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The White House

Office of the Press Secretary

For Immediate Release March 6, 1997

March 6, 1997

Memorandum For The Secretary Of Education
The 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 1980s, 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 Scholastic Aptitude Test (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 last fall, show that the United States 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 critical to college admission and success 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. Our National Assessment of Educational Progress, Timss, 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.

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Therefore, I direct the Secretary of Education and the Director of the National Science Foundation to form an interagency working group and to develop an action strategy for using Federal resources to assist States and local school systems to 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, and 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 interagency 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

# # #

Judy_Wurtzel @ ed.gov
06/05/97 04:57:00 PM

Record Type: Record

To: Michael Cohen, William R. Kincaid

cc:
Subject: RWR testimony w. Neal Lane

Sandra--I got your note re RWR/LAne hearing before the house science committee on 7/16 on coordination of federal science, math, technology education programs and the status of math, science education reform in the US and where we should be in 20 years.

You should know that we have an interagency task force with NSF on improving math science education that will be issuing a report (at a Presidental event) sometime in July. We should talk about the testimony and how they relate.

Mike/Bill/Judy/Tom -- FYI. -- Judy W

TOWARD EXCELLENCE IN K-8 MATHEMATICS

ADVANCE COPY

NOT FOR PUBLIC RELEASE BEFORE

Friday, May 23, 1997
10:00 a.m. EDT

PLEASE CITE AS A REPORT OF THE
NATIONAL RESEARCH COUNCIL

MATHEMATICAL SCIENCES EDUCATION BOARD

CENTER FOR SCIENCE, MATHEMATICS, AND ENGINEERING EDUCATION

NATIONAL RESEARCH COUNCIL

A letter report of the Mathematical Sciences Education Board, prepared for the National Science Foundation/U.S. Department of Education Interagency Working Group.

May 1997

TOWARD EXCELLENCE IN K-8 MATHEMATICS

A letter report of the Mathematical Sciences Education Board, prepared for the National Science Foundation/ U.S. Department of Education Interagency Working Group

May 1997

INTRODUCTION

In his 1997 State of the Union Address, the President of the United States of America asked the Secretary of Education to develop a voluntary national test for individual eighth grade students, to be based on widely accepted, challenging national standards in mathematics. To support that endeavor, President Clinton directed the Secretary of the U.S. Department of Education and the Director of the National Science Foundation to form an interagency Working Group

> to develop an action strategy for using Federal resources to assist States and local school systems to prepare students to meet challenging math standards in the eighth grade, and for involving the mathematical, scientific, and technical communities in support of these efforts. The action strategy will 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 and help them understand how math concepts are applied in the real world (Clinton, 1997).

The National Research Council (NRC) is charged to advise the Federal government in several areas. Situated in the NRC, the Mathematical Sciences Education Board (MSEB), with its close ties to all aspects of mathematical sciences education, has been asked by the Working Group to provide recommendations for the action strategy, in the following four areas:

Rather, they are recommendations that reflect the government's intention to institute a test, and to use that test as an occasion for improving mathematics education. Following the recommendations, we discuss the underlying considerations about the context in which the action strategy will be developed and undertaken.

RECOMMENDATIONS

This report begins with a set of overarching recommendations. Then, within the four specific areas under consideration by the Working Group, we provide recommendations, as requested, for the action strategy.

Overarching Recommendations

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

Such a coherent framework will ensure that the programmatic strategies can be effectively employed and related to the test itself. The means for enacting this recommendation are complex, and we urge the Working Group to consider questions such as: Could Title I funds be specifically allocated for the preparation and hiring of mathematics specialists in elementary and middle schools? Could some portion of Eisenhower dollars be reserved for providing long-term, school-based professional development for K-8 teachers? What about Goals 2000 dollars? Might there be a new program for the development of materials for use in school-based staff development that would progress in the directions indicated by the national mathematics test? Can the efforts of the School-to-Work program be aligned with efforts to promote high standards in grades K-8? How might Title V be reconceptualized to better prepare higher education faculty for standards-based mathematics education?

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

An important first step in such a long-term plan is immediate Federal implementation of a process by which states and districts would be able to gather, along with student test data, information about the contexts in which students are learning mathematics; information about curriculum that is in place, information about the teachers' backgrounds and professional development activity, and information about classroom instructional practice and areas of content emphasis. It will be very difficult to interpret test results meaningfully, and to make constructive use of them, without a measure of what opportunities students have had to learn the mathematics that is being tested. Funding should be allocated to for the development of materials for the measurement of such contextual factors. Such tools could then be made available to states and districts. The report *Mathematics and Science Education Around the World* (NRC, 1996a) emphasizes the importance of linking contextual information to the interpretation of test scores, and methodologies for doing so are available in TIMSS (Schmidt et al., 1996; Stigler et al., in press), the National Assessment of Educational Progress (NAEP) and other sources. Without a federally orchestrated plan for gathering such information, using the test as any indicator of the effectiveness of various programs and approaches is impossible. Moreover, the accumulation and analysis of such data over time is essential to the process of test redesign and strategy adjustment.

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

The NCTM *Standards* call for increased focus on reasoning, problem solving, and making connections, and on mathematical processes such as conjecturing, proving, exploring, and analyzing. In addition, the reform documents recommend focus in content areas of mathematics that have not historically been part of the K-12 curriculum. The base of basic research that exists to support instructional practice and curriculum development in these areas is surprisingly meager. With the renewed attention that will be devoted to mathematics education through the national test and associated activity, the need for basic research that can guide the development and test the effectiveness of various approaches is not only timely, but critical if this venture is to have a measurable impact. Particularly important is funding for basic research about instructional practice and teacher learning, and about the role of technology.

Recommendations for Improving Teaching

We recommend, for the next three years. a national focus on the professional development and preparation of grades 5-8 mathematics teachers to ensure that they are adequately prepared and supported to develop student learning at high levels.

Teachers of mathematics at the middle grades traditionally have borne the unique responsibility of helping their students in the transition from the arithmetic-dominated curriculum of the elementary years to readiness for the abstraction of algebra in the secondary school. With the advent of the NCTM *Standards*, new state frameworks, and new state level eighth grade assessments, as well newly developed instructional materials, the mathematical responsibilities of these teachers have increased significantly. The recommended curricular topics for the middle grades now include a much greater emphasis on patterns and functions, algebra, and areas of statistics, probability, geometry, and measurement (NCTM, 1989). If the national test follows the NAEP framework, it is likely to also reflect these emphases.

At the same time that curricular demands are increasing, many states do not require certification or specialization at the middle grades[2]. The result is often that school districts employ either elementary teachers prepared for the elementary grades (K-6 or K-8), or teachers prepared for the secondary grades[3] (7-12). Neither the elementary nor the secondary preparation has consciously taken into account either the mathematical emphases that are particular to the middle grades, with its cross-disciplinary features and applications orientation, nor the special needs of middle grades learners. Few institutions of higher education actually offer middle grades specializations in mathematics, although such programs have been developed through NSF funding (see Stake et al., 1993).

Teachers' professional development needs are substantial (Darling-Hammond & Cobb, 1995; National Center for Education Statistics [NCES], 1993). The introduction of the national test in mathematics will only heighten and

[2] Thirty-four states offer middle grades certification, although several do not have specific requirements for mathematics. (CCSSO, 1996.)

[3] Nationally, only 63% of secondary school teachers hold a degree in the subject they teach (Education Week, January 22, 1997.)

intensify the need for immediate explicit focus at middle grades. A number of reports have emphasized the importance of strong and appropriate content preparation of teachers, such as the MSEB report, *The Preparation of Teachers of Mathematics: Considerations and Challenges* (NRC, 1996b). Introduction of the national test will make this recommendation even more critical.

To carry out this recommendation, it will be essential to:

- **Build national, regional, and state accreditation and certification policies so teachers have the content knowledge and pedagogical expertise to support high standards in mathematics.**

  All states, over time, should strive to introduce middle school mathematics certification. Such certification should require knowledge and experience with mathematics and pedagogy appropriate to the middle school level. Such experiences would be consistent with the expectations of the National Board for Professional Teaching Standards and the Interstate New Teacher Assessment and Support Consortium. Within higher education, programs for preparing specialists in middle school mathematics teaching could become an integral part of all teacher education programs. In the short term, there should be a compilation of information on states with middle school mathematics certification programs. Such a compilation should include details about standards and relationship to school structure, as well as information about extant middle school mathematics teacher preparation programs in higher education.

- **Use and extend the research that clarifies how teacher's mathematics content knowledge relates to their classroom effectiveness, and how teachers can best learn about mathematics content.**

  In the long term, there is a need for increased funding for research about teachers' mathematics learning. More immediately, the NSF and U.S. Department of Education could jointly commission papers about the role of content knowledge in teaching effectiveness and disseminate them widely to teacher preparation institutions.

- **Enhance mathematics professional development experiences for preservice and inservice middle grades mathematics teachers.**

In the long term, this goal can be accomplished by fostering partnerships among mathematicians, mathematics educators, and teachers that focus on the mathematical emphases and instructional issues of the middle grades curriculum. In the short term, the NSF and the U.S. Department of Education could sponsor a National Professional Development forum centered on various middle school curriculum materials. There are several types of materials and curricula now available at the middle grades, and teachers need to become familiar with the options, learn from those who have used these materials about what is involved in their successful implementation, and examine the evaluation findings from these projects. It is also important to better understand the shortcomings of such materials. There is growing evidence that curriculum-based professional development—i.e., professional development situated concretely in the student curriculum—correlates significantly with teacher effectiveness (Cohen & Hill, 1997).

Teachers' opportunity to learn needs to be grounded in practice (NRC, 1996b). By examining and analyzing student work, teachers come to develop shared expectations for student performance. Any national test should be accompanied by a guide for teachers that includes the content framework sample items, student responses, sample rubrics, and teaching strategies. Such a guide should be disseminated over the Internet, as a means of generating conversations and professional networking. Additional professional development could be centered around helping teachers understand the nature and scoring of extended response items.

For the proposed national test to be a useful tool, it must be set in a broader assessment context that includes classroom assessment consonant with it, and with the K-8 reforms. Considerable staff development efforts educating teachers about assessment will be necessary, and have been undertaken elsewhere (Stake & Raizen, 1997).

- **Engage the mathematics higher education community more centrally in providing high quality preparation and professional development experiences for K-8 teachers of mathematics.**

In the long term, this could involve linking all mathematics teacher development to appropriate content-based programs in colleges and

universities. In the short term, postsecondary mathematics faculty need opportunities for professional development where they can learn about K-8 mathematics education and how the mathematical content areas recommended for grades K-8 are typically treated through curriculum and instruction. Higher education faculty also could benefit from a focus on the issues in teaching content effectively to prospective and inservice teachers. A first step would be to compile examples of programs and materials used for helping teachers learn mathematics and mathematics teaching. These could be disseminated and reviewed with postsecondary mathematics faculty as well as K-12 professional development practitioners, through conferences or other national networking activities.

Recommendations about the Adoption and Implementation of High-Quality Curriculum Materials

We recommend that high-quality instructional materials and associated support mechanisms should be available for all schools and for those who prepare and provide professional development for teachers.

Federal agencies should focus attention and resources on raising awareness and facilitating implementation of standards-based curricula in topic areas to be emphasized in the national mathematics test. Since the publication of the NCTM *Curriculum and Evaluation Standards* in 1989, commercial publishers as well as the Federal government have engaged in substantial instructional development activities, often designed to reflect the emphases of the standards. Many of these materials are just now becoming widely available. Issues related to mathematics curriculum at the middle grades are complex, as reflected in the diversity of curriculum designs at this level. There are new, innovative materials that are module-based, where teachers and students work on large, cross-cutting themes over extended periods, often with a technology emphasis. There is also is a strong movement toward preparing all students to take an algebra course in the eighth or ninth grade; and there is the more typical seventh and eighth grade sequence emphasizing general topics and culminating in pre-algebra ideas. This array of choices and competing directions places teachers in the difficult position of making judgments and decisions without adequate data or information about the effects of such choices, or the long term impact on student learning and mathematical progress.

To carry out this recommendation, it will be essential to:

- **Provide guidance to those who make curriculum selections—guidance in judging the quality of materials, and guidance which includes information about the conditions and context under which the materials have been used by others, and the resulting student achievement.**

  In the long term, there is a need to support ongoing implementation research and revision of curriculum based on teachers' and students' experiences. Such research and revision should be coordinated and linked to shifts in the national test and its emphases. The "National Professional Development Forum" mentioned earlier could provide in-depth looks at curriculum, to help people in all schools understand how these materials work and their relationship to the national test. Heightened efforts to disseminate curricular materials and evaluation information should begin immediately. Discussion of the ways in which the classroom assessment tools within these materials will complement the national test, as teachers judge student performance, needs to be introduced.

- **Help administrators, school board members, teachers, and the public understand the relationship of curriculum materials to the emphases on better student preparation in mathematics.**

  The kinds of learning this test will measure will be unevenly available to children in the United States. Mathematics teaching and learning should be structured so that all students are given the opportunity to achieve at their maximum potential. School leaders must recognize what is at stake in their decisions about adoption of instructional materials, professional development, and resources for school mathematics. Districts will need to consider how their resources can ensure that all students have the educational opportunities that will enable them to increase their capabilities in mathematics. Most immediately, there is a need to examine the potential relationship between the national test and the emphases in various curriculum materials. It will be important to have an organized program to reach administrators, especially principals and superintendents, to guarantee that they understand the high standards for students in grades K-8 set forth by the national exam, and the implications for their students of various curricular choices.

