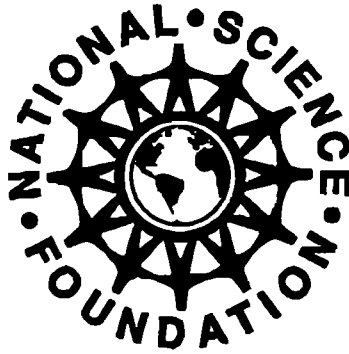




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AN ACTION STRATEGY FOR IMPROVING ACHIEVEMENT IN MATHEMATICS AND SCIENCE

I. INTRODUCTION

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

The Presidential Directive

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

The Need for Action

The Third International Mathematics and Science Study

One of the immediate inspirations for this attention to high standards in mathematics and science education in eighth grade is the Third International Mathematics and Science

Study (TIMSS), which involved 30,000 students in the United States. Results of tests administered in 1995 to students in grades 4 and 8 are now available. The fourth grade results show US students above the international average in both science and mathematics. In science, US students were outperformed only by those in Korea. However, the eighth grade results show lackluster performance by US students, with scores only a bit above the international average in science, and below the international average in mathematics. These results clearly indicate that mathematics and science education in the middle school years should be an important focus for national efforts to help ensure that our students meet world-class standards.

The Third International Mathematics and Science Study (TIMSS)

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

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

TIMSS results show that

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

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TIMSS results for the fourth grade are much more positive than the results of similar international comparisons in the past. They demonstrate that it is possible to make significant progress in international comparisons over time, and that US students can compete favorably with those of other nations in mathematics and science achievement. Our National Education Goals proclaim our intent that US students will be first in the world in mathematics and science achievement by the year 2000. In the early grades, we are making demonstrable progress toward that goal.

While collecting achievement data in each participating country, TIMSS researchers also developed a wealth of information about teachers and teaching, about curricula and instructional materials, about classroom lessons and interactions, and about student attitudes and habits outside the classroom. Thus, the TIMSS results have become a source of constructive motivation for mounting an action strategy, taking the issue well beyond the simple comparison of scores in international test taking.

Opportunities for the Future

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

A Voluntary National Test in Mathematics

The President has proposed a voluntary national test in mathematics, to be taken near the end of eighth grade, as a very visible part of an ambitious, sustained drive for higher,

more challenging standards of learning for all students. The test will be based on the framework of the National Assessment of Educational Progress (NAEP). It will be available by the spring of 1999. Parents and teachers will receive an individual score for each student who takes the test. That score will be linked to national and international benchmarks, in order to provide additional context for parents, teachers and students. For more information, see Appendix 2.

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

Plan of Action: Place Immediate Focus on Mathematics

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

To meet the challenges of the near term, this action strategy focuses on mathematics education in grades 5-8. It builds on a strong foundation of activity underway across the country to improve elementary and secondary mathematics and science education. It requires that these activities continue, at all

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

Raising Achievement for Disadvantaged Students

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

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

Challenges for All Parties

Our vision is that all American students will leave eighth grade prepared to pursue the higher-level mathematics and science courses that are the gateway to college, productive employment, lifelong learning, and effective citizenship. Reaching this vision will require:

- High expectations, held by teachers, school administrators, parents, and students themselves, for student performance in mathematics and science;
- Challenging standards for content of curriculum, teaching, assessment, and student achievement;

- Instructional materials and technology of high quality that incorporate these challenging standards;
- Teachers with the pedagogical skills and rigorous knowledge of mathematics and science needed to teach these subjects effectively; and
- Activities outside the classroom that reinforce the classroom experience by drawing on the support of parents, the professional communities of mathematicians, scientists, and engineers, business leaders, and the broader public.

Thus, the action strategy

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

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

To help meet these challenges, based on the rationale described above, the Department of Education and the National Science Foundation will focus their immediate actions -- individually and jointly -- on mathematics in grades 5-8. To be fully effective, this effort must broaden to include both mathematics and science in all grades once the immediate needs of mathematics in grades 5-8 have been addressed.

