developing and disseminating information on standards, what works in their implementation, and how to obtain assistance in making decisions about the future is an important component of an action strategy to improve mathematics and science education. Some aspects of the agencies' information function are described in the Program Action Plan above. Other aspects include:

Information on 4th grade TIMSS results and comparison with 8th grade TIMSS results and their implications for action. The primary audience for such information is teachers, principals, superintendents, etc. -- those with influence in the decision process. ED and NSF will continue their collaboration in bringing TIMSS results to the forefront of attention.

Information on use of assessment in planning instructional improvement strategies. ED will focus on information related to the national test, while NSF activities will focus more broadly on assessment. The primary audience is teachers and principals.

ED will create mathematics website(s) providing information on the national test, including sample problems and worked solutions. This will include feedback on pretesting and testing once that begins. Websites may be tailored to serve particular audiences, including parents, students, teachers, principals and superintendents, mathematics educators, etc.

Partnership Action Plan: Provide a venue for the formation of effective partnerships that increase awareness and mobilize community support for achievement of challenging standards in mathematics.

In the United States, decisions about K-12 education are made at the state and local level, with the Federal government providing support for the making and assistance in the implementation of decisions. In order to increase awareness and mobilize community support for the achievement of challenging standards in mathematics in the eighth grade, ED, NSF and other Federal agencies will provide a vision for partnership that brings together the many groups that could make contributions to the effort and an arena in which such partnerships can develop fruitfully. In addition, ED, NSF and other Federal agencies will help to develop the core materials that provide substance around which state and local partnerships can coalesce.

NSF and ED will convene a national convocation on middle school mathematics to initiate a 3-year national dialogue involving all stakeholders on standards, professional development, curricula, instructional materials and technologies, and expectations for students at the completion of eighth grade. Regional meetings and meetings of groups with more focused interests will keep the dialogue moving, and a final convocation will address progress in improving achievement in eighth grade mathematics.

ED will provide an on-going stream of core information on what students need to know by the end of eighth grade based on the NCTM standards, what to expect in terms of student work at various grade levels, how changes in curricula and instructional methods and technologies support the standards, and how the proposed national test in mathematics addresses these issues.

NSF will work with academic mathematicians, scientists and engineers and with institutions of higher education (and with their professional societies and other non-governmental organizations) to articulate their roles in state and local partnerships.

NSF will give high priority to partnership efforts toward improving K-8 mathematics achievement in its informal education activities.

ED, NSF and other agencies will use program budgets and/or existing staff to develop substantive materials for use in partnership efforts aimed at activities outside the classroom. See the set of possible partnership activities below for examples.

Examples of partnership options that might be developed at local, state, or national levels include:

- Institutions of higher education or Federal agencies partnering with local K-12 schools to provide support for teachers and administrators implementing reform activities;
- Professional societies in mathematics, science, and engineering providing guidance for their members on interacting with schools and teachers productively;
- Summer math efforts that keep students growing mathematically, building on ED's successful summer reading effort;
- Public service information campaigns;

- Math fitness circles or networks with weekly problems, discussions of how they illustrate the standards, and discussions of the importance of mathematics for future education and work options;
- Support for students via telementoring by adults actively using mathematics in their work;
- After school and evening use of facilities (including computers, etc.) of local businesses, academic institutions, local government, and community organizations for mathematics-oriented activities (the "moonlight math" equivalent of "midnight basketball").

Partnership activities should be aimed at drawing together the broad resources of the local community, engendering a community understanding of the importance of challenging mathematics standards for the children of the community, and providing support to the schools outside the direct confines of the school system. In addition, partnership activities can help address considerations of equity, particularly in the use of technology.

Additional Resources

Both NSF and ED believe it is important to use existing resources effectively before requesting additional resources in support of the strategies outlined above. The basic issue is the extent to which realignment of existing resources can fully address the critical needs identified by the working group. By focusing on existing resources, programs, and authorities, we can implement the action strategy beginning in FY 1998. Based on experience in FY 1998, ED and NSF should evaluate the extent to which additional resources might be needed.

Need for Accountability

Need for Continuing Research

(These sections need to be added, as do the appendices.)

Discussion DRAFT

5/21/97

**ED-NSF Working Group on
Improving Math and Science Education**

Report to the President

Timeline for Production
(May 15-June 6)

<i>MAY</i>	15	Circulate draft to ED, NSF, and WG members; EOP prepares first draft of press release
	19	Circulate revision to ED, NSF, and other agencies where relevant
	22	Agency reviews due; EOP revises press release
	27	Circulate 2 nd revision to all agencies, EOP, and NGOs for clearance
	30	Clearance reviews due; 2 nd revision of press release
<i>JUNE</i>	1-5	Final report wordsmithing and formatting; final press release
	6	Report submitted to the President

Working Group Ideas

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Bonus pool for Eisenhower

Hold national conference of Title I coordinators, math supervisors, SSI's and Eisenhower state coordinators to review TIMSS and other data and best practices on math and science

Use framework of the test to develop a network of teachers committed to improving math and science instruction

FOCUS INTASC/state certification and licensure efforts on middle school math instructors

Issue challenge on high quality pre-service course for teachers headed for middle school math (and science) teaching.

Objective 2

Announce new NASA 5-8 document--Mission mathematics: Linking Aerospace to the NCTM standards

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Roll out NSF guide to selecting top-quality curriculum materials--get a middle school guide out the door first. Timing?

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Announce ED NLE web site with instructional units; use frameworks for national math and reading tests as organizing principle for the site? Or at least include crosswalk

Hold national summit on standards-based educational software development in math and science for school market; target software development grants better

Objective 4

Retrain agency education staff to understand and incorporate national math and science standards and help states and districts draw connections between holdings and the national tests.

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Work with Commerce/NIST and others to mobilize the business community on the math issue--

Possibly a job shadowing initiative

Announce formation of National Partnership on Improving Math Education

Something modeled on Athena project at MIT--24 hour on-line mentoring/Virtual office hours project being funded by OERI; also, access excellence project run by Genentech, providing interaction with real scientists

Highlight the Newsweek kids

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March 6, 1997

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- An easy-access joint Department of Education – NSF Internet site where teachers could go to get challenging, classroom-tested instructional units or materials that are linked to national standards.

Spreading the Word on Best Practices:

- A strategy for producing and disseminating products (such as videos and CD-roms that compare classroom teaching approaches in the U.S., Germany and Japan) that states and local school systems could use to compare their instructional practices with those used in high-performing countries and outstanding districts in the U.S.

Preparing Teachers for World-Class Teaching and Learning:

- A plan for using Department of Education and NSF programs to foster closer collaboration among school districts, colleges of education, and math and science faculties to incorporate the insights of TIMSS and ensure that teachers graduating from pre-service programs are prepared to excel in real classrooms.

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- A highly visible, nationwide public service campaign that would help parents and children understand the real-world importance of basic and advanced math and science skills for success in the 21st Century economy.

Creating a New Partnership for Math and Science Learning

- A new partnership among federal agencies, laboratories, higher education, and community organizations to promote greater involvement of professionals with strong math and science backgrounds in consulting with teachers to help students and parents understand the real-world applications of what students are learning.

Fostering Community Schools that Promote Math Excellence

- Develop principles for new community schools focusing on math instruction geared to high standards, with after-school, weekend and summer programs to enrich classroom learning, strong parental involvement, and ongoing opportunities for teachers to stay abreast of the latest developments in their field.

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AN ACTION STRATEGY FOR IMPROVING MATH AND SCIENCE EDUCATION

Preliminary Ideas

Objective 3: Ensure that all schools, teachers, and students have access to technologies that facilitate high-quality communications and delivery of standards-based instruction and that all teachers have the ability to integrate these technologies effectively into standards-based classroom instruction in mathematics and science.