- **Provide curriculum materials for use in teacher preparation and development and for use by higher education faculty and staff development professionals.**

There is no coherent or nationally recognized system for reviewing, publishing, sharing, and critiquing the curriculum materials that are used to help teachers learn. Higher education faculty and professional developers frequently create their own materials. Higher education mathematics faculty responsible for teaching mathematics content to prospective elementary and middle grades teachers need access to appropriate high-quality materials. Staff developers who offer long-term workshops in schools need new materials that focus on the important mathematics of the K-8 grades. In the short term, prototype course modules in mathematics content for use with prospective teachers at undergraduate institutions should be developed and disseminated to faculty in mathematics departments via the Internet and a national colloquium. Similarly, appropriate materials for inservice teacher development should be selected or developed and disseminated for school-based leaders in mathematics education, with involvement by the mathematics teacher professional organizations.

Recommendation for Integrating Technology into the Classroom

We recommend that technology be made available on an equitable basis for use in improving student learning and enhancing teacher professional development.

Technology includes computers, calculators, and other learning tools that can help students with a diversity of learning needs and preferences. In addition, technological tools provide teachers with an enhanced array of strategies for instruction. Research indicates some promising uses of technology as a means of helping learners understand mathematics concepts more deeply and effectively (Heid, 1988; Hembree & Dessart, 1986), and continued research into the pedagogical implications of various uses of new technology is needed. Such instructional use of technology, to be effective, requires appropriate subject matter understanding on the part of teachers.

A key step here will be for the Federal government to follow through as soon as possible with its commitment to make the Internet available to all schools. The Internet has potential value for networking students and teachers, and for dissemination of educationally valuable materials. At a different level, the technological opportunities for teacher learning, for professional collaboration, and for building of networks around professional interests are burgeoning and promise an end to the traditional isolation of teachers. Literature in professional development is quite clear on the benefits of providing professional development opportunities within a support community (Lord, 1994).

To carry out this recommendation, it will be essential to:

- **Enable teachers to establish contacts for mentoring, participate in networks, and access a variety of curricular and pedagogical models, via technology.**

  Over the long term, increased research about how teacher learning and development occurs through innovative technologies will be critical to using these resources most effectively. In the short term, expecting all federally funded teacher enhancement and professional development programs to have an Internet component would be useful.

- **Provide all students with access to appropriate technologies for learning mathematics.**

  All federally funded programs for pre-school and K-8 students should include an appropriate introduction to the effective use of calculators and other technology. The national test should be constructed to include the judicious use of calculators. In this way the test can focus on higher-order conceptual understanding. This might also help ensure that technology is made available widely in the middle grades. In the short term, synthesis and dissemination of existing research and examples about the promising uses of the World Wide Web, the Internet, and other technologies for enhancing mathematics education should be assembled and disseminated widely. Models are needed by parents, teachers, and students for productively using test items to improve mathematics learning.

Recommendations for Building Public Support

We recommend that public information efforts highlight the linkages between the national test and the associated action plan, in order to mobilize the general public and the mathematics community to understand the entire process.

In particular, the public, the business community, and the mathematics community need to understand how any national test might be used as a vehicle for improving mathematics education. It is likely that the public will measure the effectiveness of the action plan strategies by progress on the proposed national test. Any test is explicitly intended to promote improvement in student learning and in mathematics education more generally, is not as familiar to the public as a test designed to measure the status quo. Such a test would be an indicator of "what ought to be" rather than "what is." Helping the public understand the complexity and enormity of change and improvement, on a time frame they will tolerate, is challenging.

To carry out this recommendation, it will be essential to:

- **Organize immediately a public information effort, managed by a consortium of mathematics and mathematics education organizations and an experienced public information firm, to design and implement a program introducing and promoting the importance of high standards in K-8 mathematics.**

  This effort could extend the experiences that the National Council of Teachers of Mathematics and the Joint Policy Board for Mathematics have had in the areas of public information. A major goal would be to influence public opinion about the need for a significant mathematics experience for all students through grade eight, and to explain how a national test could promote this goal. New curriculum materials and standards-like goals need to be part of the public awareness, as well as information about the various purposes and types of assessment. Considerations about how to motivate students to see this test as important are crucial. This effort should also highlight the importance of mathematics in applications, the beauty of mathematics as a field, and the role of mathematics as a gateway to careers and to higher education.

Over the long term, schools could function as community centers with extracurricular programs centered on the mathematical emphasis of the national test. Such activity might have the wider impact of promoting academic achievement in all areas by helping students develop social networks in which academic success is valued.

- **Mobilize the mathematics community in its understanding and support of K-12 mathematics education, in light of the new context provided by the national test.**

In the short term, the National Science Foundation and other funders should make clear, through their program criteria and announcement, their expectation that, whenever appropriate, mathematics faculty and departments should exhibit commitment to and engagement in the improvement of K-12 mathematics education—as something essential to their own self interest. Also, when possible, all federally funded programs that address issues in mathematics education should involve broad representation of professionals from the mathematical sciences, to include academic and industrial mathematicians and mathematics educators.

UNDERLYING CONSIDERATIONS

The following considerations about the context in which the action strategy will be developed and undertaken were fundamental to the MSEB discussions that are the basis for this report.

We assume that the action strategy developed by the Working Group will build on current efforts. The established activity to improve mathematics education that has been built through the National Council of Teachers of Mathematics, the initiatives supported by the National Science Foundation and the U. S. Department of Education, as well as many private foundations, together with the many excellent efforts initiated at the state and local school level, should serve as the base and inspiration for this renewed effort to improve mathematics education. These efforts are consistent with the reforms advocated in the NRC reports *Reshaping School Mathematics* (NRC, 1990) and *Everybody Counts* (NRC, 1989). In particular, much is to be learned from situations where assessments have been used as the lever for improved mathematics education

(such as in the states of Connecticut and Texas). The notion of using assessment as a means of supporting good instructional practice is central in the NRC report *Measuring What Counts* (NRC, 1993c). Those individuals and groups who have been working to develop standards-based curricula will also have much to contribute to the action strategy design and implementation.

Secondly, many of our recommendations for the action strategy are based on the expectation that the national test in mathematics will be consistent with current thinking of experts in mathematics assessment (NCTM, 1995; NRC, 1993c). The MSEB document, *Measuring What Counts* (NRC, 1993c) provides three principles for assessment which, if upheld in the national test, would also provide direction for the associated action strategy.. These are: "The Content Principle: assessment should reflect the mathematics that is most important for students to learn. The Learning Principle: assessment should enhance mathematics learning and support good instructional practice. The Equity Principle: assessment should support every student's opportunity to learn important mathematics" (NRC, 1993c, p. 1).

Finally, in order for the proposals for the action strategy to be effective, we assume that the national test in mathematics will convey to students, teachers, and the public a set of high expectations to aspire to in K-8 mathematics. This would mean that the content emphases and coverage of the national test will be consistent with mathematical emphases that are valued in the mathematics and mathematics education communities (NCTM, 1989; NRC, 1990). Because the action strategy will involve teachers and the public, the content emphases and coverage of the national test need to be made explicit and distributed widely, so that teachers, parents, and students will be constructively guided in their local curricular decisions in grades K-8, and in local planning for continuing professional development of teachers. In helping the public to understand the test and the action strategy, the test needs to be presented as a means of focusing on the important mathematical goals of the K-8 grades, and as an initial indicator, not a final grade, of students' progress toward those goals. We assume also that the test can be refined and adapted over time to reflect the mathematics community's changing values about assessment practices, about what mathematics students should know and be able to do, and about the effectiveness of the action strategy.

It is also our understanding and urging that the mathematics and mathematics education communities will continue to have substantial opportunity

to be involved in influential roles throughout the entire process of decision making about test development, implementation, and evaluation. The MSEB will seek ways of facilitating and ensuring this ongoing involvement.

CONCLUSION

The proposal for a national test of mathematics and the actions associated with that proposal present an opportunity for unprecedented focus on the mathematics experiences of children in grades K through eight. The eighth grade year is a significant one, in that for many students it includes the beginning of their formal study of algebra, a gateway to secondary school mathematics. Of particular importance is the potential for a broad base of support to improve mathematics education, in the areas of teacher professional development, curriculum, technology, and public awareness. These activities represent a unique opportunity for the mathematics and mathematics education communities to undertake concerted and bold efforts toward excellence in mathematics learning for all children.

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March 3, 1997 DRAFT

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

SUBJECT: Improving Math and Science Education and Preparing Students to Meet Eighth Grade Math Standards

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 just slightly above average in science and below average in math. That isn't acceptable; in this information era, our students need to perform much better in order to succeed economically.

Last month, to help parents and teachers learn who needs help, what changes in teaching to make, and which schools need to improve, I directed the Secretary of Education to develop a voluntary national test for individual eighth-grade students based on challenging standards in mathematics. This 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 the level of mathematics proficiency necessary to enable them to move forward and excel at the higher level math and science courses that are the gateway to college.

In addition to establishing the national test, we need to make sure that we are doing all we can to help improve teaching and learning in math and science. Therefore, I direct you to create an inter-agency group, under the leadership of the U.S. Department of Education and the National Science Foundation, that will be charged with preparing an action plan for raising student achievement in math and science and for preparing students to succeed on the 8th grade math test in 1999.

In developing this action plan, the working group should review the current status of improvements in math and science education, including standards, assessments, teaching, and curriculum, and identify and address critical areas of need. The plan should draw on existing research, as well as input from math and science educators and professional organizations. It should contain recommendations for the effective use of federal resources, as well as for gaining the active support and involvement of state and local government, higher education, the private sector and

voluntary organizations, in order to boost math and science achievement. The working group should submit its action plan to me within 90 days.

WILLIAM J. CLINTON

March 3, 1997 DRAFT

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

SUBJECT: Improving Math and Science Education and Preparing Students to Meet Eighth Grade Math Standards

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 just slightly above average in science and below average in math. That isn't acceptable; in this information era, our students need to perform much better in order to succeed economically.

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WILLIAM J. CLINTON

Daryl E. Chubin
02/13/97 12:27:23 PM

Record Type: Record

To: Michael Cohen/OPD/EOP

cc:
Subject: draft directive

Dear Mike:
Below is a draft of the Presidential Directive we discussed. I hope it captures your sense of what is needed. It is deliberately short and organizationally ambiguous, which suits Cliff, Ernie (who visited yesterday), and me just fine. The next step is your editing/approval so that I may share it with Mike and Neal next week.
Thanks, Daryl
**

February 13, 1997 *D R A F T*

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

SUBJECT: Improving Math Achievement by the Nation's Eighth Graders

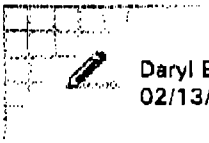
In the State of the Union, I pledged the development of national tests in 4th grade reading and 8th grade math, challenging every state and community to test every student in these critical areas by spring 1999. A national math exam is a tool for measuring progress – by every district, school, and teacher – toward achieving excellence in student performance.

The Third International Mathematics and Science Study (TIMSS) provides an international benchmarking for such achievement. I have directed the Department of Education to develop a test based on TIMSS and quality standards in mathematics, so that students, parents, and teachers can aspire together to excellence. We must mobilize the resources of local communities to help schools and districts prepare not only for this exam, but moreover, to identify the conditions and focus the practices that improve academic achievement in all subjects.

I thereby direct you to create an inter-agency group, under the leadership of the National Science Foundation and the Department of Education. This working group should draw on existing research and the programs of federal agencies, based on rigorous standards of content and performance, that advance teaching and learning of mathematics and science.

In partnership with state and local government, higher education, the private sector, and community-based organizations, the inter-agency working group should review the knowledge base of best classroom practices and materials, increase awareness of those practices and materials that support the application of standards to advance achievement, determine how better to share and adapt what works, indicate what new initiatives that strengthen teaching and learning may be needed, and recommend how key components of school systems can be harmonized and integrated to create classroom environments of great expectations. The working group should report back to me within 90 days with recommendations of steps for meeting those expectations and sustaining high performance in mathematics and science by all students – in high school and beyond.

WILLIAM J. CLINTON



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February 13, 1997 *DRAFT*

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ASSISTANT TO THE PRESIDENT FOR DOMESTIC POLICY
ASSISTANT TO THE PRESIDENT AND DIRECTOR OF THE
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Lead w achievement – Rev test

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7
level test

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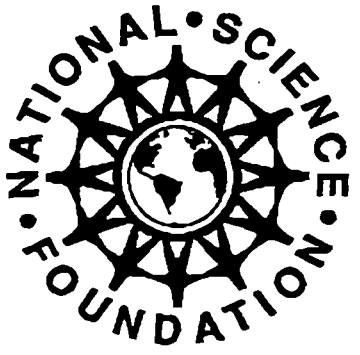
WILLIAM J. CLINTON

- survey field - identify what is working & not - specifically Ed resources
- recommendations for key improvements to improve teaching, learning

Some examples -
leverage points
resources
content

plan for using fed $ & non-federal more effectively to improve M/S education & prepare students for math test . . .



National Science Foundation

Office of the Director

4201 Wilson Boulevard
Room 1205
Arlington, Virginia 22230

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

Date: 4-22-97

To: Bill Kincaid
DPC

Fax No.: 202/456-7028

From: Judy Sunley

Pages: 6 *(Including Cover Sheet)*

Comments:

As per last nights E-mail.

Please call the number above if you experience transmission problems.