II. PRIORITIES FOR ACTION

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

Priorities for Action

While education is a national priority, it is primarily a State and local responsibility. The Federal role is to provide good information, effective tools, and financial support that will assist States and local communities in ensuring that all of their students have the mathematical skills they need to succeed in the workplace as

productive citizens. This includes promoting effective partnerships that mobilize support from the community -- students, parents, educators, business leaders, volunteers, and concerned citizens from all walks of life -- to that end.

Therefore, the priorities of this action strategy will focus Federal investment on assisting States and local school districts to

- Equip teachers in grades 5-8 with the skills and knowledge to teach challenging mathematics content in effective ways, with high expectations for their students; and
- Select and implement high-quality, standards-based curricula and instructional materials, including effective use of educational technologies; and

working through a broader set of partnerships to

- build public understanding of challenging mathematics in grades 5-8, and gaining public support for raising student achievement toward high standards.

Scope and Scale

In grades 5-8 there are approximately 13.5 million students taught by about 320,000 teachers of mathematics. These students and teachers are found in about 34,000 schools in close to 15,000 districts. Many of these schools and districts are already actively involved in setting high standards for instruction and student achievement and are implementing plans to achieve them. Their priorities in such efforts are very similar to the school-based priorities identified above.

The core of this action strategy is assisting schools and districts to make more effective use of Federal resources in their efforts to address these priorities with respect to mathematics in grades 5-8. The participating agencies will provide opportunities for districts to accelerate their progress toward improved achievement in this area through incentives for enhanced coordination,

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

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

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

III. ACTIONS TO STRENGTHEN THE IMPACT OF FEDERAL RESOURCES

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

Current Federal Resources

The Department of Education allocated approximately \$8 billion in FY 1997 through three major formula-driven programs (Goals 2000; Eisenhower Professional Development State Grants; and Title I: Education for the Disadvantaged) that include improved achievement in mathematics and science among their objectives. Goals 2000 aids States and school districts to develop and implement challenging academic standards and upgrade teaching and learning in order to reach the National Education Goals, including the goal of becoming first in the world in mathematics and science. The Eisenhower program places an explicit focus on science and mathematics. Of the \$310 million appropriated for FY 1997, \$250 million was required to go to mathematics and science.

Title I Schoolwide Programs

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

The 1994 reauthorization of Title I placed new emphasis on helping disadvantaged students meet the same challenging academic standards expected of all children. States are currently developing standards and plans consistent with that emphasis. The Department of Education works actively with

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States and school districts on identifying actions that can be taken to achieve significant change, provides information and examples, and makes technical assistance available as needed.

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

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

Mathematics Education and the Department of Defense

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

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

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

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Strengthening the Impact of Federal Resources

Using Existing Programs

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

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

Creating Synergy

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

The work of improving student achievement must be done at the State and local level, and,

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

Pooling Resources to Enhance Student Achievement

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

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

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IV. ACTION PLAN

Progress in any one of the three priority areas – teachers, instructional materials and technology, and public information and engagement – will often depend on and demand improvement in others. For instance, the introduction of high-quality instructional materials will have little impact if teachers are not trained to use those materials effectively. The action plan must work on all fronts in order to make progress toward improved student achievement. The action plan provided below is organized around the three priority areas, with an introductory section that describes plans for new joint activities of the Department of Education and the National Science Foundation designed to promote synergistic use of Federal funds across the priority areas.

New Joint Activities

As noted above, the Department of Education and the National Science Foundation plan a set of joint activities, including the other participating agencies to the extent possible, aimed at addressing school-based priorities.

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

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

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

The Department and NSF will convene a national conference of State and local leaders of Eisenhower, Title I, Goals 2000, and State, urban and rural systemic initiatives, and other key actors in maximizing the impact of Federal resources in improving mathematics education in grades 5-8.

Texas Statewide Systemic Initiative

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

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

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

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

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

- **Coordinated research and informational activities.**

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

- **Systematic involvement of other agencies.**

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

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

PRIME in Pittsburgh

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

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

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

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Equip teachers to teach challenging mathematics

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

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

Quantitative Literacy Program for Alabama K-12 Teachers

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

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

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

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

- Stimulate state and local educational agencies to implement comprehensive programs of sustained, intensive, high-quality professional development for teachers of mathematics in grades 5-8. The agencies will make such efforts the cornerstone of their new competitive planning grants, giving priority to applicant districts willing to address the needs of all teachers of mathematics in grades 5-8 in the district. They will continue existing programs that provide resources for districts to implement professional development programs, incorporating priorities for activities involving teachers of mathematics in grades 5-8, where feasible.