Action Points	Key Aspects of Strategy	Action	Who Is Responsible? What Is the Mechanism? What is the Timeframe?
Development of technologies and technology-based learning materials	Accelerate development of software and materials available via the internet for use in standards-based instructional settings.	Carry out Presidential Directive that agencies make high-quality educational materials and lesson plans available on the Internet.	ED to chair interagency working group; all agencies to participate.
	Accelerate the infusion of technology into curricula and instructional materials and professional development of teachers.	- Promote innovative projects, including testbeds, that use technology to accelerate, deepen or reshape learning and professional development. - Identify incentives to drive development of high quality software.	- NSF and ED through grantees and contractors and partnerships with commercial developers. - Convene White House or NAS Conference.
	Facilitate development and subsequent use of research base	Promote development and dissemination of research results	NSF and ED through grantees and contractors and partnerships with commercial developers.
Selection and implementation	Provide good information on software and how to choose effectively to those responsible for selection.	- Support expert reviews of existing software to identify promising and exemplary materials and widely disseminate results. - Develop guidance on choosing K-8 instructional software with models for analysis.	- ED expert panel process with NSF collaboration. First reviews available within 18 months. - ED and NSF promote effective practices literature.
	Enhance technical assistance for implementation.	Build on ED regional technology technical assistance centers.	Expand existing effort.
	Support teacher professional development for implementation in the classroom	Develop tools for professional developers to use in training teachers.	?
	Leverage the Technology Challenge Fund and state and local funding in technology	Create an ED/NSF Technology Challenge Partnership	

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20502

Judy W. Lane
237-7819

March 6, 1997

MEMORANDUM FOR DISTRIBUTION

FROM: DARYL CHUBIN
BILL KINCAID, DPC

SUBJECT: DOEd-NSF WG

Attached are materials to review in preparation for tomorrow's DOEd-NSF Working Group meeting on "Improving Math and Science Education." The package includes:

- an agenda
- the final draft Presidential Directive (to the two agencies) submitted to the Staff Secretary, Domestic Policy Council
- two pages distributed to the press in Michigan today:
 - announcing specific education developments fostered by the Administration ("Continuing Progress . . .")
 - illustrating, in bullet form, the Action Strategy that the Working Group will produce ("How the Action Strategy . . .")

Thanks for participating in this important effort. We look forward to seeing you in Room 436 OEOb (17th Street and Pennsylvania Avenue, NW), Friday, March 7 at 12:30 p.m.

Distribution:

Marshall Smith, DOEd
Thomas Corwin, DOEd
Judy Wurtzel, DOEd
Deborah Spitz, DOEd
Clare Banwart, DOEd

Neal Lane, NSF
Judy Sunley, NSF
Luther Williams, NSF

PRESIDENTIAL DIRECTIVE TO THE
DEPARTMENT OF EDUCATION AND THE NATIONAL SCIENCE FOUNDATION

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

Working Group Meeting
March 7, 1997
12:30 pm, 436 OEOB

Agenda

- I. DPC-OSTP Welcome and Introductions
- II. Review of Presidential Directive (*faxed*)
- III. Discussion of "Action Strategy"
 - A. Developing scope of Working Group activities, e.g., 3/6/97
Michigan press release accompanying Directive titled "How the Action Strategy Will Help Improve Math and Science Education" (*faxed*)
 - B. Definition of "results" of the Directive, i.e., form and specificity of recommendations and action strategy to be reported in 90 days
- IV. Next Steps
 - A. Working group division of labor (subgroup assignments?) and timetable
 - B. Determining other federal agency inputs and participation of NGOs
 - C. Modes of information-gathering, e.g., briefings, document review, Working Group's own reviews/briefs
 - D. DPC-OSTP staff role
 - E. Other

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

Continuing Progress Toward Raising Standards and Improving Reading and Math

DRAFT March 6, 1997

MICHIGAN SECOND STATE TO ACCEPT CHALLENGE ON NATIONAL STANDARDS OF EXCELLENCE IN MATH AND SCIENCE.

Last month, in his State of the Union address, President Clinton challenged states and school districts to participate in a new, voluntary national test for individual students in fourth-grade reading and eighth-grade students mathematics to be administered beginning in the spring of 1999. Today, Governor Engler will announce that Michigan intends to participate in the new national tests. This makes Michigan the second state, after Maryland, to make this commitment.

FOCUSING FEDERAL RESOURCES ON HELPING STATES AND SCHOOL DISTRICTS IMPROVE MATH EDUCATION

Today the President is directing the Department of Education and the National Science Foundation, working with other agencies, to develop an action strategy for using federal resources and involving the math, scientific, and technical communities in helping states and school districts prepare students to meet challenging standards in eighth grade math, as well as raise achievement in science. The action strategy, to be completed within 90 days, will 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.

TECHNOLOGY GRANT AWARDED TO MICHIGAN

The President also announced today that the U.S. Department of Education is awarding Michigan \$8.6 million under the President's Technology Literacy Challenge Fund. Under the award, funds will go to local schools to help teachers gain training in the use of technology, and also help fund software and hardware, as well as Internet access, to help students connect with the information superhighway and learn to high standards.

MORE COMMITMENTS TO AMERICA READS

In a sign of progress on his America Reads initiative, the President also announced today that 16 colleges and universities in Michigan had committed more than 1500 work study students to serve as reading tutors over the next 5 years.

HOW THE ACTION STRATEGY WILL HELP IMPROVE MATH AND SCIENCE EDUCATION

March 6, 1997

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OFFICE OF SCIENCE AND TECHNOLOGY POLICY

Science Division
Executive Office of the President
436 Old Executive Office Building
Washington, DC 20502

202-456-6130
202-456-6027 (FAX)

FAX TRANSMITTAL SHEET

DATE: March 6, 1997

NAME/AGENCY

PHONE/FAX NUMBERS

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Neal Lane, NSF	(703) 306-1000/(703) 306-0109
Judy Sunley, NSF	(703) 306-1018/(703) 306-0109
Luther Williams, NSF	(703) 306-1606/(703) 306-0399

FROM: Daryl Chubin and Bill Kincaid (DPC)

NUMBER OF PAGES (INCLUDING COVER SHEET): 7

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

An Action Strategy

Preliminary Outline

The President has directed the Department of Education (ED) and the National Science Foundation (NSF), in cooperation with the Office of Science and Technology Policy (OSTP) and the Domestic Policy Council (DPC) 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. (See the Presidential Directive, attached as Appendix 1.)

This document is a preliminary outline for such an action strategy. It describes the vision motivating the strategy and a long term goal for the effort. It is predicated on using a voluntary, nation-wide examination in mathematics at the end of the eighth grade as a tool for implementation.

Vision

All American students will leave eighth grade prepared to excel at the higher level math and science courses that are the gateway to college, citizenship, productive employment, and lifelong learning.

Goal

All students have access to high-quality, standards-based K-8 learning environments that permit them to demonstrate effectively what they know and are learning in mathematics.

Components of a Productive Learning Environment

- Expectations: for student performance, student expectations for themselves.
- Standards: for content, materials, teaching, assessment, proficiency.
- In the Classroom: curriculum, instructional materials, integrated use of technology, teachers, supportive school environment.
- Outside the Classroom: supportive state and local policies, informed parents and students, informed public, informed and supportive professional community of mathematicians, scientists and engineers.

Productive learning environments result from the interplay of a large number of seemingly separate elements. In order to optimize the effectiveness of the learning process, all these factors must be taken into consideration and addressed appropriately, as must their interaction. High-quality instructional materials cannot do their job without teachers who have appropriate expectations for their students and appropriate skills to carry out the instruction. Informed, supportive parents contribute to the demand for standards-based instruction and help raise the level of expectation for student performance.

In developing an action strategy reaching toward the goal and vision articulated above, the working group has explored key leverage points in the components of a productive learning environment. The basic framework for discussion has been the four substantive areas

described in the Presidential Directive (See Appendix 1). However, as is apparent in the material that follows, those areas are not distinct. It is in creating synergy among them that the action strategy can be most effective.

Building from Strength

In developing the action strategy, the working group was able to build from the growing base of educational reform activities in science and mathematics. We are in a time of unprecedented opportunity to make a major improvement in science and math education as a result of activities undertaken over the past decade.

- The National Council of Teachers of Mathematics (NCTM) has developed sets of standards for curriculum and evaluation, teaching, and assessment in mathematics.
- All states have some sort of framework for mathematics curricula, driven largely by the NCTM standards.
- There is an increasing commitment to the education of all students and their exposure to challenging mathematics.
- There are newly appearing materials to help structure a good classroom environment, both comprehensive curricula and special purpose supplemental materials.
- There is on-going development of learning technologies and exploration of their use in the classroom.
- There is a strong base of knowledge about assessment in mathematics, including its use as a tool for professional development of teachers.
- There is a good base of knowledge about how to support teachers.
- There are active programs in federal agencies to link content, materials, and teaching strategies in support of teachers, including the development of networks where teachers can support one another.

Thus, for much of the action strategy, the foundation of action is in place. Moving toward the goal is a matter of getting information into appropriate hands, accelerating a planned staging of activities, or increasing the scale of activity. Much of this can be facilitated directly by the federal government in cooperation with state and local governments or the private sector through existing mechanisms at moderate additional cost. However, massive change in the scale of some types of activities needed to ensure all K-8 students access to productive learning environments will require significant change in existing mechanisms and may be quite costly. Key elements here are professional development for teachers and implementation of high-quality, standards-based curricular materials in the classroom.

The Essence of the Strategy

Eighth grade is only the place where a snapshot of capability is taken; it is in the eight previous years of formal education that the capability is built. The focus of this action strategy is K-8 math and science education, with particular attention to grades 4-8. We expect to redirect activities so that, for example, federal teacher professional development activities have a visible focus on K-8 math and science. We expect to influence the use of all available types of funds, using funds explicitly targeted to math and science standards-based education reform to draw on the much broader pools of funding available for education activities. We also expect to use the current visibility of mathematics education to convene interested parties, both to spread information and to provide resources for expanding certain types of activities.