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-service teachers	planned, long-term programs of professional development	• develop/disseminate models for exemplary professional development • expand availability of exemplary professional development	
	professional development tied to exemplary instructional materials to be used in the classroom	• coordinate professional development modules with packages of exemplary instructional materials • encourage schools and districts to combine professional development with selection of new curricular materials	• providers of materials/ kits coming with the materials/ almost immediate
	develop master teachers	• provide professional development opportunities for those who might serve as master teachers	
	develop networks of teachers	• encourage professional development that permits teachers to remain in contact • encourage teachers to assist in grading of open-ended questions on the exam	
	engage colleges and universities	• promote partnerships between states, school districts, or schools and higher education for professional development	

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?
Hiring teachers	increase licensure requirements	• challenge states to raise standards • use of exams	
	school district hiring policies	• challenge local districts to raise standards	
	appropriate transitional support for teachers	• promote intensive support for teachers during their first 3-5 years	
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 • define standards for exemplary classrooms for siting of student teachers	
	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	

Three of the items above show the most promise for immediate action that could have significant impact on student performance by the spring of 1999. They are
(1) Professional development materials directly tied to newly selected, exemplary instructional materials;
(2) Development, dissemination, and broad implementation of models for planned, long-term programs of professional development; and
(3) Links between K-12 and higher education aimed at implementation of the models in (2).

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.

Pressure Points	Key Aspects of Strategy	Possible Action	Who Is Responsible? What Is the Mechanism? What is the Timeframe?
Development of materials	Comprehensive, coherent sets of materials	• Accelerate development; bring to market	• Providers; ready for market; immediate
	Supplementary materials	• Tie to other areas of science, social studies	
Selection of materials	Information guide for curriculum assessment aimed at selectors	• Evaluate available materials and develop information guide	
	Encourage public support	• Evaluate available materials and develop information guide for public	
Implementation	Guides for implementation in the classroom	• Develop as part of the "kit"	• Providers
	Link to professional development	• Develop as part of the "kit"	• Providers
	Link to pre-service education and training	• Encourage colleges and universities to use exemplary instructional materials in educating future teachers	

All of these actions can be undertaken in the immediate timeframe for K-8 mathematics and can have a significant impact by Spring, 1999.

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.

Pressure Points	Key Aspects of Strategy	Possible Action	Who Is Responsible? What Is the Mechanism? What is the Timeframe?
Development of technologies	Accelerate development	• Challenges for potential classroom implementation of new technologies • Challenge teachers to describe what they would like to be able to do	
	Provide testbeds	• Tie to Challenges above?	
	Facilitate use of research base	• Dissemination of research results	
Adoption and adaptation	Strategies for use of educational technologies	• Encourage states, districts, schools to develop strategies • Provide information on what works • Develop model strategies • Synchronize strategies with possible partners	
	Access	• Get schools wired to the internet • Get computers into the schools • Develop websites appropriate for student and teacher access	
	Materials development for integration into the classroom	• Incorporate use of technology in "kits" for instructional materials • Link supplementary material to comprehensive, coherent curricula	
	Teacher professional development for implementation in the classroom	• Include integration of technology in professional development models	

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.

Pressure Points	Key Aspects of Strategy	Possible Action	Who Is Responsible? What Is the Mechanism? What is the Timeframe?
		•	
		•	
		•	
		•	
		•	
		•	
		•	

jsunley @ nsf.gov
04/18/97 05:10:00 PM

Record Type: Record

To: Daryl E. Chubin, Michael Cohen, William R. Kincaid

cc:

Subject: objective #4 material

Working Group #4:

Objective: 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.

Strategy #1: Help make math study more exciting and concrete for students and teachers.
ACTIONS

Nobel prize winners
Astronaut
Tom Hanks
sports pros

1. At the time of our kickoff event, release thousands of balloons from the White House containing challenging math problems (elementary and middle grades content) and invite families to solve the problems and send them back (line up corporate sponsors for suitable prizes, e.g., fast food gift certificates, etc.); could coordinate a similar effort with network tv (feature on the national news broadcast) and with regional newspapers.

2. Line up corporate support and education association sponsorship to hold a contest for students writing about what they like most about studying math and use those results in a forum with teacher training institutions, teacher organizations, textbook publishers, etc. to make them aware of the fact that math needs to be fun (as well as challenging!)

3. Prepare a media campaign (print, electronic, speech material to be used by federal officials) stressing the study of math's relation to development of problem solving skills and the importance of developing such skills (Check with research centers for supporting documentation)

4. Encourage businesses to sponsor teacher-in-residence positions (perhaps just in the summer) to enable teachers to experience realistic applications of mathematics in the workplace (this type of activity could also easily be expanded to include structured visits by students at middle school and beyond featuring "hands-on" experiences).

5. Institute Presidential recognition awards for students for math achievement in school (on tests, on report cards) similar to the Presidential Academic Fitness certificates issued in the 1980's by ED; line up corporate sponsors to provide merchandise rewards associated with math achievement.

6. Make parents and educators aware of the extensive array of existing resources (print, televised, electronic, including interactive internet sites where interesting mathematical problems can be explored such as NSF's Math Forum) that can help stimulate student interest in math and increase student academic achievement.

7. Support additional instructional assistance for students in their study of mathematics by (a) encouraging more schools to offer Title I-supported math instruction, (b) encouraging businesses and community service organizations to offer tutoring and mentoring programs for children (both remediation and enrichment) outside regular school hours, and (c) encouraging expansion of adult education opportunities(perhaps at community school centers) to familiarize parents with the math their children are learning

8. Encourage businesses to sponsor school-based math clubs and interschool competitions (including provision of personnel, organizational support, and prizes) as part of the Adminstrations' Volunteer Initiative.

Strategy #2: Help students and parents understand the importance of mathematics study and understanding to students' future educational and career plans.
ACTIONS

1. Work with DOL (perhaps through STW office) to compile lists of occupations (including wage information) requiring math background and distribute through schools (guidance depts)for the use of students and their parents, as well as enlisting the support of parent organizations.

2. Have the President and other top federal officials report the results of TIMSS (and other national math assessments) to clearly communicate the necessity of having a strong mathematics curriculum in schools. The press release of population 1 on June 10 is an occasion to have such an opportunity

3. Enlist the assistance of successful businessmen who have succeeded in life through knowledge of mathematics in commuicating with inner city youth, and their parents, the

value of continuing the study of mathematics.

Strategy #3: Help educate the public on the importance of standards-based education to strengthen mathematics study in grades K-12.
ACTIONS

1. Support future international studies to extend and replicate the results of TIMSS to further explain to the public the changes in student achievement and the relationship of high achieving countries to good school practices, such as a wholesome curriculum. Future studies should concentrate efforts on additional studies of the changes in mathematics curriculum at elementary and middle grades of school. (Cost: $50 million)

2. Hold a "parent awareness campaign" that would commuicate the meaning of the middle school mathematics curriculum to parents by writing documents that would be distributed as publications and through other means such as INTERNET, local access TV and CDs.

3. Encourage attempts of the business community and governors to join to raise public awareness of, and support for, more rigorous academic standards (and standards-based education) (e.g., meetings convened by Gerstner of IBM)

Strategy #4: Help educate the public on the nature of appropriate materials and instructional strategies for the study of mathematics in grades K-12.
ACTIONS

1. Prepare a media campaign (including letters to editors of newspapers and popular press magazines) to help parents and the general community (1) understand the general topic of appropriate mathematics materials and instruction at the elementary and middle school grades and (2) locate useful resources, including as many free resources and 800 numbers as possible; prepare comparable inserts for professional periodicals read by elementary school teachers

2. Prepare a checklist for parents (based on NCTM standards, or customized for each state) on "What your child should know and be able to do at each grade level in math" (modelled on the E.D. Hirsch approach for cultural literacy which has been very popular), including little "tests" to use in the family

3. Prepare a checklist for parents (or parent group in school) to use to assess the school math program (curriculum, pedagogy, assessment) to see if it incorporates "best practice" (eg, standards-based

approach); this checklist may also be relevant for a wider commuity/business audience.

4. Widely disseminate the two checklists discussed above directly through parent organizations as well as through popular print and electronic media and via the INTERNET

jsunley @ nsf.gov
04/18/97 05:10:00 PM

Record Type: Record

To: Daryl E. Chubin, Michael Cohen, William R. Kincaid

cc:
Subject: objective #4 material

Working Group #4

Objective: 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.

Strategy #1: Help make math study more exciting and concrete for students and teachers.
ACTIONS

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ok for event; not for study

2. Line up corporate support and education association sponsorship to hold a contest for students writing about what they like most about studying math and use those results in a forum with teacher training institutions, teacher organizations, textbook publishers, etc. to make them aware of the fact that math needs to be fun (as well as challenging!)

Good, but action study? Prudential?

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Not wild about

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? how ?

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ACTIONS

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Strategy #3: Help educate the public on the importance of standards-based education to strengthen mathematics study in grades K-12.
ACTIONS

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jsunley @ nsf.gov
04/14/97 05:01:00 PM

Record Type: Record

To: Daryl E. Chubin, Michael Cohen, William R. Kincaid

cc:
Subject: objective 1 and suggested strategies

Working Group #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 the eighth grade, they have laid the foundations for the study of more advanced mathematics.

* Provide a high-quality, standards-based, pre-service program for all who aspire to teach mathematics in grades K-12.

Encourage the states to increase the requirements for initial teaching

licensure to include mathematical content requirements that meet

the recommendations of the Mathematical Association of American for the
preparation of teachers of mathematics, including elementary and middle school teachers.

Encourage strong linkages between the education and arts and sciences colleges in universities to provide strong, pedagogically sound mathematics
experiences for teacher candidates.

Encourage partnerships of institutions of higher education and the K-12 education community that respect and capitalize on the strengths of each in
increasing the high-quality, standards-based pedagogical preparation of teacher candidates.

Encourage institutions of higher education and their faculties to require
student teaching or other pedagogical and practicum experiences in

invigorating, standards-based classroom environments where exemplary,

comprehensive instructional materials in mathematics are used.

Encourage school systems to provide intensive and appropriate transitional

support for teachers during their first three to five years of teaching.

Engage the mathematical and professional communities to work with K–12 teachers and students throughout K–16 to highlight the excitement of mathematics and to show the importance of bringing into the teaching profession those who are the best and brightest.

* Provide for all teachers of K–12 mathematics sustained, high–quality professional development experiences in mathematical content and pedagogy.

Encourage planned, long–term programs of professional development that enhance teachers' mathematical understanding and promote standards–based, investigative, research–proven strategies for classroom teaching.

Increase the availability of teacher enhancement experiences that support the implementation of comprehensive, exemplary instructional materials in mathematics.

Identify and enlarge the pool of teacher leaders who have the mathematical and pedagogical expertise and experience to become resource or master teachers in their school buildings; and provide them with appropriate rewards and recognition.

Engage university faculties in mathematics and teacher education to become actively involved as partners with K–12 teachers of mathematics and other professionals to work jointly on the planning and delivery of the teacher enhancement programs needed by schools and districts.

jsunley @ nsf.gov
04/14/97 04:59:00 PM

Record Type: Record

To: Daryl E. Chubin, Michael Cohen, William R. Kincaid

cc:
Subject: Objective 2 with suggested strategies

Objective 2:

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

Strategies:

1. Provide support (not financial) to schools, districts, and states to help them make informed choices among high quality, standards-based curricula and instructional materials, with a focus on choosing comprehensive and coherent sets of materials.

2. Provide guides and/or materials to schools and districts to help them develop programs to implement high qualtiy, standards-based instructional materials. These guides would include resources for organizing professional development for teachers who are to implement the materials, suggestions for assessments tied to the materials, etc.

3. Provide resources for preservice programs so that they can better prepare new teachers to use these high quality standards-based materials effectively.

4. Encourage public support and the demand for high quality, standards-based instructional materials.

jsunley @ nsf.gov
04/14/97 05:09:00 PM

Record Type: Record

To: Daryl E. Chubin, Michael Cohen, William R. Kincaid

cc:
Subject: objective 3 and suggested strategies

***Objective
"Ensure that all schools, teachers, and students have access to high-quality content-based and communication technologies, and that all teachers have the ability to effectively integrate these technologies into standards-based classroom instruction in mathematics and science."

***Strategies/related activities

1) Research and development.
Activities include promoting a strong research base on efficacies of educational technology, and continued development of innovative technologies and implementation strategies, including software. Includes promotion of R/D testbeds (ie, innovative implementations that look beyond immediate implementation goals to serving as a formal vehicle to inform other practitioners of the particular issues the project is implementing.)
This strategy promotes both parts of the objective (insuring access to technology and ability to use it).

2) Adoption and adaptation of the best existing and emerging technologies.

This strategy corresponds to the access part of the objective -- make sure schools have access to high-quality content-based and communication technologies.
Activities include providing technical and financial assistance to schools to construct and implement informed and cost-effective educational technology strategies, adapting best practices, at all stages, from technology acquisition (e.g., obtaining most effective software, communication infrastructures, etc.) to classroom practice. Among the technical assistance activities would be to optimize the means by which sites take advantage of access provisions of the Telecommunications Act of 1996.

3) Promotion of professional development for all teachers

This strategy corresponds to the second half of the objective, namely ensuring that all teachers have the ability to effectively integrate these technologies into standards-based classroom instruction in mathematics and science. Activities could include coordinating and increasing efforts among

post-secondary Eisenhower professional development providers, the regional clearinghouses, and/or the urban systemic initiatives.

4) Synchronize or coordinate the strategic planning of municipal governments, libraries, housing authorities, schools, telephone companies, Internet Service Providers, and other organizations to promote interoperability, connectivity, access, etc. (This also corresponds to improving access)

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 the eighth grade, they have laid the foundations for the study of more advanced mathematics.