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- Initiate a short-term effort to strengthen the pool of talented, committed individuals able to provide exemplary professional development for classroom teachers. The agencies will provide opportunities for competitive support of projects that will provide intensive training experiences for those who will lead future teacher training efforts.
- Support the creation of materials for professional development of teachers of mathematics in grades 5-8 that are grounded in the NCTM standards, tied to newly emerging educational materials and technologies, and assist teachers to link mathematics to real-world skills and applications.
- Support wider opportunities for teachers to help one another with content knowledge and teaching skills through such activities as dissemination of information about effective forms of professional development and encouraging the development of master teachers (including those recognized through the Presidential Awards for Excellence in Mathematics and Science Teaching and the National Board for Professional Teaching Standards Certification), mathematics specialists, and teacher networks.

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

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

Improving Teaching Through Distance Learning

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

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

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

- Provide incentives for appropriate organizations to develop national standards for the preparation of teachers of mathematics in grades 5-8.
- Support the development of materials for preparation of K-8 mathematics teachers that are grounded in the NCTM standards and tied to newly emerging instructional materials and educational technologies.

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

New Initiatives in Teacher Preparation

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

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

Teacher Preparation in Louisiana

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

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

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

Implement curricula, instructional materials, and educational technologies in classrooms

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

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

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

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

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

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

Open CESAME!

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

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

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

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

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- Develop and disseminate guides to help interested schools and school districts select instructional materials and software most appropriate for their local needs and undertake the necessary steps to effective implementation. This effort will include reviews of instructional materials and software designated by experts as promising or exemplary.
- Provide technical assistance for schools and school districts in putting updated mathematics instructional materials to work in the classroom. NSF-supported curriculum implementation sites dedicated to mathematics materials for grades 5-8 will work with broader technical assistance providers, including the Department's Eisenhower Regional Consortia and National Clearinghouse, as needed.
- Provide teachers and other educators with information on how they might use assessment in planning instructional improvement strategies. These materials will include information on how best to use results from the voluntary national mathematics test -- to interpret them to students and parents, place them in appropriate context, and improve mathematics instruction.
- Continue competitive support for the development of supplementary materials, with new priority for efforts aimed at mathematics in grades 5-8, to assist schools and districts in making the transition to standards-based comprehensive materials.
- Seed research and development of powerful models for integrating technology into classroom practice and informal learning environments. This will include support for critical expansion and evaluation efforts preceding commercialization of these models. K-8 mathematics will be a high priority in the near term.

Eisenhower Regional Consortia for Science and Mathematics Education

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

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

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

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

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

- Agencies will work in cooperation with NASA and NCTM to develop standards-based materials along the lines of NASA's "Mission Mathematics." These materials illustrate the use of mathematics in engaging, real world examples related to the agency mission.
- The Department of Education is chairing a Federal Government-wide working group that has already begun to promote and develop -- and make it easier for teachers and others to find -- high-quality educational materials, including instructional units and related materials, for use on the Internet. The purpose of this group is to take the rich informational resources of organizations such as the Census Bureau or the U.S. Geological Survey, and make them easier for teachers and others to find and use. The first priority of this group will be to identify materials that support teaching of challenging mathematics.
- The Departments of Defense and Education and the National Science Foundation are leading an interagency review of Federal activities related to research in learning technologies in order to establish effective practices for their use.

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

NASA's Mission Mathematics

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

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

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Build public understanding and support.

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

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

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

Saturday Schools Provide Tutoring Boost

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

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

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

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In order to support these strategies, the Department of Education and the National Science Foundation have taken the initial steps to move forward on the

Public Understanding and Engagement Mathematics Initiative,

an activity designed to create a large-scale, national public education effort that is coupled with extensive opportunities for active engagement of students, parents, and the larger community in the support of mathematics education.