There is no one model of math and science educational reform towards high expectations and challenging standards that works everywhere. Our strategies must provide opportunities for state and local entities to adapt effective models to their particular situation. Change must take place at the local level. Federal funds can influence change, but should not direct how change is accomplished or what standards are set.

In many instances, the specific actions to be taken require further exploration. This action strategy is being prepared under very tight time constraints, and details are missing. An on-going working group to monitor implementation and to develop the details is important for appropriate follow-up. Such a group can also be instrumental in maintaining on-going, substantive cooperation and collaboration among the federal agencies engaged in the effort.

The following set of tables provides four objectives taken from the four areas of the Presidential Directive. Under each objective, it lists key aspects of strategy, recommended actions, and a brief indication of how the action might be accomplished and in what timeframe. Shaded items are those most likely to require substantial added funding.

AN ACTION STRATEGY FOR IMPROVING MATH AND SCIENCE EDUCATION

Preliminary Ideas

Objective 1: Ensure that teachers have the content knowledge and pedagogical skills necessary to teach standards-based, challenging mathematics to all students, so that, by the end of eighth grade, they have laid the foundations for the study of more advanced mathematics.

(Note: the words high-quality, standards-based are assumed to be placed in front of all references to professional development)

Action Points	Key Aspects of Strategy	Action	Who Is Responsible? What Is the Mechanism? What is the Timeframe?
Planned, long-term programs of professional development	Provide information on exemplary activities.	- Develop/disseminate models for exemplary professional development. - expand availability of exemplary professional development	ED and NSF based on existing mechanisms.
	Tie professional development to exemplary instructional materials to be used in the classroom	Coordinate professional development with selection and implementation of exemplary instructional materials in mathematics and with student assessment in mathematics.	NSF and ED based on existing mechanisms with more intense focus on K-8 math and science.
	Expand availability of exemplary, long-term professional development.	- Add focus to existing programs aimed at professional development. - Develop an ED/NSF partnership to leverage Title 1 and Eisenhower most effectively. - Expand the capacity for effective professional development by promoting partnerships between states, school districts, or schools and higher education.	- NSF teacher enhancement programs; ED Eisenhower - Show how such leverage has worked in specific instances. - Model after NSF/EPA partnership. - Show how such partnerships have worked in specific instances. - ED/NSF partnership modelled after NSF/EPA partnership.

AN ACTION STRATEGY FOR IMPROVING MATH AND SCIENCE EDUCATION

Preliminary Ideas

Objective 1: Ensure that teachers have the content knowledge and pedagogical skills necessary to teach standards-based, challenging mathematics to all students, so that, by the end of eighth grade, they have laid the foundations for the study of more advanced mathematics.

Pressure Points	Key Aspects of Strategy	Possible Action	Who Is Responsible?/ What Is the Mechanism? What is the Timeframe?
In-school support for teachers	Develop master teachers	Provide professional development opportunities for those who might serve as master teachers	ED and NSF through existing programs.
	Develop networks of teachers	- Encourage professional development that permits teachers to remain in contact for follow-up - Encourage teachers to assist in grading of open-ended questions on the exam	- ED and NSF through existing programs. - Will depend on how exam is administered and scored
	Provide appropriate transitional support for teachers	Promote intensive support for teachers during their first 3-5 years using master teachers and math specialists.	Requires local commitment to use funds effectively.
Pre-service education and training	Engage K-12 schools.	Promote partnerships between states, school districts, schools, and higher education for pre-service education and training.	New NSF/ED activity, possibly tied to in-service professional development activity described above.
		Define standards for exemplary classrooms for siting of student teachers.	ED, NSF and professional organizations.
	Implement more appropriate courses for future K-8 math teachers through cooperation between education and arts and sciences colleges	- Develop courses that ensure future teachers have appropriate content knowledge and experience appropriate forms of pedagogy. - Make such courses widely available to students.	ED, NSF, and appropriate partners.

AN ACTION STRATEGY FOR IMPROVING MATH AND SCIENCE EDUCATION

Preliminary Ideas

Objective 2: Ensure that all schools, teachers, and students have access to high quality, standards-based instructional materials in their classrooms.

(Note: all references to instructional materials should have "high-quality, standards-based" assumed in front of them.)

Action Points	Key Aspects of Strategy	Action	Who Is Responsible? What Is the Mechanism? What is the Timeframe?
Development of materials	Build on comprehensive, coherent sets of K-8 mathematics materials now entering the market in developing appropriate supplemental materials.	- Require rapid dissemination of information about new comprehensive materials developed using federal funds. - Support development of high quality supplemental materials, including technology-based materials and materials incorporating links to science and social studies.	- NSF has supported the development of materials. Use award follow-up mechanisms. - NSF, ED, NASA, NAS, and NCTM. (Acceleration of existing activities.)
Selection of materials	Provide good information about materials and how to choose among them to those responsible for selection.	- Support expert reviews of existing materials to identify promising and exemplary materials and widely disseminate results. - Develop guidance on choosing K-8 instructional materials with models for analysis.	- ED expert panel process with NSF collaboration. First publication by 1/98; others to follow every six months. - ED TIMSS toolkit to be released July 1; NSF/ED collaboration for others within 18 months (Acceleration of planned activities.)
	Build public support	Develop guidance for parents that help them understand and affect materials selection.	ED and NSF in partnership with PTA, Urban League, etc. (New activity linked to existing activities)
	Enable purchase of effective new materials.	- Work with publishers to decrease cost. - Enable creative use of Title I, etc. funds	ED and NSF with assistance of White House.

AN ACTION STRATEGY FOR IMPROVING MATH AND SCIENCE EDUCATION

Preliminary Ideas

Objective 2: Ensure that all schools, teachers, and students have access to high quality, standards-based instructional materials in their classrooms.

(Note: all references to instructional materials should have "high-quality, standards-based" assumed in front of them.)

Action Points	Key Aspects of Strategy	Action	Who Is Responsible? What Is the Mechanism? What is the Timeframe?
Implementation	Provide guidance on what is necessary for effective implementation of new materials in the classroom and assistance with implementation.	• Prepare guides for teachers, principals, superintendents, state supervisors, etc. • Use Regional Labs and Eisenhower consortia to disseminate information and provide assistance as needed.	• ED and NSF; immediate for preliminary guidance; up to 24 months • ED to provide guidance to Labs and Consortia, coordinate efforts with NSF.
	Increase supply of technical assistance on implementation to states, districts and schools implementing new materials.	• Increase extent to which Eisenhower state grants are used to support implementation of new materials. • Fund implementation sites to assist schools and districts.	• ED principles of effectiveness for Eisenhower programs. • Expand NSF activity to 4-8 sites covering K-8, possibly with ED assistance.
	Link implementation to professional development	• See material on teacher professional development under Objective 1	
	Link to pre-service education and training	• Encourage colleges and universities to use exemplary instructional materials in educating future teachers	• NSF through teacher preparation activities; see also pre-service actions under Objective 1.

AN ACTION STRATEGY FOR IMPROVING MATH AND SCIENCE EDUCATION

Preliminary Ideas

Objective 3: Ensure that all schools, teachers, and students have access to technologies that facilitate high-quality communications and delivery of standards-based instruction and that all teachers have the ability to integrate these technologies effectively into standards-based classroom instruction in mathematics and science.

Action Points	Key Aspects of Strategy	Action	Who Is Responsible? What Is the Mechanism? What is the Timeframe?
Development of technologies and technology-based learning materials	Accelerate development of software and materials available via the internet for use in standards-based instructional settings.	Carry out Presidential Directive that agencies make high-quality educational materials and lesson plans available on the Internet.	ED to chair interagency working group; all agencies to participate.
	Accelerate the infusion of technology into curricula and instructional materials and professional development of teachers.	- Promote innovative projects, including testbeds, that use technology to accelerate, deepen or reshape learning and professional development. - Identify incentives to drive development of high quality software.	- NSF and ED through grantees and contractors and partnerships with commercial developers. - Convene White House or NAS Conference.
	Facilitate development and subsequent use of research base	Promote development and dissemination of research results	NSF and ED through grantees and contractors and partnerships with commercial developers.
Selection and implementation	Provide good information on software and how to choose effectively to those responsible for selection.	- Support expert reviews of existing software to identify promising and exemplary materials and widely disseminate results. - Develop guidance on choosing K-8 instructional software with models for analysis.	- ED expert panel process with NSF collaboration. First reviews available within 18 months. - ED and NSF promote effective practices literature.
	Enhance technical assistance for implementation.	Build on ED regional technology technical assistance centers.	Expand existing effort.
	Support teacher professional development for implementation in the classroom	Develop tools for professional developers to use in training teachers.	?
	Leverage the Technology Challenge Fund and state and local funding in technology	Create an ED/NSF Technology Challenge Partnership	

AN ACTION STRATEGY FOR IMPROVING MATH AND SCIENCE EDUCATION

Preliminary Ideas

Objective 4: Engage students, parents, teachers and the general public by building wide-spread understanding of the necessity of mastering challenging mathematics as a gateway to future educational opportunities and jobs; empahsize that all students are capable of such mastery.