* Provide a high-quality, standards-based, pre-service program for all who aspire to teach mathematics in grades K-12.

Encourage the states to increase the requirements for initial teaching licensure to include mathematical content requirements that meet the recommendations of the Mathematical Association of American for the preparation of teachers of mathematics, including elementary and middle school teachers.

- Jump start NTASC/math
- challenge state to require rigorous/perform based certification.
- Hunt commission follow-up

recs
content [5 standards]
MAA - targets undergrads
NCTM does not have for pre-service

Encourage strong linkages between the education and arts and sciences colleges in universities to provide strong, pedagogically sound mathematics experiences for teacher candidates.

- Use Title II - Teachy & high content FIPSE, Eisenhower
-

Encourage partnerships of institutions of higher education and the K-12 education community that respect and capitalize on the strengths of each in increasing the high-quality, standards-based pedagogical preparation of teacher candidates.

Encourage institutions of higher education and their faculties to require student teaching or other pedagogical and practicum experiences in invigorating, standards-based classroom environments where exemplary, comprehensive instructional materials in mathematics are used.

Encourage school systems to provide intensive and appropriate transitional support for teachers during their first three to five years of teaching.

- Coalitions out good info
- Modeling prof orgs

Engage the mathematical and professional communities to work with K-12 teachers and students throughout K-16 to highlight the excitement of mathematics and to show the importance of bringing into the teaching profession those who are the best and brightest. recruitment

- diversity / underrepresented
- incentives
- work w/ prof communities

* Provide for all teachers of K-12 mathematics sustained, high-quality professional development experiences in mathematical content and pedagogy.

Encourage planned, long-term programs of professional development that enhance teachers' mathematical understanding and promote standards-based, investigative, research-proven strategies for classroom teaching.

- Eisenhower guidelines - principles of effectiveness
- TA providers
- Teacher enhancement

Increase the availability of teacher enhancement experiences that support the implementation of comprehensive, exemplary instructional materials in mathematics.

Identify and enlarge the pool of teacher leaders who have the mathematical and pedagogical expertise and experience to become resource or master teachers in their school buildings; and provide them with appropriate rewards and recognition.

Enlist Praxis math/sci teachers —

Engage university faculties in mathematics and teacher education to become actively involved as partners with K-12 teachers of mathematics and other professionals to work jointly on the planning and delivery of the teacher enhancement programs needed by schools and districts.

merge w/ other like it

Bob i Madge

Objective #2:

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

Strategies:

1. Provide support (moral) (not financial) to schools, districts, and states to help them make informed choices among high quality, standards-based curricula and instructional materials, with a focus on choosing comprehensive and coherent sets of materials.

review panel via OERI

2. Provide guides and/or materials to schools and districts to help them develop programs to implement high qualtiy, standards-based instructional materials. These guides would include resources for organizing professional development for teachers who are to implement the materials, suggestions for assessments tied to the materials, etc.

review panel via OERI

3. Provide resources for preservice programs so that they can better prepare new teachers to use these high quality standards-based materials effectively.

4. Encourage public support and the demand for high quality, standards-based instructional materials.

Parents
math is power

DOT engineers

***Objective #3

"Ensure that all schools, teachers, and students have access to high-quality content-based and communication technologies, and that all teachers have the ability to effectively integrate these technologies into standards-based classroom instruction in mathematics and science."

***Strategies/related activities

1) Research and development.

Activities include promoting a strong research base on efficacies of educational technology, and continued development of innovative technologies and implementation strategies, including software. Includes promotion of R/D testbeds (ie, innovative implementations that look beyond immediate implementation goals to serving as a formal vehicle to inform other practitioners of the particular issues the project is implementing.) This strategy promotes both parts of the objective (insuring access to technology and ability to use it).

2) Adoption and adaptation of the best existing and emerging technologies.

This strategy corresponds to the access part of the objective -- make sure schools have access to high-quality content-based and communication technologies.
Activities include providing technical and financial assistance to schools to construct and implement informed and cost-effective educational technology strategies, adapting best practices, at all stages, from technology acquisition (e.g., obtaining most effective software, communication infrastructures, etc.) to classroom practice. Among the technical assistance activities would be to optimize the means by which sites take advantage of access provisions of the Telecommunications Act of 1996.

3) Promotion of professional development for all teachers

This strategy corresponds to the second half of the objective, namely ensuring that all teachers have the ability to effectively integrate these technologies into standards-based classroom instruction in mathematics and science. Activities could include coordinating and increasing efforts among post-secondary Eisenhower professional development providers, the regional clearinghouses, and/or the urban systemic initiatives.

4) Synchronize or coordinate the strategic planning of municipal governments, libraries, housing authorities, schools, telephone companies, Internet Service Providers, and other organizations to promote interoperability, connectivity, access, etc. (This also corresponds to improving access)

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 Plan for Group 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.

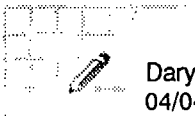
Strategies:

Have the President and other top federal officials report the results of TIMSS to clearly communicate the necessity of having a strong mathematics curriculum in schools. The press release of population 1 on June 10 is an occasion to have such an opportunity.

Support future international studies to extend and replicate the results of TIMSS to further explain to the public the changes in student achievement and the relationship of high achieving countries to good school practices, such as a wholesome curriculum. Future studies should concentrate efforts on additional studies of the changes in mathematics curriculum at elementary and middle grades of school. Cost: $50 million.

Hold a "parent awareness campaign" that would communicate the meaning of the middle school mathematics curriculum to parents by writing documents that would be distributed as publications and through other means such as INTERNET, local access TV and CDs.

Enlist the assistance of successful businessmen who have succeeded in life through knowledge of mathematics in communicating with inner city youth, and their parents, the value of continuing the study of mathematics.



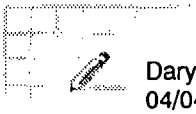
Daryl E. Chubin
04/04/97 02:40:21 PM

Record Type: Record

To: William R. Kincaid/OPD/EOP

cc:
Subject: objectives reconfigured

---------- Forwarded by Daryl E. Chubin/OSTP/EOP on 04/04/97 02:42 PM ----------



Daryl E. Chubin
04/04/97 02:38:45 PM

Record Type: Record

To: See the distribution list at the bottom of this message

cc:
Subject: objectives reconfigured

Colleagues:

Below is a reformatted version of the draft objectives submitted by the subgroups earlier this week. I have put them together in a single document, by category, to aid your consideration -- revision, culling, etc. -- of them. Hope it helps, Daryl

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

Working Group Objectives
As Proposed by Subgroups in 4/2/97 Drafts

Improve Teaching

Highest priority (short term):

1. Provide more sustained professional development in mathematics (100 or more hours) for more teachers through Eisenhower and NSF funds; and promote higher standards of quality and accountability in this professional development.

2. Develop mechanisms that increase the degree to which local Eisenhower funds are utilized to assist teachers in implementing research-proven strategies for teaching mathematics.

3. Encourage higher education to become more pro-active in pre-service education in mathematics, both to increase the numbers of students who complete a major in mathematics/mathematics education and to revise pre-service programs to incorporate exemplary instructional strategies and materials.

4. Engage in long-term, strategic planning to identify, disseminate, and promote the adoption of instructional materials and exemplary strategies for professional development at all levels.

Lower priority:

5. Develop mechanisms that increase the degree to which current Federal funds are utilized to develop a strong research and evaluation base in the arena of distance learning (e.g., what are the "best practices" that support effective professional development via distance learning? what value is value added, if any, by the electronic capabilities available through the medium? how can distance learning be used effectively to support changes in classroom practice?).

6. Use the current heightened focus on education and national interest in TIMSS as an opportunity to educate the public about the NCTM Standards, and standards-based instructional materials and classroom styles of teaching/learning; also, reach a greater number of mathematics educators.

7. Encourage greater communication and clearer linkages among the K-12 mathematics community, higher education, and the professional associations in mathematics (American Mathematical Society, Mathematical Association of America, American Statistical Association, NCTM)

Curriculum and Materials

Three curriculum-related objectives for the action plan can be derived from the discussions above, including:

1. Provide support to schools to help them make informed choices among high-quality materials;

2. Provide support to schools to help them implement high-quality standards-based materials; and

3. Encourage public support and demand for high-quality, demanding curricula.

Some thoughts about strategies to support these objectives include:

Short-term priorities:

4. Get the Mathematical Sciences Education Board or similar organization to launch a campaign for quality materials - NCTM will buy in but won't lead.

5. Challenge the community to submit proposals to provide assistance for schools who want to do the implementation - encourage regional consortia to take this as a mission.

Short and long-term priorities:

6. Ramp the professional development in mathematics through Eisenhower and NSF; evoke more proposals.

7. Challenge the Presidential Awardees in mathematics to take a bigger role in all activities.

Integrate Technology

Although the agencies support efforts that are interdisciplinary in nature, the action plan in support of the examination should focus primarily on K-8 mathematics.

1. Continue to support a vigorous program of research, testbeds, and innovative implementations. In particular, continue research and testing that integrates cognitive and mathematics learning sciences with technologies that accelerate and deepen mathematical knowledge formation.

2. Promote the dissemination of best-practice innovations in instruction, teacher training, and assessment. This includes supporting the dissemination efforts of the Eisenhower Consortia and Clearinghouse, and the RTEC's, by determining effective programs, strategies, software, and other technologies. {The systemic initiatives should be explicitly linked to these dissemination efforts.} The action strategy should insure that the best practices compendia appearing earlier are part of the "technology dialog" in every site.

3. Promote effective and widespread understanding of the implications of the 1996 Telecommunications Act.

4. Promote local agency collaboration. The problem of integrating technology into the domains of professional development, materials, and instruction mirrors another significant gap in "what's out there," i.e. the problem of integrating various social enterprises or agencies. The importance of public/private partnerships has been noted. Collaboration between various agencies and branches of government is also a promising but poorly developed area. Unitary planning involving the local telephone company and ISPs, the municipal library system, local government, health care providers, the housing authority, and the local school system will promote many positive reform agendas. Such collaborations rarely take place, though cities such as Memphis and Pittsburgh are exceptions. The action plan should facilitate much more vigorous interaction.

5. Promote federal agency and private sector collaboration. Work with the Eisenhower Consortia and Clearinghouse and the RTEC personnel to ensure their awareness of directions taken by many of NSF's most promising R & D efforts. Similarly, the Technology Innovation Fund programs are promoting imaginative applications that would benefit the various systemic initiatives. Corporate vendors may stimulate powerful research and implementation models that should inform and be informed more fully by the federal investment.

6. Increase technical assistance, equipment, and materials to assist schools, LEAs and SEAs in optimizing the communication and technology integration.

Motivate Students

1. Increase students' understanding of the need to exert effort to become a champion in any field of endeavor (including mathematics).

2. Increase community and students' understanding of the importance of mathematical proficiency for future job and educational opportunities.

3. Students need to believe that their friends and family believe that mathematics is important for their lives. The government should provide national examples of persons of different occupations using math in work settings.

4. Communities should examine the results of international studies to understand how students in other countries learn better mathematics than do US students.

5. Also, good classroom materials help motivate students.

6. Improve the supply and use of modern technology to increase student motivation and understanding of mathematics.

7. Improve the available resources to support students and parents' efforts to increase student mathematical proficiency.

Message Sent To:

clare_banwart @ ed.gov @ inet
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kincaid_w @ a1.eop.gov @ ine

jsunley @ nsf.gov
04/09/97 08:56:00 AM

Record Type: Record

To: Daryl E. Chubin, Michael Cohen, William R. Kincaid

cc:
Subject: objectives and strategies from yesterday's working group meetin

You will find below a brief summary of the discussion at yesterday's meeting, framed as objectives and remarks about possible strategies. The subgroup assignments should be sent to the full working group by the end of the week, if possible, and no later than first thing Monday morning. If you want to send them to me, I will forward them on to the full working group. From past experience, it seems to work better for transmittal between ED and NSF if documents are copied into the body of the e-mail than when documents are attached.

Judy Sunley

ED/NSF WORKING GROUP

OBJECTIVES and STRATEGIES
as discussed at the meeting of April 8, 1997

The working group agreed on the following four objectives as key to the action strategy we are developing. The notes about possible strategies under each objective reflect to the extent possible the group's further discussion of the types of strategies.

The two-person working subgroups are to (a) refine the statement of the objective, if necessary; (b) provide a set of strategies for the objective for discussion next week; and (c) indicate actions appropriate to each strategy. The subgroup should also review the baseline material already provided to ensure that there is good support for the objectives, strategies and actions as key elements of the action strategy.

A number of themes should run through the write-ups as either motivation for the objectives or critical factors in attaining them.

- student motivation
- addressing assumptions about who can learn
- promoting federal/state/local/and private sector partnerships
- enhance coherence of federal programs
- involving professional, mathematical, scientific, and technical communities in a fundamental way

1. Ensure teachers have the content knowledge and pedagogical skills necessary to teach standards-based, challenging mathematics to all children so that by the end of 8th grade they have laid the foundations for the study of more advanced mathematics.

- two basic pieces of strategy: in-service and pre-service

- importance of availability of sustained, high quality professional development
- train trainers
- link professional development to materials to be used in the classroom
- recruitment and certification issues
- involve higher education in a fundamental way

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

- provide support to schools (districts, states) to help them make informed choices
- provide support to schools (and districts) to help them implement
- encourage public support and demand for high-quality, demanding curricula

- focus on comprehensive, coordinated, coherent set of materials

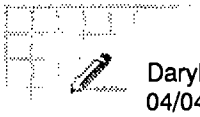
- quantity of materials may need mention; not critical issue right now; spur private sector development

3. Ensure that all schools, teachers and students have access to high-quality learning and communications technologies that promote instruction and professional development in mathematics.