Action Points	Key Aspects of Strategy	Action	Who Is Responsible? What Is the Mechanism? What is the Timeframe?
Public expectations for student performance, including attitudes about importance and excitement of mathematics	Provide information for parents, business, policy makers and general public on what students can and should be able to do in mathematics by 8th grade and its importance.	- Develop and disseminate materials, including concrete examples of what students should be able to do, checklists, elements of good programs, examples of careers using mathematics, resource guides, and examples of success. - Prepare and disseminate op-ed pieces, articles in professional journals and parent magazines, etc.	- ED and NSF with a variety of partners (e.g., NCTM, PTA, NASBA, NAB, etc.) (immediate; new activities) - ED, NSF and partners; tie to immediacy of test, where appropriate.
Community and business support for mathematics achievement through mentoring, tutoring and providing role models.	Involve community and business in active support of standards-based mathematics instruction.	- Develop and disseminate materials that will support community and business involvement in standards-based mathematics classrooms. - Tie mathematics achievement to broad community benefits. - Link to the America Reads and broad-based volunteer efforts to develop high quality, fun mathematics materials for use of parents and tutors. Tie to the exam, as appropriate. - Encourage media efforts.	- ED, NSF and other agency partners. - White House

ED-NSF Working Group on Improving Math and Science Education

Briefing of the Principals on Progress of the Working Group

DRAFT AGENDA

476 OEOB

May 2, 1997, 4:30 pm

- | | |
|---|---|
| I. Welcome and Introductions | Jack Gibbons |
| II. Review of Charge to the Working Group | Mike Cohen |
| III. Report of Progress on Action Strategy
(Including highlights under
each objective) | Working Group Co-chairs:
Judy Sunley
Tom Corwin |
| IV. Feedback and Discussion | |
| V. Other Discussion Items: | |
| * National Partnership on Improving Math
Education:
Structure
Activities
Spokesperson?
Next steps? | Judy Wurtzel |
| * Meeting with Other Agency Reps | Judy Sunley
Tom Corwin |
| VI. Last Words | Neal Lane
Mike Smith |

**OFFICE OF SCIENCE AND TECHNOLOGY POLICY**

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Executive Office of the President
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DATE: May 1, 1997

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	Gerald Tirozzi	202/205-0303
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	Judith Sunley	703/306-0109
	Luther Williams	703/306-0399
	Mike Cohen	202/456-7028
	→ Bill Kincaid	202/456-7028
	Jack Gibbons	202/456-6021

Lisa Duffey for Daryl Chubin

FROM:

NUMBER OF PAGES (INCLUDING COVER SHEET): 1

ADDITIONAL MESSAGE:

To confirm: A meeting will be held on Friday, May 2 at 4:30 p.m. in Room 476 of the Old Executive Office Building. The purpose of the meeting is to brief Mike Smith, Neal Lane, and Jack Gibbons on the activities of the working group to improve math and science education and to discuss directions of the draft recommendations for the action strategy.

Please provide dates of birth and social security numbers (required for building access) for all attendees by calling me at 202/456-6130.

NATIONAL SCIENCE FOUNDATION
4201 Wilson Blvd. Room 1205
Arlington, VA 22230

OFFICE OF THE DIRECTOR

FACSIMILE COVER SHEET

PLEASE DELIVER TO:

NAME: Bill Kencaid

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FROM:

NAME: Judy Sunley

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DATE: 5-1 TIME: _____

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Preliminary Working DRAFT
5/1/97

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Vision

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Components of a Productive Learning Environment

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- Standards: for content, materials, teaching, assessment, proficiency.
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Productive learning environments result from the interplay of a large number of seemingly separate elements. In order to optimize the effectiveness of the learning process, all these factors must be taken into consideration and addressed appropriately, as must their interaction. High-quality instructional materials cannot do their job without teachers who have appropriate expectations for their students and appropriate skills to carry out the instruction. Informed, supportive parents contribute to the demand for standards-based instruction and help raise the level of expectation for student performance.

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described in the Presidential Directive (See Appendix 1). However, as is apparent in the material that follows, those areas are not distinct. It is in creating synergy among them that the action strategy can be most effective.

Building from Strength

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- There are newly appearing materials to help structure a good classroom environment, both comprehensive curricula and special purpose supplemental materials.
- There is on-going development of learning technologies and exploration of their use in the classroom.
- There is a strong base of knowledge about assessment in mathematics, including its use as a tool for professional development of teachers.
- There is a good base of knowledge about how to support teachers.
- There are active programs in federal agencies to link content, materials, and teaching strategies in support of teachers, including the development of networks where teachers can support one another.

Thus, for much of the action strategy, the foundation of action is in place. Moving toward the goal is a matter of getting information into appropriate hands, accelerating a planned staging of activities, or increasing the scale of activity. Much of this can be facilitated directly by the federal government in cooperation with state and local governments or the private sector through existing mechanisms at moderate additional cost. However, massive change in the scale of some types of activities needed to ensure all K-8 students access to productive learning environments will require significant change in existing mechanisms and may be quite costly. Key elements here are professional development for teachers and implementation of high-quality, standards-based curricular materials in the classroom.

The Essence of the Strategy

Eighth grade is only the place where a snapshot of capability is taken; it is in the eight previous years of formal education that the capability is built. The focus of this action strategy is K-8 math and science education, with particular attention to grades 4-8. We expect to redirect activities so that, for example, federal teacher professional development activities have a visible focus on K-8 math and science. We expect to influence the use of all available types of funds, using funds explicitly targeted to math and science standards-based education reform to draw on the much broader pools of funding available for education activities. We also expect to use the current visibility of mathematics education to convene interested parties, both to spread information and to provide resources for expanding certain types of activities.

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5/1/97

There is no one model of math and science educational reform towards high expectations and challenging standards that works everywhere. Our strategies must provide opportunities for state and local entities to adapt effective models to their particular situation. Change must take place at the local level. Federal funds can influence change, but should not direct how change is accomplished or what standards are set.

In many instances, the specific actions to be taken require further exploration. This action strategy is being prepared under very tight time constraints, and details are missing. An on-going working group to monitor implementation and to develop the details is important for appropriate follow-up. Such a group can also be instrumental in maintaining on-going, substantive cooperation and collaboration among the federal agencies engaged in the effort.

The following set of tables provides four objectives taken from the four areas of the Presidential Directive. Under each objective, it lists key aspects of strategy, recommended actions, and a brief indication of how the action might be accomplished and in what timeframe. Shaded items are those most likely to require substantial added funding.

AN ACTION STRATEGY FOR IMPROVING MATH AND SCIENCE EDUCATION

Preliminary Ideas

Objective 1: Ensure that teachers have the content knowledge and pedagogical skills necessary to teach standards-based, challenging mathematics to all students, so that, by the end of eighth grade, they have laid the foundations for the study of more advanced mathematics.

(Note: the words high-quality, standards-based are assumed to be placed in front of all references to professional development)

Action Points	Key Aspects of Strategy	Action - More specific - how?	Who Is Responsible? What Is the Mechanism? What is the Timeframe?
Planned, long-term programs of professional development	Provide information on exemplary activities.	- Develop/disseminate models for exemplary professional development. - expand availability of exemplary professional development	ED and NSF based on existing mechanisms.
	Tie professional development to exemplary instructional materials to be used in the classroom	Coordinate professional development with selection and implementation of exemplary instructional materials in mathematics and with student assessment in mathematics.	NSF and ED based on existing mechanisms with more intense focus on K-8 math and science.
	Expand availability of exemplary, long-term professional development.	Add focus to existing programs aimed at professional development.	NSF teacher enhancement programs; ED Eisenhower
		- Develop an ED/NSF partnership to leverage Title I and Eisenhower most effectively. <i>Organize sample</i> - Expand the capacity for effective professional development by promoting partnerships between states, school districts, or schools and higher education.	- Show how such leverage has worked in specific instances. - Model after NSF/EPA partnership. - Show how such partnerships have worked in specific instances. - ED/NSF partnership modelled after NSF/EPA partnership.

— provide greater mention for invest^{T.I.E} resources in effective professional development approaches — bonus pool

AN ACTION STRATEGY FOR IMPROVING MATH AND SCIENCE EDUCATION

Preliminary Ideas

Objective 1: Ensure that teachers have the content knowledge and pedagogical skills necessary to teach standards-based, challenging mathematics to all students, so that, by the end of eighth grade, they have laid the foundations for the study of more advanced mathematics.

Pressure Points	Key Aspects of Strategy	Possible Action <i>How?</i>	Who Is Responsible?/ What Is the Mechanism? What is the Timeframe?
In-school support for teachers	Develop master teachers	Provide professional development opportunities for those who might serve as master teachers	ED and NSF through existing programs.
	Develop networks of teachers <i>new</i> <i>use existing networks to disseminate networks of expert ponds</i> <i>such as</i>	- Encourage professional development that permits teachers to remain in contact for follow-up - Encourage teachers to assist in grading of open-ended questions on the exam	- ED and NSF through existing programs. - Will depend on how exam is administered and scored
	Provide appropriate transitional support for teachers	Promote intensive support for teachers during their first 3-5 years using master teachers and math specialists.	Requires local commitment to use funds effectively.
Pre-service education and training	Engage K-12 schools	Promote partnerships between state, school districts, schools, and higher education for pre-service education and training	New NSF/ED activity possibly led to in-service professional development activity described above.
		Define standards for exemplary classrooms for siting of student teachers.	ED, NSF and professional organizations.
	Implement more appropriate courses for future K-8 math teachers through cooperation between education and arts and sciences colleges	- Develop courses that ensure future teachers have appropriate content knowledge and experience appropriate forms of pedagogy - Make such courses widely available to students	ED, NSF, and appropriate partners

AN ACTION STRATEGY FOR IMPROVING MATH AND SCIENCE EDUCATION

Preliminary Ideas

Objective 2: Ensure that all schools, teachers, and students have access to high quality, standards-based instructional materials in their classrooms.

(Note: all references to instructional materials should have "high-quality, standards-based" assumed in front of them.)

Action Points	Key Aspects of Strategy	Action	Who Is Responsible? What Is the Mechanism? What is the Timeframe?
Development of materials	Build on comprehensive, coherent sets of K-8 mathematics materials now entering the market in developing appropriate supplemental materials.	- Require rapid dissemination of information about new comprehensive materials developed using federal funds. - Support development of high quality supplemental materials, including technology-based materials and materials incorporating links to science and social studies.	- NSF has supported the development of materials. Use award follow-up mechanisms. - NSF, ED, NASA, NAS, and NCTM. (Acceleration of existing activities.)
Selection of materials	Provide good information about materials and how to choose among them to those responsible for selection.	- Support expert reviews of existing materials to identify promising and exemplary materials and widely disseminate results. - Develop guidance on choosing K-8 instructional materials with models for analysis.	- ED expert panel process with NSF collaboration. First publication by 1/98; others to follow every six months. - ED TIMSS toolkit to be released July 1; NSF/ED collaboration for others within 18 months (Acceleration of planned activities.)
	Build public support	Develop guidance for parents that help them understand and affect materials selection.	ED and NSF in partnership with PTA, Urban League, etc. (New activity linked to existing activities)
	Facile purchase of effective new materials	- Work with publishers to decrease cost - Facile creative use of Title I, etc. funds	ED and NSF with assistance of White House

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(Note: all references to instructional materials should have "high-quality, standards-based" assumed in front of them.)

Action Points	Key Aspects of Strategy	Action	Who Is Responsible? What Is the Mechanism? What is the Timeframe?
Implementation	Provide guidance on what is necessary for effective implementation of new materials in the classroom and assistance with implementation.	• Prepare guides for teachers, principals, superintendents, state supervisors, etc. • Use Regional Labs and Eisenhower consortia to disseminate information and provide assistance as needed.	• ED and NSF; immediate for preliminary guidance; up to 24 months • ED to provide guidance to Labs and Consortia, coordinate efforts with NSF.
	Increase supply of technical assistance on implementation to states, districts and schools implementing new materials.	• Increase extent to which Eisenhower state grants are used to support implementation of new materials. • Fund implementation sites to assist schools and districts.	• ED principles of effectiveness for Eisenhower programs. • Expand NSF activity to 4-8 sites covering K-8, possibly with ED assistance.
	Link implementation to professional development	• See material on teacher professional development under Objective 1	
	Link to pre-service education and training	• Encourage colleges and universities to use exemplary instructional materials in educating future teachers	• NSF through teacher preparation activities; see also pre-service actions under Objective 1.

AN ACTION STRATEGY FOR IMPROVING MATH AND SCIENCE EDUCATION

Preliminary Ideas

Objective 3: Ensure that all schools, teachers, and students have access to technologies that facilitate high-quality communications and delivery of standards-based instruction and that all teachers have the ability to integrate these technologies effectively into standards-based classroom instruction in mathematics and science.

Action Points	Key Aspects of Strategy	Action	Who Is Responsible? What Is the Mechanism? What is the Timeframe?
Development of technologies and technology-based learning materials	Accelerate development of software and materials available via the internet for use in standards-based instructional settings.	Carry out Presidential Directive that agencies make high-quality educational materials and lesson plans available on the Internet.	ED to chair interagency working group; all agencies to participate.
	Accelerate the infusion of technology into curricula and instructional materials and professional development of teachers.	- Promote innovative projects, including testbeds, that use technology to accelerate, deepen or reshape learning and professional development. - Identify incentives to drive development of high quality software.	- NSF and ED through grantees and contractors and partnerships with commercial developers. - Convene White House or NAS Conference.
	Facilitate development and subsequent use of research base	Promote development and dissemination of research results	NSF and ED through grantees and contractors and partnerships with commercial developers.
Selection and implementation	Provide good information on software and how to choose effectively to those responsible for selection.	- Support expert reviews of existing software to identify promising and exemplary materials and widely disseminate results. - Develop guidance on choosing K-8 instructional software with models for analysis.	- ED expert panel process with NSF collaboration. First reviews available within 18 months. - ED and NSF promote effective practices literature.
	Enhance technical assistance for implementation.	Build on ED regional technology technical assistance centers.	Expand existing effort.
	Support teacher professional development for implementation in the classroom	Develop tools for professional developers to use in training teachers.	?
Develop the Technology Challenge Fund to provide seed money for technology		Develop an ED/NSF Technology Challenge Partnership	

AN ACTION STRATEGY FOR IMPROVING MATH AND SCIENCE EDUCATION

Preliminary Ideas

Objective 4: Engage students, parents, teachers and the general public by building wide-spread understanding of the necessity of mastering challenging mathematics as a gateway to future educational opportunities and jobs; emphasize that all students are capable of such mastery.

Action Points	Key Aspects of Strategy	Action	Who Is Responsible? What Is the Mechanism? What is the Timeframe?
Public expectations for student performance, including attitudes about importance and excitement of mathematics	Provide information for parents, business, policy makers and general public on what students can and should be able to do in mathematics by 8th grade and its importance.	- Develop and disseminate materials, including concrete examples of what students should be able to do, checklists, elements of good programs, examples of careers using mathematics, resource guides, and examples of success. - Prepare and disseminate op-ed pieces, articles in professional journals and parent magazines, etc.	- ED and NSF with a variety of partners (e.g., NCTM, PTA, NASBA, NAB, etc.) (immediate; new activities) - ED, NSF and partners; tie to immediacy of test, where appropriate.
Community and business support for mathematics achievement through mentoring, tutoring and providing role models.	Involve community and business in active support of standards-based mathematics instruction.	- Develop and disseminate materials that will support community and business involvement in standards-based mathematics classrooms. - Tie mathematics achievement to broad community benefits. - Link to the America Reads and broad-based volunteer efforts to develop high quality, fun mathematics materials for use of parents and tutors. Tie to the exam, as appropriate. - Encourage media efforts.	- ED, NSF and other agency partners. - White House

Author: Thomas Corwin at WDCT02
Date: 5/5/97 9:56 AM
Priority: Normal
TO: jsunley@nsf.gov at INTERNET
TO: Judy Wurtzel at WDCT01
CC: James Butler
CC: Deborah Spitz
Subject: Ideas from Saturday

----- Message Contents -----

I thought Saturday's CBMS meeting was quite useful. Here are some ideas I came away with that could be added to our action strategy. Most address our Objective 1, since that was the subject of the breakout group in which I participated:

1. The Department could carry out an initiative to encourage Title I "Schoolwide" schools to use highly qualified math specialists (particularly instead of poorly qualified aides) to teach math to all students. We would probably do this through our bully pulpit mechanisms -- speeches, program directives, newsletters, etc. I don't think we could be more prescriptive, but we can at least emphasize the importance of this action and point to some examples of where it is done well. (Also not sure which of our four objectives this fits under.)
2. Encourage a strengthening of teacher licensure requirements in math (and science?) by carrying out research that compares the requirements across States and with other countries. Seems like fairly quick and easy research that could be done by OERI. Should generate public attention.
3. Fund creation of professional development materials tied to the high standards that will be the basis for the test. Seems like an NSF task, but ED could get involved in dissemination, prod Ike programs to use the materials. (Has NSF already done any of this?)
4. Create, or expand, professional development programs specifically for middle school teachers. One of the participants in Judy W and my break-out group said that middle school teachers are always an "add-on or a subtract-off-of" PD programs aimed at either elementary or secondary teachers. They are never the focus of the program. But the middle school years are critical and they are also the point at which we will administer the test. This, again, seems like an NSF task; I don't know the extent to which the criticism of past efforts is valid -- you may have a lot going at the middle school level.
5. Carry out teacher enhancement programs specifically focused on preparation for the test. Use distance learning in order to reach a lot of teachers quickly and cost-effectively.