- research
- testbeds
- innovative implementation in the classroom
- disseminate effective practices in implementation of technology
- improve integration between technology systems providers and schools

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.

- help make math study more exciting and concrete
- importance of mathematics to future
- educate public on importance of standards-based education
- educate public on nature of appropriate materials and instructional strategies



Daryl E. Chubin
04/04/97 02:50:30 PM

Record Type: Record

To: See the distribution list at the bottom of this message

cc: William R. Kincaid/OPD/EOP
Subject: wordsmithed framework

Chubin edit of Sunley (4/4/97)

Working Group on
IMPROVING MATH AND SCIENCE EDUCATION

A *Draft* Framework

In a Directive to the Secretary of Education and the Director of the National Science Foundation issued 6 March 1997, the President instructed that they create an interagency working group to develop an action strategy in support of a voluntary national test for individual eight-grade students. The strategy would ensure that Federal programs, research, and human resources are used as effectively as possible to help improve teaching and learning based on widely accepted, challenging national standards in mathematics.

The Directive states that the Secretary of Education has been tasked to develop the national math exam (with a framework that is standards-based, reflecting content and benchmarks encompassed by the standards of the National Council of Teachers of Mathematics [NCTM] and of the TIMSS and NAEP assessments). The interagency working group is to develop an action strategy that is explicitly linked to preparing students for the exam to be administered beginning in Spring 1999 and supported by the mathematics, scientific, and technical communities.

In developing a strategy, the interagency group needs to identify which components of standards-based education should be the focus of efforts to prepare students for world-class achievement in mathematics as assessed in the eighth grade. The following framework addresses major categories within which the action plan might be described. The working group should consider the extent to which the categories are interrelated in developing the action strategy. The framework provides basic terms of reference that should be revised as the work of the group progresses.

1. Improve teaching: Teachers have the most direct influence on student learning. What they teach, how they teach it, and their expectations for their students determine much about student performance on any form of assessment. Improving teaching starts with helping teachers understand the value of standards-based educational approaches, encouraging them to embrace

such approaches, and facilitating their classroom use of strategies that incorporate standards. Both preparation and certification of new teachers and the professional development of veteran teachers are vital to an effective action strategy.

2. Upgrade and enhance access to and implementation of curriculum and instructional materials: Since the offering of the NCTM Standards in 1989, curricula and materials incorporating them have been under development. Curricular frameworks and the selection of textbooks are largely State and district processes that should be informed by the strengths and weaknesses of the choices. Implementation of curricular frameworks and daily use of texts are school and classroom processes. The action strategy should address how standards-based curricula and materials that have demonstrated a positive impact on student achievement can be identified as desirable choices and made more accessible to teachers. The linkage between assessment tools and curriculum and instructional materials might also be explored.

3. Integrate technology into the classroom: Tests and textbooks frequently drive the trajectory of teaching and learning. Technology can expand the universe of materials (e.g, CD-ROMs, Internet) available to teachers and students, but only if the hardware is in place, teachers know how to use it, and there are friendly interfaces for the student. The action strategy should address how technology and materials might be integrated to transform teaching and learning and how knowledge of available best practices and technology-based tools might be spread to support more teachers and classrooms.

4. Motivate students and help them understand how math concepts are applied in the real world: This component connects the notion of content standards in math and science -- why they must be aspired to, how parents and communities can help children and schools achieve at world-class levels, how the media and business/industry can be enlisted in public service campaigns -- with skills for the world of work and advanced learning. It draws significantly on partnerships with organizations outside the Federal sector, but may also include agencies within the Federal government for which education is not the primary mission. The action strategy should address how such resources can be brought to bear nationally and locally to raise the visibility of the issue of standards-based mathematics and science education, including novel arrangements – in school and out – that might involve experts in math and science, as well as volunteers, and make larger segments of the public attentive to the link between school and work.

Within this evolving framework, and for each of these components, the working group will define a set of critical objectives and policy levers, Federal and otherwise, that the action strategy will be designed to address. To do so, the interagency group will review existing resources to determine what is working, identify gaps in knowledge, and sketch emerging or persistent issues that identify the objectives that relevant parties might pursue. The action strategy will be delivered to the President during the first week of June 1997.

Message Sent To:

jsunley @ nsf.gov
04/01/97 03:33:00 PM

Record Type: Record

To: Daryl E. Chubin, Michael Cohen, William R. Kincaid

cc:
Subject: revised draft framework

What follows is a revision to the draft framework based on the preliminary input from the working groups.

Judy Sunley

Working Group on
IMPROVING MATH AND SCIENCE EDUCATION

A Draft Framework

In a Directive to the Secretary of Education and the Director of the National Science Foundation issued 6 March 1997, the President instructed that they create an interagency working group to develop an action strategy in support of a voluntary national test for individual eight-grade students. His purpose was ensure that Federal programs, research, and human resources are used as effectively as possible to help improve teaching and learning based on widely accepted, challenging national standards in mathematics.

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learning. What they teach, how they teach it, and their expectations for their students determine much about student performance on any form of assessment. Improving teaching starts with helping teachers understand the value of standards-based educational approaches, getting them ready to embrace such approaches, and facilitating their classroom use of strategies incorporating standards. Both preparation and certification of new teachers and the professional development of veteran teachers are important to an effective action strategy.

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materials: Since the offering of the NCTM Standards in 1989, curricula and materials incorporating them have been under development. Curricular frameworks and the selection of textbooks are largely State and district processes that should be informed by the strengths and weaknesses of the choices. Implementation of curricular frameworks and daily use of texts are school and classroom processes. The action strategy should address how standards-based curricula and materials that have demonstrated a positive impact on student achievement can be identified as desirable choices and made more accessible to teachers. The linkage between assessment tools and curricula and materials might also be explored.

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trajectory of teaching and learning. Technology can expand the universe of materials (e.g, CD-ROMs, Internet) available to teachers and students, but only if the hardware is in place, teachers know how to use it, and there are friendly interfaces for the student. The action strategy should address how technology and materials might be integrated to transform teaching and learning and how knowledge of available best practices and technology-based tools might be spread to support more teachers and classrooms.

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address. To do so, the interagency group will review existing resources to determine what is working, identify gaps in knowledge, and sketch emerging or persistent issues that identify the objectives that relevant parties might pursue. The action strategy will be delivered to the President during the first week in June, 1997.

jsunley @ nsf.gov
04/01/97 03:37:00 PM

Record Type: Record

To: Daryl E. Chubin, Michael Cohen, William R. Kincaid

cc:
Subject: revised material from working group 1

Here is the material from working group 1.

Judy Sunley

04/01/97

Working Group on Improving Mathematics Education--Area #1: Teaching

1. What's already been done?

The Teacher Enhancement (TE) program in NSF's Division of Elementary, Secondary, and Informal Education (ESIE), currently funded at $ 96 million, has supported a large number of professional development projects to broaden and deepen the disciplinary and pedagogical knowledge of K-12 teachers in mathematics and science. The TE portfolio in mathematics consists of over a hundred active, multi-year, Standards-based projects, ranging from planning grants (under $50,000) to very large-scale efforts (over $5 million). The portfolio is cast broadly and is comprised of projects that provide:

* Teacher enhancement to support increased disciplinary and pedagogical knowledge in mathematics (e.g., The PUMP Algebra Project, housed at Illinois State University; the project for Implementation of the National Council of Teachers of Mathematics Standard in Discrete Mathematics, housed at Boston College; the Teaching for Mathematics Learning project in the Jones County Public Schools of North Carolina; and the TEAM 2000 project at the Cherry Creek School District in Colorado);
* Leadership development projects with a special focus on increased use of technology in the mathematics classroom (e.g., Mathematics Technology Institute, housed at Wesleyan University) or increased knowledge of assessment (e.g., Assessment Communities of Teachers, housed at the School District of Pittsburgh) or increased attention to equity issues (e.g., the Equity in Mathematics Education Leadership Institute, housed at the University of California at Santa Barbara),

* Development of materials to support professional development (e.g., The Mathematical Inquiry Videotapes - Tools for Professional Growth, housed at BBN Systems & Technologies Corporation in Massachusetts; and various case study materials).
* Conferences and materials that inform "best practices" for teacher

enhancement (e.g., the project for Reflecting on our Work in K-6 mathematics, housed at the University of North Carolina at Chapel Hill), and "research in practice" that is expected to yield both basic and applied findings about "best practices" for local systemic reform, especially at the middle school level (the Making Mathematics Reform a Reality in Middle Schools project, housed at the University of Rochester).

To ensure sustained professional development for ALL mathematics teachers in targeted schools/districts and clear linkages with the classroom use of high quality instructional materials in mathematics, the first of ESIE's Local Systemic Change (LSC) projects for grades K-8 was funded in FY 94 within TE. This was soon followed by the Local Systemic Change projects for secondary mathematics in FY 96. To date, 13 LSC projects in mathematics have been funded through the TE program.

Throughout the TE program, projects provide an intense, sustained experience consisting of at least 100 hours of direct, formally-defined professional development for each participating teacher. It is not uncommon, however, for projects to provide 200 - 300 hours of professional development, especially for those who are to be teacher leaders. All LSC projects require a minimum of 100 hours (for K-8) or 130 hours (for 7-12) of enhancement for EVERY teacher of mathematics in the participating schools/districts.

TE projects that focus on teacher leaders tend to be small, typically serving fewer than a hundred teachers. Other non-LSC projects in teacher enhancement directly target up to 600-700 teachers and indirectly serve many more. LSC projects require a minimum of 200 (for K-8) or 100 (for 7-12) teachers, and some LSC projects serve 2000 teachers.

NSF's Division of Educational Systemic Reform has funded 15 State Systemic Initiatives (SSI), 20 Urban Systemic Initiatives (USI), and four Rural Systemic Initiatives (RSI). To varying degrees, each of these systemic initiatives provides professional development in support of the vision of teaching/learning promoted by the NCTM's Standards. 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 Department of Education (ED) makes funding for professional development in mathematics and science available to every State and local educational agency in the Nation through the Eisenhower Professional Development Program, currently funded at over $ 300 million per year. Programs, which vary widely in scope, depth, and approach, operate at three levels-those sponsored by the State education agency, those operated by institutions of higher education or non-profits as a result of statewide competition, and those operated by local education agencies. While current legislation

allows some expenditures in other core subjects, the program maintains its focus on mathematics and science, with over three fourths of the funds designated for these two priority subjects.

Goals 2000 from ED, now utilized in every State, requires subgrants to local educational agencies for pre-service and professional development. Some of these projects focus on mathematics and science. The Title I program for basic educational services requires a professional development component. Since mathematics achievement improvement is a requirement for participating schools, much of the professional development is in the area of mathematics.

ED funds several systems of regional centers which provide assistance to educators..

*Foremost for mathematics and science are the ten Eisenhower Mathematics and Science Consortia. Central among their objectives is the commitment to developing the professional skills of today's mathematics and science teachers. The Consortia provide a rich variety of support to teachers including electronic networks, training trainers, and brokering the professional development offerings of others.

*Most of the fifteen Comprehensive Centers have a professional development expert on staff to advise state and local educational agencies on improving teaching, including the teaching of mathematics and science.

*The ten Education Laboratories also offer opportunities for sessions to improve teaching and learning in mathematics and science.

*Six Regional Technology Education Consortia offer professional development in support of technology education, including its application to mathematics and science teaching.

Other major initiatives sponsored by ED in the area of mathematics education include:

*The National Research and Development Center on Achievement in School Mathematics and Science, located at the University of Wisconsin--Madison. It is organized into six working groups, including the learning and teaching of whole numbers, the learning and teaching of algebra and quantitative analysis, the learning and teaching of geometry, and implementation of reform.

* The National Diffusion Network validates and makes available exemplary education programs, many of which are professional development programs in mathematics or science.

* Mathline, developed and implemented by Public Broadcasting System (PBS) is an interactive technology-based long-term professional development program for teachers of mathematics.

*Star Schools provide a professional development component in distance learning.

*The National Board of Professional Teaching Standards has developed criteria for certifying master teachers--mathematics was the first field for which standards were determined and the NBPTS has now certified _____ master teachers in mathematics. In time, these standards may form the accepted definition of excellence in

mathematics teaching and thus serve as a guide for professional development.

ED is also developing an approach to identifying high-quality professional development. This began with the development of ten principles of professional development and expanded to a recognition program of professional development projects that met the principals AND demonstrated student achievement. Currently underway is a project to translate the recognition program evaluation instrument into a self-evaluation instrument. This work has direct application to professional development in mathematics.

2. What is working?

Project-specific evaluation data document numerous successes in each of the NSF program areas cited above. More and more, the data tend to show quality programs of professional development for teachers, increases in student achievement scores, adoption/implementation of standards-based instructional materials, and improved course-taking patterns in mathematics by students, including those who have been traditionally underrepresented. The prototype core evaluation for ESIE's LSC program requires all projects to collect data using professional development and classroom observation instruments, along with teacher and principal questionnaires, that were designed and developed especially for the LSC program. The 1995 Cross-Site Evaluation report for Year One of the LSC program stated that (p. 61) "The LSC projects are providing professional development consistent with current standards for best practice" and that (p. 63) "LSC projects should stay their course with regard to high-quality, inclusive professional development designs, continuing to build interactive cultures that are reflective of professional learning communities. Data indicate great willingness and interest on the part of teachers, but great need on the part of teachers, as well, in order to implement exemplary, inquiry-based instruction in their classes." The LSC core evaluation is supplemented by additional evaluation components that are site-specific. Student performance/achievement data, for example, are being collected in selected LSC mathematics projects (e.g., Renewing Mathematics Teaching through Curriculum, housed at Western Michigan University; and Changing the High School System-Implementing the Interactive Mathematics Program in Arizona, housed at the Maricopa County Community College District).