I don't know how bold these ideas are, but they seem fresher than much of what we've been kicking around the table.

While I'm on, the following are a couple proposals the Department's Title V reauthorization team has put together that might be added to our strategy. The Title V team has not been concentrating specifically on math and science, so the ideas are meant to improve

the preparation of all teachers, but we might give them a math-science gloss in the strategy.

1. Fund "lighthouse" institutions of higher ed that have exemplary teacher training programs, to assist other institutions in adopting the best practices.
2. Support national reforms in teacher recruitment, preparation, licensure, and induction through a broad discretionary fund established in the Department.
3. We're also talking about establishing a scholarship program for talented teacher candidates who will teach in underserved urban and rural areas, but I have a number of serious issues with that proposal and wouldn't, at this time, recommend that it go into our strategy.

See you later.

Tom

Objective 3: Ensure that all schools, teachers, and students have access to technologies that facilitate high-quality communications and delivery of standards-based instruction and that all teachers have the ability to integrate these technologies effectively into standards-based classroom instruction in mathematics and science.

Pressure Points	Key Aspects of Strategy	Possible Action	Who Is Responsible? What Is the Mechanism? What is the Timeframe?
Research and Development	Accelerate a) the development of and b) the usable research literature on - technologically infused content and instruction. - technologically infused professional development - effective system adaptations of educational technology - effective system adaptation to continued change	- Promote innovative projects that use technology to accelerate, deepen, or productively reshape mathematical or scientific learning and/or professional development (without particular attention to implementation barriers). This includes development of new comprehensive curriculum and professional development models. It also includes the deep integration of technological innovation into existing high quality curriculum and professional development (e.g., through supplemental materials, etc.) - Support research that evaluates the effectiveness of these and other innovations in standards-based instruction and professional development. This in part implies promoting the development and use of a pool of standards-based assessment instruments. - Provide testbeds that integrate the innovations and research in scaled-up contexts, specifically addressing technical, social, and policy barriers to scale-up and implementation. - Develop technology planning implementation templates that can be fit to the different resource (fiscal, human, infrastructural, hardware, software) configurations of school systems.	- Grantees and Contractors - NSF and Education/NCES - Partnerships with commercial developers
Adoption and adaptation	Strategies for use of educational technologies	- Promote best-practices literature (i.e., the real-time literature, online or otherwise, of practices that appear effective); promote interactive and self-modifying dissemination of this literature. - Encourage states, districts, schools to use such best practices and templates or to develop and carry out implementation strategies that are consistent with them. - Promote local partnerships that synergize infrastructural access for schools and that expand usability of technology in learning to the community and to the home (e.g., partnerships between municipalities, libraries, health care providers, housing authorities, telecommunications firms, etc)	- White House public support effort. - Continued or expanded grant/contract funding by NSF/ED - Interactive and self-modifying dissemination via web, IKE consortia, systemics, professional organizations, etc. - Technical assistance
	Access	- Get schools, classrooms, libraries, and homes connected to the Internet - Get technology tools (computers, classroom, multimedia, networking and communication technology, scientific instrumentation, etc.) into the classrooms	- Technical assistance



wurtzel @ mindspring.com

04/27/97 08:21:00 PM

Record Type: Record

To: William R. Kincaid

cc:

Subject: Revised action strategy-objectives 2-4

>Date: Sun, 27 Apr 1997 11:33:55

>To: jsunley@nsf.gov lsuter@nsf.gov ehamilton@nsf.gov mcozzens@nsf.gov
chubin_d@a1.eop.gov kincaid_b@a1.eop.gov Anne_Tenney@oa.eop.gov
Mary_Cassell@oa.eop.gov dspresser@nsf.gov christine_jackson@ed.gov
carol_chelemer@ed.gov robert_stonehill@ed.gov judy_wurtzel@ed.gov
thomas_corwin@ed.gov

>From: Judy Wurtzel <wurtzel@mindspring.com>

>Subject: Revised action strategy-objectives 2-4

>X-Attachments: A:\CHART.WPD;

>

>Tom Corwin, Judy Sunley and I went over the draft of objectives 2-4 on Friday with an eye to making it more focused and concrete. I offered to revise them -- and apologize in advance for any misrepresentations of the intent of the subgroups (I managed to speak to Midge at length about objective 2 and Deborah about objective 3 but did not have an opportunity to speak to other subteam members).

>

>Judy S. has asked that our Tuesday meeting focus first on a discussion of objective 1 and how to focus on a few concrete action steps and then, if there is time, to go on to a discussion of this redraft.

>

>The redraft is attached as a chart in WP 5.1.

>

>I am sending this from my email at home and my experience is that sometimes not all messages go through -- it would be great if whomever gets this would re-circulate it by email to the entire group (I won't be in the office at all on Monday or I would do it). Thanks.!!

>

>Judy

>

>

>

>

>



Mike_Smith @ ed.gov
04/28/97 05:32:00 PM

Record Type: Record

To: William R. Kincaid

cc:

Subject: Re: math textbook

Bill: I think one of the sources of the high quality texts and other curricular materials is the NSF. There will also be a panel of experts convened by OERI to look at Math curriculum materials to determine which of them are of high quality. This panel will be meeting over the fall and into the winter and should have their first results in the spring. Finally, as you know we have a direct prohibition from developing curriculum materials in our enabling legislation and in our General Provisions so we could not do it directly.

Best Mike

Message Creation Date was at 28-APR-1997 10:22:00

When we issued the math/science directive, one of the things we cited as an example of the kind of thing that the working group could recommend would be a privately-funded, nationwide competition for the development of a high quality middle school math textbook that embodies the high standards of the national test. Mike and I still like the idea of doing something along these lines--maybe having the president challenge publishers to develop such a textbook at the same time we release the report. However, at last week's working group meeting (Judy W. was not there) I brought this up and Midge Cozzens at NSF said she thought that they and a few lesser-known commercial publishers had plenty of good materials out there, we just needed to encourage states and districts to buy them--for example, by putting out a purchasers' guide to selecting high quality materials. I pushed her a little on this and she said something to the effect that as much as 50% of the market, at this point, was high quality. She also thought it was unrealistic to issue such a challenge because it takes 5-8 years to develop a new series and because the folks most likely to act on this quickly and claim they succeeded were not likely to produce what in fact would meet the needs identified by TIMSS, etc.

I think this issue will come up at some point between now and when the working group reports back in June; it might get discussed when we have the meeting over here. I'd be interested in knowing that the two of you think about this, what (if anything) you have heard from the field, etc., about the need for new materials that are focused and challenging. My concern is that NSF is being a little parochial on this one, and that unless the major publishers start putting out top-quality stuff it's unlikely to really permeate classrooms. It also seems like a constructive area for presidential leadership. Any thoughts?

Thanks

DOEd-NSF Working Group on Improving Math and Science Education

FAX COVER SHEET

Date: April 29, 1997

NAME	FAX NUMBER	OFFICE NUMBER
Neal Lane, NSF	703/306-0109	703/306-1000
Judy Sunley, NSF	703/306-0109	703/306-1018
Luther Williams, NSF	703/306-0399	703/306-1600
Margaret Cozzens, NSF	703/306-0412 ✓	703/306-1628
Larry Suter, NSF	703/306-0434 ✓	703/306-1650
Eric Hamilton, NSF	703/306-0456 ✓	703/306-1682
Marshall Smith, DOEd	202/401-3095	202/401-1000
Christine Jackson, DOEd	202/260-0302	202/260-2516
Carol Chelemer, DOEd	202/219-2198	202/219-2235
Thomas Corwin, DOEd	202/401-6139	202/401-0318
Deborah Spitz, DOEd	202/401-0220	202/401-3939
Robert Stonehill, DOEd	202/219-2198	202/219-2088
Judy Wurtzel, DOEd	202/401-3095	202/401-3281
Daryl Chubin, OSTP	202/456-6027	202/456-6129
*Mike Cohen, DPC	202/456-7028	202/456-5575
*Bill Kincaid, DPC	202/456-7028	202/456-2857
Anne Tenney, OMB	202/395-4817	202/395-3535
Mary Cassell, OMB	202/395-4875	202/395-5880

FROM: Judy Sunley Wurtzel

Number of pages including this Cover Sheet 10

Remarks:

The attached is for this afternoon's meeting at 3:00p.m.

OPTIONAL FORM 89 (7-89)

FAX TRANSMITTAL

To: <u>Bill Kincaid</u>	From: <u>Judy Wurtzel</u>
Dept./Agency: <u>NSF</u>	Phone #: <u>703-306-0109</u>
Fax #: <u>450-7028</u>	Fax #: <u>703-306-0109</u>

NSN 7540-01-317-7388 5099-101 GENERAL SERVICES ADMINISTRATION

OPTIONAL FORM 89 (7-89)

FAX TRANSMITTAL

To: <u>MIKE COHEN</u>	From: <u>Judy Wurtzel</u>
Dept./Agency: <u>DOEd</u>	Phone #: <u>202-401-3095</u>
Fax #: <u>450-7028</u>	Fax #: <u>202-401-3095</u>

NSN 7540-01-317-7388 5099-101 GENERAL SERVICES ADMINISTRATION

Attached is the revised draft of objectives 2-4. I am faxing it out since many people indicated that they couldn't pick it up off their email.

Judy Wurtzel

Objective 1: Not yet revised. To be discussed in depth on Tuesday.

Objective 2: Ensure that all schools, teachers, and students have access to high quality, standards-based instructional materials in their classroom.

<i>Pressure Points</i>	<i>Strategies</i>	<i>Actions</i>	<i>Mechanisms/Responsibility</i>
Increasing supply of quality instruction materials in preK-12 mathematics, with emphasis on preK-8	Build on existing comprehensive materials that are in or just coming to market by encouraging development of supplemental materials that link to them	Support development of high quality supplemental materials, including technology-based materials [Q-is this mostly about technology-based materials? If so, should this be in the technology section?]	NSF grant guidelines

Selection of quality instructional materials -- building a market for existing high quality materials.	Provide good information about materials and how to choose among them to those responsible for materials selection Build public support for high quality materials by providing good information to parents.	Support expert reviews of existing materials to identify promising and exemplary materials and widely disseminate results. Develop a guide on how to choose a K-8 math curriculum with models for analysis and information about specific curricular materials (similar to NSF middle school science guide). Develop materials for parents that help them understand and affect materials selection. Develop in partnership with PTA , Urban League, NSF Family/Community involvement grantees[?]	ED expert panel process with NSF collaboration. First publication by January; others to follow every 6 months. TIMSS Toolkit to be released July 1 contains curriculum analysis module that shows TIMSS curriculum analysis and other curriculum analysis models (primarily science). NSF to develop with ED collaboration within xx months. Is this an NSF or ED activity or joint?

Implementation of quality instructional materials	Provide good information about what is necessary for implementation of quality materials, including awareness that effective implementation requires substantial professional development linked to the new materials. Increase supply of high quality technical assistance to states, districts and schools implementing new materials.	Increase extent to which Eisenhower state grants are used to support implementation of high quality materials. Fund in a number [3-6?] of technical assistance centers to assist schools and districts in implementation of new K-8 materials (similar to existing NSF center on implementation of 9-12 materials) Use Regional Labs and Consortia to provide up-to-date information on new materials and assistance in implementation. Develop guides for teachers, principals and math leaders on how to implement instructional materials. Develop tools for professional professional developers to use in training teachers to use new materials (for pre- and in-	ED to issue principles of effectiveness as guidance for Eisenhower programs that promote linking professional development to instruction materials. NSF to fund (may be possible to fund one with FY97 funds, the rest in FY98). Provide guidance to Labs and Consortia; coordinate efforts of Consortia and NSF funded TA. NSF to develop guides within xx months. Who will do and when???
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Objective 3: *Ensure that all schools, teachers and students have access to technologies that facilitate high-quality communications and delivery of standards-based instruction and that all teachers have the ability to integrate these technologies effectively into standards-based classroom instruction in mathematics and science.*

<i>Pressure Points</i>	<i>Strategies</i>	<i>Actions</i>	<i>Mechanisms/Responsibility</i>
Development of technologies and technology-based learning materials (software and materials available via internet)	Accelerate development of high quality software and materials available via the internet.	Carry out Presidential Directive that agencies make high-quality educational materials and lesson plans available on the Web.	ED to chair interagency working group; all agencies to participate and, where appropriate, to focus on math and science.

Selection and implementation of high quality technology-based materials	Provide good information about software and how to choose among them to those responsible for materials selection Support teacher enhancement for use of technology in the classroom Leverage Technology Challenge Fund (and state and local funding in technology) to improve mathematics achievement by (1) encouraging states to create a market for high quality software and (2) providing technical assistance and tools to states and districts on technology-based math and science learning materials and associated professional development.	Support expert reviews of existing materials to identify promising and exemplary materials and widely disseminate results. Develop tools (videos, CD ROMs, written materials) for professional developers to use in training teachers to use technology in mathematics instruction (for pre- and in-service) [Q- should we consider proposing an NSF or ED TA effort here that would either be something new or build on existing efforts such as ED's regional technology technical assistance centers?? Should we consider how we might foster state collaborations to become larger market forces?] Encourage Mathline to focus new middle school programs on rigorous content tied to the	ED expert panel process with NSF collaboration. First review of software could begin within 18 months. [Q-should we do something on a shorter timeline?] Who would do? ??
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Objective 4: Engage students, parents, teachers, professionals and the general public by building wide-spread understanding of the necessity of mastering challenging mathematics by 8th grade as gateway to college and jobs and belief that all students are capable of such mastery.

<i>Pressure Points</i>	<i>Strategies</i>	<i>Actions</i>	<i>Mechanisms/Responsibility</i>
(note: the strategies and actions cut across all three pressure points)			

Public understanding of what students can and should be able to do in mathematics by 8th grade and attitudes about importance of mathematics. Student attitudes about importance and excitement of mathematics. Community and business support for mathematics achievement through mentoring, tutoring, and providing role models.	Develop and disseminate with a variety of partners (e.g., NCTM, PTA, NASBA, NAB) high-quality materials for parents, business, policymakers and general public. A number of federal agencies and the industries they work with commit to develop materials, support teachers, and provide tutors-- could be tied to effort below.	Develop and disseminate materials (e.g., 1. concrete examples of what students should be able to do in mathematics; 2. checklists for parents to know if their child is on track for success; 3. elements of a good mathematics program; 4. examples of where low-income and minority children are achieving to high levels; 5. examples of careers that use mathematics; 6. resource guides) Prepare and disseminate op-ed pieces, articles in professional journals and parent magazines, on test, importance of challenging mathematics instruction, and supportive resources. Specific agencies initiatives. DOT-Morgan Garrett initiative which includes mobilizing transportation industry to support mathematics and technology achievement K-12	ED and NSF ED and NSF Transportation and other agencies to be determined
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	Launch a large-scale volunteer effort to support math tutoring/coaching/awareness that focuses on importance of mathematics, particularly in relation to the test.	Engage professional and scientific societies, engineers, business and educational organizations to commit to a large-scale month-long effort to highlight importance of mathematics, to visit classrooms to show math in action, to provide math coaches, and to create math competitions in schools around the nation.	ED, NSF and all relevant agencies
	As part of/or instead of year-long effort, support large-scale summer family involvement and tutoring effort tied to America Reads.	Coordinating with networks created by America Reads, develop high quality and fun mathematics materials geared to test content that parents and tutors can use with K-8 students.	same
		Create high-profile committee of Nobel Laureates, business leaders etc... to support mathematics initiative	same/WH
	Encourage media efforts	Challenge the media and business to do this.	WH

Notes: Major outstanding issues not addressed in this draft include -- more thinking on how Eisenhower and Title I can be tools for improvement; use of Title V reauthorization; should this plan include a significant research agenda (or at least a process for developing one? As a sub issue--to what extent are their firm plans for TIMSS follow-up that should be included)

We should consider how upcoming events that are already planned (e.g. July 1 TIMSS Toolkit) should be integrated into this.

I have not included the interesting idea of challenging corporation to hire teachers for summer internships under objective 4 since it seemed more suited as a strategy for objective 1.

DOEd-NSF Working Group on Improving Math and Science Education

FAX COVER SHEET

Date: April 29, 1997

<u>NAME</u>	<u>FAX NUMBER</u>	<u>OFFICE NUMBER</u>
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Mary Cassell, OMB	202/395-4875	202/395-5880

FROM: *Judy Sunley*

Number of pages including this Cover Sheet 6

Remarks:

The attached is for this afternoon's meeting at 3:00p.m.