In the Eisenhower state and local program, there is a trend toward more sustained professional development efforts, consistent with State education reform efforts and with emphasis on giving teachers skills that are transferable to the classroom. Since States are now required to develop and report on performance indicators, many are gearing their efforts toward strategies that are expected to yield increases in scores on mathematics assessments. Most projects funded by the higher education component of the program provide evaluation data to show their effectiveness.

In the NSF program areas cited above, there is evidence of effective partnerships involving school districts, higher education, and others (e.g., businesses and industry, teacher unions, etc.). These partners make significant cost-sharing contributions to the projects: in LSC projects, for example, it is not uncommon for cost-sharing commitments from partners, especially school districts, to actually exceed the amount of the NSF award. Such high percentages of cost-sharing are visible signs of strong programmatic and financial commitment from districts and other partners.

3. Gaps?

At present, sufficient capacity/infrastructure to deliver long-term, high quality professional development for all the nation's teachers of K-12 mathematics is lacking. Qualified professional developers with the necessary combinations of expertise/experience in disciplinary content, pedagogical expertise, assessment, technology, etc., are in short supply, relative to the need. Districts frequently have to commit valuable resources to "growing their own" teacher leaders or resource teachers from among the pool of talented, available, and experienced mathematics teachers; and this leadership development takes time.

While there are many avenues for the delivery of professional development in mathematics, not all of these efforts are "quality operations." There is a real need to support professional developers in expanding their knowledge base about "best practices" and about evaluation instruments for use in their work with teachers.

There are also large geographic areas throughout the U.S. that haven't yet been brought "on board" for teacher enhancement that supports standards-based instructional materials in mathematics.

Change is slow in coming at the high school level. The involvement of higher education faculty (from departments of mathematics and colleges of education) is essential if the desired changes at the secondary level are to be accomplished and accepted. University faculty can speak with credible voices in support of newer instructional materials and high school course titles that differ from those with which parents are most familiar. It is the universities that must reassure students (and their parents) that they will be competitive for admission to top institutions after completion of such a program of study in mathematics. Higher education is also essential to the reform of pre-service education. Although some change is beginning to show in colleges/universities, higher education is not "on board" at this point.

Nationally, in 1991, only 69 percent of grades 9-12 public school teachers who had mathematics as their main assignment had a major in the field [Science and Mathematics Education Briefing Book, Volume IV, 1994, p. 6]. 1988 data show that only 43 percent of eighth grade

mathematics teachers majored in mathematics/mathematics education [ibid., p. 10]. While these percentages may have changed in a more favorable direction in recent years, there continues to be a shortage of mathematics teachers who have been well-prepared with a major in the field.

4. Issues?

Perhaps the most compelling issue is that of coordinating professional development with the implementation of high-quality instructional materials and student assessment. Fragmentation is prevalent.

Another important issue is the often-negative response of parents to classroom styles, instructional materials, and student assessment that are very different from what they experienced when they were in school. While local responses can be helpful, having to wage the battle district by district is expensive and time-consuming. We need to find effective ways of educating a broad public.

There is frequently a significant programmatic gap between the vision of what a mathematics classroom should be and the reality of what must be done to get there. The public wants credible results right away; yet, the remedies are complex and involve long-term commitments for professional development, etc. The issue is how to educate both the public and (sometimes) the teachers themselves.

How do we persuade higher education that its involvement is essential both for its role in pre-service education and for the credibility it brings for making changes at the high school level? How do we encourage higher education to build partnerships with elementary and secondary institutions, respecting and capitalizing on the strengths of each, while nurturing and improving each?

At the elementary level, how do we guarantee a coherent, long-term plan for teacher enhancement in mathematics, given that districts frequently focus on professional development in mathematics one year, reading the next, and so on?

Distance-learning offers potential for providing teacher enhancement to large groups of teachers, and may be unique in the potential it offers for geographically remote areas. But, where is the solid base of research and evaluation on distance-learning that informs effective professional development practice and classroom change?

5. Recommended objectives for the action plan

Highest priority:

Provide more sustained professional development in mathematics (100 or more hours) for more teachers through Eisenhower and NSF funds; and promote higher standards of quality and accountability in this

professional development. [Can begin to address in the short term]

Develop mechanisms that increase the degree to which local Eisenhower funds are utilized to assist teachers in implementing research-proven strategies for teaching mathematics. [Can begin to address in the short term]

Encourage higher education to become more pro-active in pre-service education in mathematics, both to increase the numbers of students who complete a major in mathematics/mathematics education and to revise pre-service programs to incorporate exemplary instructional strategies and materials. [Can begin to address in the short term]

Engage in long-term, strategic planning to identify, disseminate, and promote the adoption of instructional materials and exemplary strategies for professional development at all levels.

Lower priority:

Develop mechanisms that increase the degree to which current Federal funds are utilized to develop a strong research and evaluation base in the arena of distance learning (e.g., what are the "best practices" that support effective professional development via distance learning? what value is value added, if any, by the electronic capabilities available through the medium? how can distance learning be used effectively to support changes in classroom practice?). [Can begin to address in the short term]

Use the current heightened focus on education and national interest in TIMSS as an opportunity to educate the public about the NCTM Standards, and standards-based instructional materials and classroom styles of teaching/learning; also, reach a greater number of mathematics educators. [Short term]

Encourage greater communication and clearer linkages among the K-12 mathematics community, higher education, and the professional associations in mathematics (American Mathematical Society, Mathematical Association of America, American Statistical Association, NCTM, etc.). [Can begin to address in the short term]

jsunley @ nsf.gov
04/02/97 07:20:00 AM

Record Type: Record

To: Daryl E. Chubin, Michael Cohen, William R. Kincaid

cc:
Subject: revised materials from group 2

My apologies that you did not get this yesterday. I left the office before it arrived. I will have hard copies for those at the meeting this morning.

Judy Sunley

DRAFT: March 31, 1997

Presidential Mathematics Directive --
Improving Curriculum

1. What has already been done?

NSF-developed high-quality instructional materials are available for implementation in grades K-8 and are becoming available for grades 9-12. Quality standards-based instructional materials in mathematics have been developed with NSF funding over the last 6 years. The K-8 materials have been published commercially and, by fall 1997, are ready for full adoption at all levels. Current figures indicate that at least 25% of schools will be using these K-8 materials and if two other sets of quality standards-based materials, developed without NSF money, are included then the number will be closer to 50% for the K-5 levels. Most of these materials have been available, at least in part, for the last two years, and some grade 9-12 materials, namely Core-Plus and IMP, are already available commercially now for grades 9 and 10. The remainder of the 9-12 materials will be completed by Fall, 1998.

All of the above referenced materials are based on the NCTM standards, have been reviewed for compliance during the development process and at completion, and each aligns well with state frameworks, despite the diversity in these frameworks. Since the NAEP framework was based on the NCTM standards, these materials align well with the NAEP frameworks. A key difference in these new materials and traditional textbooks is that students learn to solve multistage problems, similar to ones on the TIMMS test, but which are only minimally represented in NAEP. Topics in these new sets of materials appear at fewer grade levels, but at considerably more depth when they do appear.

ED has designated and disseminated numerous exemplary and promising mathematics programs. While NSF has focused on supporting the development

of high-quality materials, ED has instead focused on identifying, validating and disseminating exemplary and promising mathematics programs, many of which include curricula as well as teaching training components. In 1995, ED's Eisenhower Regional Consortia for Mathematics and Science Education (Eisenhower consortia) and regional educational laboratories identified 117 promising practices for teaching mathematics and science. Previously, the National Diffusion Network had provided support for disseminating and implementing twenty nationally validated mathematics programs, each with demonstrated evidence of effectiveness. (May want to add something about contributions from the Math R&D Center or Eisenhower state program)

2. What is working?

Evidence shows that high-quality mathematics materials and programs have a positive influence on student learning. The NSF document, "The Success of Standards-based Mathematics Curricula for all Students: A Preliminary Report" is available and outlines the success of these instructional materials in field tests in diverse settings. Other evaluation data exists from the projects themselves. Similarly, some of the programs disseminated and evaluated by ED have clearly been successful.

3. Where are some critical gaps?

Schools need extensive support for evaluating and implementing curricula. New NSF curricula are not being implemented as widely as they could be, partly due to local choice issues and the need to work directly with schools and communities. NSF has funded a number of center type projects to facilitate implementation, including:

* A project to provide professional development materials for any school using any one of the three NSF-funded elementary projects;

* A very successful project to provide advice and technical assistance and some professional development in the state of Massachusetts for implementing quality standards-based science and/or mathematics materials in grades K-12; and

* A national site for implementation of quality grades 9-12 mathematics materials.

NSF would have liked to fund sites like the one for grades 9-12 at both the elementary and middle school level in FY97 but the projects submitted did not review well enough; they hope to be able to do so in FY98. These national dissemination sites are critical as they provide schools with the necessary expertise to choose and implement quality materials.

Many of the popular traditional mathematics materials and programs may neither be challenging nor instructionally effective. TIMSS has much to suggest about ways in which curricula and programs can be strengthened, particularly by focusing the curriculum and providing more in-depth learning opportunities for each topic (a key feature of the NCTM

standards). OERI and NCES (and some of the national organizations, e.g. AAAS) are working on tool kits to help local educators analyze their textbooks and curricula against TIMSS and NAEP frameworks; these will be widely disseminated as they become available.

ED--through the Eisenhower National Clearinghouse for Science and Mathematics Education (ENC)-- will be reviewing the range of programs that have been designated previously as exemplary and promising programs to assess which of those most closely match the NCTM standards and the TIMSS pedagogy and content findings. OERI is also supporting an expert panel to help identify additional exemplary and promising mathematics programs as candidates for dissemination.

We also propose that we examine closely some of the after-school enrichment programs that have become popular, like Hands-On Science, Family Math and Family Science. These have been both praised (for involving children in after-school science and math activities) and criticized (for not necessarily being good science and for not being offered in a context that promotes broader learning about science and mathematics).

4. Issues:

Ensuring and informing choice. Providing access to a broad range of high quality materials while helping districts to make informed choices among them will be a critical issue in framing this initiative. To avoid getting into the business of marketing specific products, NSF will not fund a center or other type of project that is designed to implement exclusively one set of materials, except through local systemic change teacher enhancement projects where the district has already chosen the set of materials. On the other hand, ED has provided funds for dissemination and implementation assistance to project developers whose programs had received national validation; however, there were always many such programs for districts and states to choose among. Schools need expertise to choose quality materials and to understand and provide professional development around the materials. The issue is the capacity of the system to deliver this needed technical assistance. The teachers who field test these materials are in great demand, but cannot get away from their classrooms to assist others as much as they are needed.

Providing support for implementation of high-quality standards-based materials. The local systemic change K-8 teacher enhancement projects in math and science are designed to provide the professional development around implementation of quality materials. Unfortunately, of the 40 projects funded to date only 6 have been in math. The local systemic change 7-12 in math started in late 1996 and 7 have been funded. The issue is getting projects submitted, in other words getting people willing to deliver the needed professional development for implementation of quality materials!

Ensuring public support and demand for high-quality, demanding curricula. Vivid memories of "The New Math" seem to have instilled a lingering public cynicism toward mathematics reform efforts. A small but vocal minority of

the public is waging a war of "back to basics," not understanding that the basics have been increased and that challenging materials can benefit all students. The issue is how to reach the public with the successes of these new materials on all standard measurements, including NAEP and TIMSS. A public campaign can't be waged from inside the Beltway, so this effort must seek broad grassroots support.

5. Proposed objectives for the action plan.

Three curriculum-related objectives for the action plan can be derived from the discussions above, including:

* Provide support to schools to help them make informed choices among high-quality materials;

* Provide support to schools to help them implement high-quality standards-based materials; and

* Encourage public support and demand for high-quality, demanding curricula.

Some thoughts about strategies to support these objectives include:

Short-term priorities:

1. Get the Mathematical Sciences Education Board or similar organization to launch a campaign for quality materials - NCTM will buy in but won't lead.

2. Challenge the community to submit proposals to provide assistance for schools who want to do the implementation - encourage regional consortia to take this as a mission.

Short and long-term priorities:

3. Ramp the professional development in mathematics through Eisenhower and NSF; evoke more proposals.

4. Challenge the Presidential Awardees in mathematics to take a bigger role in all activities.

Drafted by: Midge Cozzens (NSF)
Bob Stonehill (ED)

jsunley @ nsf.gov
04/01/97 04:03:00 PM

Record Type: Record

To: Daryl E. Chubin, Michael Cohen, William R. Kincaid

cc:
Subject: revised material from working group 4

INTERAGENCY COMMITTEE ON SCIENCE AND MATHEMATICS EDUCATION

Motivate students and help them understand how math concepts are applied in the real world.

This component connects the notion of content standards in mathematics and science with how parents and communities can help children and schools achieve at world-class levels, how the media and business and industry can be enlisted in public service campaigns, and how to bring these resources together nationally and locally to raise the visibility of the need for improved mathematics education.

What has already been done?

Research

The Federal government has sponsored relevant research about student motivation. Studies of Constructive thinking should help understand how students are motivated by becoming engaged in the content of mathematics and science (OERI, NCES, and NSF support such research). A growing percentage of students at 4th and 8th grades are receiving more exposure to mathematical topics such as measurement, statistics, and algebra and functions. However, many classrooms continue to emphasize facts and concepts, skills and procedures rather than developing reasoning ability to solve unique problems.