Judy,

This is the work we've done on Objective #1. This objective so broad in scope, with so many components, that I think it makes sense to get more strategic and focus on the three points you identified at our last meeting as having the most potential. So, we completed our assignment but, at the end, offered some revisions and thoughts on those three items.

I started to transmit our report to you via e-mail, but the formatting gets messed up and the document becomes hard to read. I suggest you fax it to the folks outside NSF, and I'll see that the NSF folks get a hard copy this morning.

Thanks.



Diane Spreser

Objective 1: Ensure that teachers have the content knowledge and pedagogical skills necessary to teach standards-based, challenging mathematics to all students, so that, by the end of eighth grade, they have laid the foundations for the study of more advanced mathematics.

In-service teachers

Planned, long-term programs of professional development

- Disseminate models for exemplary professional development
 - NSF -- through PI meetings, national conferences, and publications (e.g., *Reflecting on Our Work*, *NSF Teacher Enhancement in K-6 Mathematics*); organizations or projects, such as NISE (National Institute for Science Education)
 - Dept. of Educ. -- through Eisenhower State Coordinators (i.e., the SEA may conduct State-level dissemination activities; the Eisenhower National Clearinghouse and Eisenhower Regional Consortia)
 - Other Federal agencies (?)
 - State and local education agencies
 - Associations and professional/scholarly organizations -- through NCTM Educational Materials Committee, through publications of MAA, etc.
 - Timeframe is ongoing and long-term.
- Expand availability of exemplary, long-term professional development
 - NSF -- through Teacher Enhancement and other programs
 - Dept. of Educ. -- utilize Comprehensive Technical Assistance Centers; SEAs, LEAs, and SAHEs (state agencies for higher education) receiving funds are expected to promote sustained, intensive, and high-quality professional development activities. The Department can continue to encourage these entities, as part of their performance indicators for professional development, to include an indication of increased number of these activities. SAHEs may include language in their RFPs to IHEs and nonprofit organizations to emphasize development of professional development of this magnitude.
 - State and local education agencies
 - Timeframe is ongoing and long-term.

Professional development tied to exemplary instructional materials to be used in the classroom

- Coordinate professional development with implementation of comprehensive, exemplary instructional materials in mathematics and with student assessment in mathematics
 - LEA's -- plan and coordinate programs of professional development for teachers in tandem with review/adoption/implementation of instructional materials
 - Providers of professional development -- ensure strong linkages between what teachers need for effective implementation of the instructional materials and the teacher enhancement curriculum in the p.d. experience
 - Curriculum developers/publishers and others who develop materials for teachers -- make available professional development materials to support exemplary classroom materials and newer strategies for student assessment in mathematics
 - NSF -- professional development opportunities for school districts available through Teacher Enhancement program, especially Local Systemic Change component. Also: NSF's implementation centers -- funding for implementation centers for elementary and middle school mathematics to complement the K-12 center in mathematics that has already been funded at Education Development Center, Inc. Timeframe for this element is next twelve months.
 - Dept. of Educ. -- Leadership and technical assistance can be provided by the SEA to LEAs which focus on having publishers and other commercial suppliers provide

high-quality professional development for its teachers using their materials. This could include frequent communication with teachers throughout the school year to ensure effective usage and to provide teachers with product updates with accompanying high-quality professional development activities. Timeframe for other elements is long-term, but ongoing.

- Encourage schools and districts to combine professional development with selection of new curricular materials

[With the rewording of the previous "bullet," this bullet is redundant.]

Develop master or lead teachers, or school specialists in mathematics

- Provide professional development opportunities for those who might serve as master or lead teachers, or school specialists in mathematics
 - NSF – through Teacher Enhancement and other programs
 - Dept. of Educ. – through Eisenhower Program, developing master teachers is considered an eligible activity and is being implemented in many LEAs and IHEs. SEAs can encourage LEAs to continue to include such activity in their local professional development plans in an effort to maximize their Eisenhower Program dollars and increase the cadre of master teachers. SAHEs can choose to make this a priority in their RFPs; Title I allows for use of funds for this type of activity as well.
 - Other Federal agencies (?)
 - Institutions of higher education, working with state or LEAs – through master's degree or specialist's programs
 - National professional or educational association – through examinations and certification
 - Timeframe is long-term, but ongoing.

Develop networks of teachers

- Encourage professional development that supports "mathematical communities" of teachers, especially within school buildings and districts, but also in the context of larger professional communities
 - NSF – through existing programs (i.e., the Local Systemic Change component of the Teacher Enhancement program, which targets all the teachers of mathematics in school buildings and districts); TEECH (Teacher Enhancement Electronic Communications Hall)
 - Dept. of Educ. – through Eisenhower, to support technological networks for teachers; Title I and Title VI both can support professional development in the use of educational technology.
 - LEAs – by making available on a regular basis common planning/discussion periods for teachers; by supporting electronic networks and the professional development that encourages their use in effective ways
 - Timeframe is long-term and ongoing.
- Encourage teachers to assist in grading of open-ended questions on the exam
[Necessitates appropriate professional development that supports teachers as they learn and implement newer styles of assessing student understanding in mathematics. See revised "bullet" in professional development section above.]

Engage colleges and universities

- Promote partnerships between states, school districts, or schools and higher education for professional development
 - NSF – through existing programs that support K-12 and higher education

- Dept. of Educ. – through Eisenhower Program funds for higher education which have existing projects in support of collaboratives and partnerships of this type.
- Professional organizations/societies (e.g., AMS, MAA, NCTM, AAHE Education Trust, Council of Chief State School Officers, etc.) – encourage partnerships; promote appropriate recognition and reward structures throughout both higher education and K-12.

Hiring teachers

Increase initial licensure requirements

- Challenge states to raise standards, to include use of appropriate examinations
 - State superintendents and Boards of Education
 - Governors –through use of “bully pulpits” and staffs that work with state legislators to pass appropriate legislation supporting increases in standards
- Use of exams
[This action has been combined with previous action]

School district hiring policies

- Challenge local districts to raise standards

Appropriate transitional support for teachers

- Promote intensive support for teachers during their first three-five years
 - District administration – provide financial support for building specialists in mathematics
 - Building principals – recruit and support capable building specialists with qualifications to work with new teachers

Pre-service education and training

Engage K-12 schools

- Promote partnerships among states, school districts, schools, and higher education for pre-service education
 - NSF – through programs such as the Collaboratives for Excellence in Teacher Preparation
 - Dept. of Educ. – has awarded 6 grants to States that formed a partnership with an LEA, institution of higher education and other entities to develop preservice frameworks. The Eisenhower State Program encourages the State agency for higher education (SAHE) to make preservice a funding priority as part of its REP process. There has been an increase in the number of preservice projects funded this year. Institutions of higher education are required to collaborate with LEAs in order to be eligible for competitive grants.
 - Colleges of Education – actively recruit K-12 master teachers with strong content preparation and experience in using comprehensive, exemplary instructional materials as school-based supervisors for student teaching
 - Departments of Mathematics – ensure that faculty ranks include those who are discipline-based mathematics educators, either through direct departmental hiring or collaboration in hiring decisions for mathematics education faculty in the College of Education

- School districts and schools – actively recruit graduates of pre-service programs from partnering institutions of higher education
 - Professional associations – through policy statements, publications, new initiatives that encourage higher educational involvement with K-12
 - Timeframe in long-term and ongoing.
- Define standards for exemplary classrooms for student teaching sites
 - State departments of education – strengthen initial licensure requirements to include characteristics of student teaching sites
 - Colleges of Education – determine for pre-service students the local placement sites for student teaching
 - NCATE – accreditation leverage
 - Timeframe is long-term and ongoing.

Implement appropriate courses for K-8 pre-service teachers through cooperation between Colleges of Education and Colleges of Arts and Sciences

- Develop/revise courses that ensure future teachers have appropriate content knowledge, with faculty who model appropriate pedagogy
- Develop/revise mathematical methods courses to include as examples exemplary instructional materials, with faculty who model appropriate pedagogy
- Ensure consultation (or coordination) in development/revision of such courses so that connections are appropriate (e.g., mathematics needed to support newer instructional materials is taught, at a level of sophistication appropriate for college students)
- Make such courses widely available to students
- Timeframe is both short-term (within two years) and longterm.

Three items that may show the most promise for immediate action by spring 1999:

1. *Professional development materials that provide guidance for the selection of new, comprehensive, exemplary instructional materials in K-12 mathematics.* (Primarily mechanism likely to be through NSF's implementation centers.)
2. *Planned, long-term programs of professional development that are coordinated with the implementation of these new instructional materials and with newer strategies for student assessment in mathematics.* (See section on coordinating professional development with materials and student assessment for mechanisms, etc.)
3. *Links between K-12 and higher education for delivery of programs in (2) and for pre-service education.* (Includes an important role for professional associations and accreditation agencies – including NCATE – in promoting linkages.)