Also, studies and implemented programs have been carried out that attempt to understand how schools might be organized to insure that students of differing ethnic backgrounds become motivated to participate in quality science and mathematics study.

The TIMSS results show that all US students believe that study at home is important for doing well in mathematics. Only half of US students believe that natural ability is necessary for doing well, compared with more than 80 percent in the top achieving countries (Singapore, Japan and Korea). While all US students say that the believe that it is important to do well in mathematics and science, fewer (75 percent) believe that their friends agree; fewer even than in the top performing countries (85 percent). Thus, US students appear to be motivated to study mathematics in that they believe in its importance and they believe that hard work is necessary to achieve it; but, they

may be less likely to believe that this value is shared by their friends.

Programs

Federal efforts to increase student involvement in mathematics and science include support for implementing the national mathematics and science standards in school materials to increase efforts to include all students in mathematics classes. National efforts to inform teachers of these standards have reached most teachers and federal curriculum projects use the standards as a basis for materials. Federal support has increased the development of computer tools designed to increase student motivation by showing mathematics in action. Research efforts are underway to experiment with the best methods of including technology in the classroom to improve student motivation and understanding of mathematics and science phenomenon.

NSF has supported implementation projects that attempt to integrate mathematicians and scientists from colleges and universities into lower grades. ED supports a number of programs (including Star Schools, Challenge Grants, Magnet Schools, the National Eisenhower Programs) that may fund projects designed to promote the type of math instruction that fosters student interest and achievement in the middles grades, and that seeks to engage underserved and underachieving populations.

Several programs have strong parent participation components to engage parents more directly and effectively in their children's academic achievement. These federal programs seek to develop materials in mathematics that parents can follow and they seek to engage parents with existing local organizations to support the study of their students.

Products

ED has supported the development and dissemination of a variety of products for parents, educators, and community members on the subjects of helping students with mathematics, connecting mathematics to the real world, and placing the study of mathematics in a multicultural context. Many of these products are aimed at the elementary school grades.

What is working?

Hands-on science experiments in classrooms (or as supplemental after school activities) motivate students. Computer applications in classrooms apply mathematics and science. Providing kits (and information) to parents for learning activities has been shown to be effective; these activities have generally been targeted at elementary age students.

The First in the World Consortium of Illinois school districts who

generated a community level campaign within and outside schools to promote students' math achievement and high performance on the TIMSS assessment were successful in garnering attention, interest, and support. Programs like the Academic Fitness Awards (recognition of students' academic performance analogous to the Physical Fitness Awards) provide incentives for students.

Gaps

There remain gaps in our knowledge of the teaching and learning process, including the issue of providing an appropriate learning environment (in terms of curricular material, teacher, pedagogical style) for our increasingly diverse student population.

We need to demonstrate how to implement the high quality mathematics and science standards being developed at all levels of the public school system.

Issues

At the national level:

How can the media be enlisted to reach parents with the need to foster their students' mathematical learning?

How can the media assist in increasing public awareness of the national standards for mathematics performance?

How can business and industry be enlisted to provide incentives for students' achievements?

State and local levels:

International studies show US students value mathematics about the same as do students in other countries. However, their achievement is lower. US students are not as likely to believe that their "friends" value mathematics as much as do their mothers. Thus, it appears that community support (perhaps especially the support of peers) is important. How can businesses and community organizations provide outside, extra-school learning opportunities to increase students' mathematical understanding and achievement?

How can businesses and community organizations assist parents to play effective roles in their children's learning?

How can businesses and community organizations reinforce the national message about the Presidential Initiative with local campaigns and incentives, and recognition programs?

Recommended objectives for the action plan

Increase students' understanding of the need to exert effort to become a champion in any field of endeavor (including mathematics).

Increase community and students' understanding of the importance of mathematical proficiency for future job and educational opportunities.

Students need to believe that their friends and family believe that mathematics is important for their lives. The government should provide national examples of persons of different occupations using math in work settings.

Communities should examine the results of international studies to understand how students in other countries learn better mathematics than do US students.

Also, good classroom materials help motivate students.

Improve the supply and use of modern technology to increase student motivation and understanding of mathematics.

Improve the available resources to support students and parents' efforts to increase student mathematical proficiency.

Working DRAFT
4/1/97

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NUMBER OF PAGES (INCLUDING COVER SHEET): 3

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DoEd-NSF Working Group on Improving Math and Science Education

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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 14, 1997
1 pm, 436 OEOB

Agenda

I. DPC-OSTP Meeting Objectives

II. Review of Framework and Objectives

III. Process Issues:

A. frequency of meetings convened by DoEd-NSF co-chairs
B. timeline with checkpoints and deliverables en route to recommendations and action strategy reported in 90 days (early June)
C. materials to review
D. other needed information-gathering

IV. Other

DATE: March 13, 1997

TO: Judy Wurtzel, ED/OUS
Daryl Chubin, OSTP
Bill Kincaid, DPC

FROM: Bob Stonehill, ED/OERI

SUBJECT: OERI Response to Draft Framework

Great (and fast!) job on the rough draft. As we looked across our key efforts and thought about possible new initiatives to enable us to carry out the Presidential Math/Science Directive, we found that the framework worked very well for us--with one exception. We found #3 (Integrate technology and high-quality instructional materials into the classroom) to be redundant with #1 and #2 and we recommend that we consolidate to three objectives that represent pedagogy, content and public engagement, as follows:

- **Improve teaching and teacher preparation.**

A key goal under the first objective should be to help teachers *teach for understanding* (one of the main TIMSS findings). This can be accomplished through a series of activities focusing both on preservice education and in-service education, and would include additional **content**--rather than process--workshops for elementary school teachers who are not expert in mathematics or science (perhaps these can be supported through the Eisenhower Consortia or NSF summer institutes). Technology can be an important tool in delivering this instruction to remote locations.

Another effort we recommend pursuing to achieve this objective is to identify and extensively promote the teacher professional development in these areas that appear to be working, including efforts supported by the Eisenhower State or National programs, HEA Title V, or elsewhere. In our review of exemplary and promising mathematics programs we will closely look for excellent professional development programs as well.

Finally, we recommend that we continue and enhance our efforts to use technology to provide access to model teaching. The Stigler videos offer a glimpse at contrasting teaching styles, but so far without any accompanying analysis or guidance for audiences. Other professional development tools that feature exemplary teaching styles and strategies are also becoming available, e.g., *Captured Wisdom* (a CD-ROM and video product produced by the North Central Regional Laboratory); we should identify these tools and promote them as appropriate.

- **Improve access to high-quality curricula and programs.**

TIMSS has much to suggest about ways in which our curriculum and programs can be strengthened, particularly by focusing the curriculum and providing more in-depth learning opportunities for each topic (a key feature of the NCTM standards). OERI and NCES (and some

of the national organizations, e.g. AAAS) are working on toolkits to help local educators analyze their textbooks and curricula against TIMSS and NAEP frameworks; these will be widely disseminated as they become available.

In achieving this objective, OERI will be looking closely at the range of exemplary and promising programs that have already been disseminated to see which of those most closely match the NCTM standards and the TIMSS pedagogy and content findings. We will be using an expert panel to help us do that; the panel will also be looking more broadly to identify and designate as promising or exemplary programs that have not been already disseminated by the Department.

We also propose that we examine closely some of the after-school enrichment programs that have become popular, like Hands-On Science, Family Math and Family Science. These have been both praised (for involving children in after-school science and math activities) and criticized (for not necessarily being good science and for not being offered in a context that promotes broader learning about science and mathematics).

- **Engage parents and the public to help motivate students.**

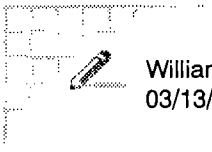
While most people are able to read to or with children, the mathematics analog to this challenge is not as simple--most people can't just do math with their kids. There is a need for structured materials that will help children learn and practice math, but also will be fun. Many materials already exist, both commercial and federally sponsored, e.g., the OERI series on *Helping Your Child Learn Math* and *Helping Your Child Learn Science* and others have been widely disseminated by the Department, e.g., *Family Math* but we can do more to promote--or possibly produce--these kinds of fun activity kits, e.g., math-related materials to take on car trips (at this speed, how long will it take until we get there?).

We're not sure yet about the feasibility of using a volunteer or student work-study approach in this initiative, except in a mentoring capacity. Tutoring programs that enlist professionals in math or science-related fields (retired or otherwise) pose more problems in this content area than with reading, and there's already concern in the America Reads initiative about the quality control of tutors and volunteers. We should discuss these issues as a group.

The possibility of business and public involvement campaigns seem to us to offer real opportunities to move mathematics learning forward. For instance, millions of children have become good at analyzing and estimating statistics as a result of their interest in sports, especially baseball, football and basketball, where percentages of success decide which strategies will be tried. We recommend exploring partnerships with the sports industries, e.g., a campaign with major league baseball to put math challenge problems on the scoreboards (or the TV screens), much as they now pose trivia problems. These problems will be fun for the participants, but can also help them use and refine math skills (estimation, analysis and probability).

A related suggestion for discussion is the use of direct marketing on two fronts: (1) to educators, perhaps through a letter from the Secretary to every elementary and middle school principal in the country, of the upcoming 8th grade mathematics test, and how each participating child can

benefit; and (2) to parents, describing why it's important that all children develop a solid foundation of understanding of mathematics and science, and how they can help.



William R. Kincaid
03/13/97 05:48:30 PM

Record Type: Record

To: Robert_Stonehill @ ed.gov @ INET @ LNGTWY
cc:
bcc: Records Management
Subject: Re: OERI Comments and Suggestions on Draft Framework

Robert--

Thanks for sharing this with us. A very quick, off the cuff critique to consider as you discuss this with Tom, Clare, Judy, and other folks at ED between now and tomorrow's meeting. As I just read over this, my initial reaction is that this may be getting a little ahead of the game. What Darryl and I supplied are supposed to be frameworks, within which the next task (I think) is to settle on a specified set of objectives for things that need to be accomplished under each of the broad areas (we can discuss more on Friday your suggestion that the four areas be collapsed into three). Once the group agrees collectively on the set of objectives, then work can proceed on developing some effective strategies for achieving those objectives.

I think helping teachers teach for understanding is a good example of a possible objective we might want to pursue under the heading of improving teaching. Another might be to change preservice teacher education to place a stronger focus on substantive content expertise. A third might be to transform teacher certification so as to require a stronger content grounding. (NOTE: these are just some examples for illustration). And then, having agreed on some objectives like this, we could talk about the possible strategies. The working group needs to do the same for each of the three (or four or five) broad areas that it agrees on). Overall, your paper seems to me to have some of the possible objectives, but that it starts to get into the strategies without first clearly identifying the most important objectives...

I don't want to get spend a lot of time discussing definitiions, but I think there needs to be more thinking on the "what" we want to accomplish before figuring out how to use our resources or other approaches to get there. See what others think...

I look forward to seeing you tomorrow.

Thanks..

Robert_Stonehill @ ed.gov

Robert_Stonehill @ ed.gov
03/13/97 04:28:00 PM

Record Type: Record

To: Daryl E. Chubin, Michael Cohen, William R. Kincaid

cc:

Subject: OERI Comments and Suggestions on Draft Framework

I've attached, for tomorrow's discussion, some preliminary thoughts and suggestions that the OERI group came up with as candidates for an action plan.

Chubin-Kincaid Draft 3/7/97 pm

Working Group on
IMPROVING MATH AND SCIENCE EDUCATION

standards-based | Draw clear linkage to policy recs for 99 budget.

A *Rough Draft* Framework

In the Directive to the Secretary of Education and the Director of the National Science Foundation issued 6 March 1997, the President stated the need for an "action strategy" that supports "a voluntary national test for individual eight-grade students based on widely accepted, challenging national standards in mathematics. . . . We must ensure that Federal programs, research, and human resources are used as effectively as possible to help improve teaching and learning." The Directive also called for the strategy to address "involving the mathematics, scientific, and technical communities in support of these efforts."

Before developing a strategy, the interagency group needs to identify which components of standards-based education should be the focal point for efforts to better prepare students for world-class achievement in mathematics as assessed in the eighth grade. The following draft framework is intended to stimulate thinking. It should be revised as the work of the group progresses:

1. **Improve teaching**: The focus must include both the preparation and certification of new teachers – their content knowledge, readiness to provide standards-based instruction, facility with technology as a learning tool – and the professional development of veteran teachers in need of training, support, and assistance to change their classroom practices. How can models of preservice and inservice training that help teachers embrace high standards be recognized and candidates for emulation? How have NSF and Department of Education programs in systemic reform and teacher enhancement contributed to this retraining? What other agency vehicles could be used for this purpose? In addition, how can we best disseminate information on significant research findings, such as TIMSS, and help teachers incorporate what we have learned into the classroom?

Access ⊕ ; instructional materials

2. **Upgrade curriculum**: The ~~adoption~~ implementation of curricula is a State and district process that should be informed by the strengths and weaknesses of the choices. Similarly, there are many ways to teach standards-based content in math and science. Some ways are known to inspire and spur achievement, others to lower expectations and stifle both interest and proficiency. How can curricula that have demonstrated promise of lifting expectations and achievement be identified as preferred choices and made more accessible to teachers? How can assessment tools reinforce the better choices – sometimes in the face of uninformed local control?

3. **Integrate technology ~~and high-quality instructional materials~~ into the classroom**: Next to tests, textbooks drive the trajectory of teaching and learning. Technology expands the universe of materials (e.g, CD-ROMs, Internet) – only if the hardware is in place and teachers know how to use it. Clearly, standards-based materials (texts, lessons, modules) that have been classroom-tested and accessible should be promoted. How can technology and materials be integrated to transform teaching and learning? Strategically, how can knowledge of available best practices and materials be spread by existing programs to support more teachers and classrooms?

4. **Motivate students and help them understand how math concepts are applied in the real world**: This component draws significantly on partnerships with organizations outside the Federal sector, but could also include agencies within the Federal government for which education is not their primary mission. They no doubt have people and other resources that could help enrich math and science instruction. It connects the notion of content standards in math and science – why they must be aspired to, how parents and communities can help children and schools achieve at world-class levels, how the media and business/industry can be enlisted in public service campaigns – with skills for the world of work and advanced learning. How can these resources be brought to bear nationally and locally to raise the visibility of the need? What novel arrangements would involve experts in math and science as well as volunteers, and make larger segments of the public attentive to the link between school and work?

From within this framework, and for each of these components, the working group needs to define a set of critical objectives that the action strategy will be designed to address. At our next meeting we can discuss both the general framework, as well as suggested key objectives, and begin to arrive at a consensus so we can move on to the ultimate task of devising a strategy for action. Thanks.

THE WHITE HOUSE

WASHINGTON

March 10, 1997

SCHEDULING PROPOSAL

_____ Accept	_____ Regret	_____ Pending

TO: Stephanie Streett and Anne Hawley
Deputy Assistants to the President and Directors of Scheduling

REQUESTED BY: John H. Gibbons, Assistant to the President for Science and Technology

REQUEST: Presidential speech on the Administration's plans and goals for science and mathematics education at the occasion of the 1996 Presidential Award for Excellence in Science and Mathematics Teaching.

PURPOSE: To highlight the President's commitment to science and mathematics education and his support for America's teachers.

BACKGROUND: This award represents the highest honor of its kind that any mathematics or science teacher can receive in the United States. It applauds the efforts these teachers have made to improve the skills of our Nation's young people. The award is presented to four teachers (elementary science, elementary math, secondary science, secondary math) from each state, the District of Columbia, Puerto Rico, U.S. Territories, and the Department of Defense Dependent Schools. The award includes a certificate and a $7,500 grant given to the recipient's school, to be spent under the awardee's direction over a three-year period.

Award recipients are chosen on the basis of the excellence of their teaching performance and consideration of their background and experience including their formal education, continuing education activities, teaching experience, as well as professional and non-professional activities related to their role as a teacher.

DATE & TIME: The secondary (middle and high school) teachers are scheduled to be in Washington, DC June 24-28. Open windows in the schedule of events include all day Wednesday, June 25 and all day Friday, June 27. If necessary, arrangements could be made to shift the interagency briefing scheduled for the afternoon of Thursday, June 26.

	The elementary teachers are scheduled to be in Washington, DC June 10-14. Open windows in the agenda include all day Wednesday, June 11 and all day Friday, June 13. If necessary, arrangements could be made to shift the interagency briefing scheduled for the afternoon of Thursday, June 12. **Please note:** Due to the large numbers of awardees, these dates are not changeable.
DURATION:	20-30 minutes
BRIEFING TIME:	5 minutes.
LOCATION:	White House Complex
PARTICIPANTS:	The President Richard Riley, Secretary of Education (invited) John H. Gibbons, Assistant to the President for Science and Technology Bruce Reed, Assistant to the President for Domestic Policy Neal Lane, Director, National Science Foundation
VICE PRESIDENT'S ATTENDANCE:	Optional.
FIRST LADY'S ATTENDANCE:	Optional. **Note:** The First Lady will be asked to address the elementary school teachers.
SEQUENCE OF EVENTS:	To be determined by the format of the event.
REMARKS:	Brief remarks to be prepared by the speech writers with assistance from OSTP.
PRESS PARTICIPATION:	Open press.
PREVIOUS PARTICIPATION:	1993: The President hosted the 1992 secondary teachers on 3/11/93. 1993: The First Lady hosted the 1992 elementary awardees on 4/29/93. 1994: The Vice President hosted the 1993 secondary teachers on 4/28/94. 1994: The First Lady hosted the 1993 elementary teachers on 3/10/94. 1995: The First Lady hosted the 1994 secondary teachers on 3/9/95. 1995: The Vice President hosted the1994 elementary teachers on 4/28/95. 1996: The First Lady addressed the 1995 elementary and secondary awardees on 5/10/96.
STAFF CONTACT:	Cliff Gabriel, 456-6130

DATE: March 13, 1997

TO: Judy Wurtzel, ED/OUS
Daryl Chubin, OSTP
Bill Kincaid, DPC

FROM: Bob Stonehill, ED/OERI

SUBJECT: OERI Response to Draft Framework

Great (and fast!) job on the rough draft. As we looked across our key efforts and thought about possible new initiatives to enable us to carry out the Presidential Math/Science Directive, we found that the framework worked very well for us--with one exception. We found #3 (Integrate technology and high-quality instructional materials into the classroom) to be redundant with #1 and #2 and we recommend that we consolidate to three objectives that represent pedagogy, content and public engagement, as follows:

- **Improve teaching and teacher preparation.**

A key goal under the first objective should be to help teachers *teach for understanding* (one of the main TIMSS findings). This can be accomplished through a series of activities focusing both on preservice education and in-service education, and would include additional **content**--rather than process--workshops for elementary school teachers who are not expert in mathematics or science (perhaps these can be supported through the Eisenhower Consortia or NSF summer institutes). Technology can be an important tool in delivering this instruction to remote locations.

Another effort we recommend pursuing to achieve this objective is to identify and extensively promote the teacher professional development in these areas that appear to be working, including efforts supported by the Eisenhower State or National programs, HEA Title V, or elsewhere. In our review of exemplary and promising mathematics programs we will closely look for excellent professional development programs as well.

Finally, we recommend that we continue and enhance our efforts to use technology to provide access to model teaching. The Stigler videos offer a glimpse at contrasting teaching styles, but so far without any accompanying analysis or guidance for audiences. Other professional development tools that feature exemplary teaching styles and strategies are also becoming available, e.g., *Captured Wisdom* (a CD-ROM and video product produced by the North Central Regional Laboratory); we should identify these tools and promote them as appropriate.

- **Improve access to high-quality curricula and programs.**

TIMSS has much to suggest about ways in which our curriculum and programs can be strengthened, particularly by focusing the curriculum and providing more in-depth learning

opportunities for each topic (a key feature of the NCTM standards). OERI and NCES (and some of the national organizations, e.g. AAAS) are working on toolkits to help local educators analyze their textbooks and curricula against TIMSS and NAEP frameworks; these will be widely disseminated as they become available.

In achieving this objective, OERI will be looking closely at the range of exemplary and promising programs that have already been disseminated to see which of those most closely match the NCTM standards and the TIMSS pedagogy and content findings. We will be using an expert panel to help us do that; the panel will also be looking more broadly to identify and designate as promising or exemplary programs that have not been already disseminated by the Department.

We also propose that we examine closely some of the after-school enrichment programs that have become popular, like Hands-On Science, Family Math and Family Science. These have been both praised (for involving children in after-school science and math activities) and criticized (for not necessarily being good science and for not being offered in a context that promotes broader learning about science and mathematics).

- **Engage parents and the public to help motivate students.**

While most people are able to read to or with children, the mathematics analog to this challenge is not as simple--most people can't just do math with their kids. There is a need for structured materials that will help children learn and practice math, but also will be fun. Many materials already exist, both commercial and federally sponsored, e.g., the OERI series on *Helping Your Child Learn Math* and *Helping Your Child Learn Science* and others have been widely disseminated by the Department, e.g., *Family Math* but we can do more to promote--or possibly produce--these kinds of fun activity kits, e.g., math-related materials to take on car trips (at this speed, how long will it take until we get there?).

We're not sure yet about the feasibility of using a volunteer or student work-study approach in this initiative, except in a mentoring capacity. Tutoring programs that enlist professionals in math or science-related fields (retired or otherwise) pose more problems in this content area than with reading, and there's already concern in the America Reads initiative about the quality control of tutors and volunteers. We should discuss these issues as a group.

The possibility of business and public involvement campaigns seem to us to offer real opportunities to move mathematics learning forward. For instance, millions of children have become good at analyzing and estimating statistics as a result of their interest in sports, especially baseball, football and basketball, where percentages of success decide which strategies will be tried. We recommend exploring partnerships with the sports industries, e.g., a campaign with major league baseball to put math challenge problems on the scoreboards (or the TV screens), much as they now pose trivia problems. These problems will be fun for the participants, but can also help them use and refine math skills (estimation, analysis and probability).

A related suggestion for discussion is the use of direct marketing on two fronts: (1) to educators, perhaps through a letter from the Secretary to every elementary and middle school principal in the country, of the upcoming 8th grade mathematics test, and how each participating child can benefit; and (2) to parents, describing why it's important that all children develop a solid foundation of understanding of mathematics and science, and how they can help.

ED/NSF Interagency Working Group

Tentative agenda for Tuesday, March 25, 1997

Time: 3:00 p.m.

Place: NSF Headquarters; Room 1295

Items for discussion:

1. Draft Framework

2. Draft Timeline

3. Establishing the baseline for an action plan

-- Outcome of working group consideration: teachers; curriculum and materials; technology; and students.

-- Obtaining input from stakeholders, including other Federal agencies (including discussion of appropriate stakeholder groups for contact)

-- Obtaining a briefing on test design, its relation to standards

-- Obtaining a good reading on the environment in which the action plan will be implemented: school/local/state/federal/private sector interactions

4. Other items

To: nsfed
From: Judy Sunley <jsunley@nsf.gov>
Subject: draft framework
Cc: Mary_Cassell@oa.eop.gov, Anne_Tenney@oa.eop.gov
Bcc:
X-Attachments:

This is an updated draft framework document from Daryl Chubin. He sent it to Tom and me last week, but I did not realize he had sent it only to us until today. Please be prepared to comment on and finalize the framework at Tuesday's meeting.

Judy Sunley

DRAFT DRAFT DRAFT

Working Group on
IMPROVING MATH AND SCIENCE EDUCATION

A Draft Framework

In the Directive to the Secretary of Education and the Director of the National Science Foundation issued 6 March 1997, the President stated the need for an &action strategy 8 that supports &a voluntary national test for individual eight-grade students based on widely accepted, challenging national standards in mathematics. . . . We must ensure that Federal programs, research, and human resources are used as effectively as possible to help improve teaching and learning. 8

While the Directive states that the Secretary of Education has been tasked to develop the national math exam) based on a framework that is standards-based, reflecting content and benchmarks encompassed by NCTM, TIMSS, and NAEP) the interagency working group is to develop the action strategy. This strategy is explicitly linked to preparing students for the exam to be administered beginning in Spring 1999. The strategy must include recommended actions "involving the mathematics, scientific, and technical communities in support of these efforts."

In developing a strategy, the interagency group needs to identify which components of standards-based education should be the focus of efforts to prepare students for world-class achievement in mathematics as assessed in the eighth grade. The following draft framework should be revised as the work of the group progresses:

1. Improve teachers: The focus must include both the preparation and certification of new teachers) their content knowledge, readiness to provide standards-based instruction, facility with technology as a learning tool) and the professional development of veteran teachers in need of training, support,

and assistance to change their classroom practices. How can models of preservice and inservice training that help teachers embrace high standards be recognized and candidates for emulation? How have NSF and Department of Education programs in systemic reform and teacher enhancement contributed to this retraining? What other agency programs could be used for this purpose? In addition, how can we best disseminate information on significant research findings, such as TIMSS, and help teachers teach with confidence and understanding?

2. Upgrade access to and implementation of curriculum and instructional materials: The implementation of curricula is a State and district process that should be informed by the strengths and weaknesses of the choices. Similarly, there are many ways to teach standards-based content in math and science. Some ways are known to inspire and spur achievement, others to lower expectations and stifle both interest and proficiency. How can curricula that have demonstrated promise of lifting expectations and achievement be identified as preferred choices and made more accessible to teachers? How can assessment tools reinforce the better choices) sometimes in the face of local control) so that standards-based materials (texts, lessons, modules), which have been classroom-tested and accessible, are promoted?

3. Integrate technology into the classroom: Next to tests, textbooks drive the trajectory of teaching and learning. Technology expands the universe of materials (e.g, CD-ROMs, Internet)) only if the hardware is in place and teachers know how to use it. How can technology and materials be integrated to transform teaching and learning? Strategically, how can knowledge of available best practices and technology-based tools be spread by existing programs to support more teachers and classrooms?

4. Motivate students and help them understand how math concepts are applied in the real world: This component draws significantly on partnerships with organizations outside the Federal sector, but could also include agencies within the Federal government for which education is not their primary mission. They no doubt have people and other resources that could help enrich math and science instruction. It connects the notion of content standards in math and science) why they must be aspired to, how parents and communities can help children and schools achieve at world-class levels, how the media and business/industry can be enlisted in public service campaigns) with skills for the world of work and advanced learning. How can these resources be brought to bear nationally and locally to raise the visibility of the need? What novel arrangements would involve experts in math and science as well as volunteers, and make larger segments of the public attentive to the link between school and work?

Within this evolving framework, and for each of these components, the working group will define a set of critical objectives and policy levers, Federal and otherwise, that the action strategy will be designed to address. To do so, the interagency group will review existing resources to determine what ,s working,

identify gaps in knowledge, and sketch emerging or persistent issues that support the objectives to pursue after the 90-day report.