Collectively, the projects selected through this initiative will:

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

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

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

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Partnership activities beyond those described in under the initiative above will take advantage of connections the Department and the Foundation maintain in the course of their on-going work. The agencies will:

- Facilitate the connection of national organizations having interests in helping to raise levels of achievement in mathematics and science (for example, professional societies of mathematicians, scientists, and engineers) with State, local and community-based organizations having similar purposes.
- Develop systematic mechanisms for the headquarters and field offices of relevant Federal agencies to participate in the partnerships.

The Department of Energy's STEM Initiative

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

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

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

Secretary Pena has made clear his strong support for educational activities consistent with DOE's energy and defense missions. An effort is underway to coordinate the use of DOE resources in promoting the public's understanding of science and ensuring a diverse workforce for the Nation's science and technology infrastructure.

V. CONCLUSION

The time is ripe for a concerted effort to improve the achievement of US students in mathematics and science. Recent results from international testing have raised the consciousness of the American public about the importance of achieving to high standards in mathematics and science and have made clear that too many of our students are falling short of the levels of achievement we should expect from them.

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

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

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

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**A New Federal Education Partnership
Program
at the Department of Transportation**

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

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

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

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

HELPING STUDENTS MASTER CHALLENGING MATHEMATICS AND PREPARE FOR COLLEGE

October 20, 1997 -- DRAFT

Today, beginning a week-long Administration focus on improving education, Secretary Riley released a new U.S. Department of Education report showing that students who take rigorous math and science courses in high school are much more likely to go on to college. The report shows that these gateway courses are especially important for low-income students. In addition, the study indicates that when differences in course-taking are accounted for, student achievement is the same for students in public and private schools. Joining Secretary Riley for release of the report were students and educators from Equity 2000, a College Board-sponsored program in Prince George's County, Maryland, in which lower-level math courses are being phased out so all students take a rigorous, college-preparatory mathematics curriculum.

[Will beef up with quotes from transcript of actuality][Commenting on the report, President Clinton noted the Administration's efforts to make college affordable for all Americans through increased Pell Grants and work study positions, new HOPE scholarships, and other tax credits, but called for stronger efforts to get students ready for college academically. The President noted that his proposed voluntary national test in 8th grade mathematics would help ensure that students master the rigorous math courses they need for college, and called on Congress to end delays of his plan for national standards.]

KEY REPORT FINDINGS:

- **Students Who Take Tough Math And Science Courses Go on to College.** The study released today analyzes data from the National Educational Longitudinal Study (NELS) which show, for example, that 83% of students who take geometry in high school go on to attend college within 2 years of high school graduation, compared to just 37% of those not taking geometry.
- **Rigorous Math Courses Most Critical For Low Income Students.** Data from the report indicate that 71% of low-income students who take algebra I and geometry go on to college, versus only 27% of low-income students who did not take these courses. Low income students who take geometry are almost 3 times as likely to attend college as those who do not, when course-taking is accounted for, income differences in college-going diminish dramatically. However, low income students are much less likely to take algebra and geometry.
- **Student Course-taking More Important For Math Achievement Than Type of School (Public or Private) Student Attends.** Students at public and private schools who had taken the same rigorous mathematics courses are equally likely to score at the highest level on the NELS 12th grade mathematics achievement test. This is also true of low-income students.

THE VOLUNTARY NATIONAL TEST IN 8TH GRADE MATHEMATICS WILL ENSURE STUDENTS ARE READY FOR THE RIGOROUS MATH AND SCIENCE COURSES THAT ARE THE GATEWAY TO COLLEGE. Mastering algebra by the 8th grade opens the door for students to take rigorous math and science courses in high school. Yet only 25% of U.S. 8th graders take algebra. The voluntary national test in mathematics proposed by President Clinton will include the basics of algebra and even geometry. As a result, it will encourage schools to and students to take a challenging mathematics curriculum, including algebra, by the 8th grade. The test will also help parents learn if their children are being prepared for postsecondary education.

on the road toward high school

who want to go to college but these students are less likely to enroll in 1st year.

of algebra geometry

students take be sure math courses

too few students particularly

71 vs. 27%
algebra and geometry
46% vs. 25%

Not used

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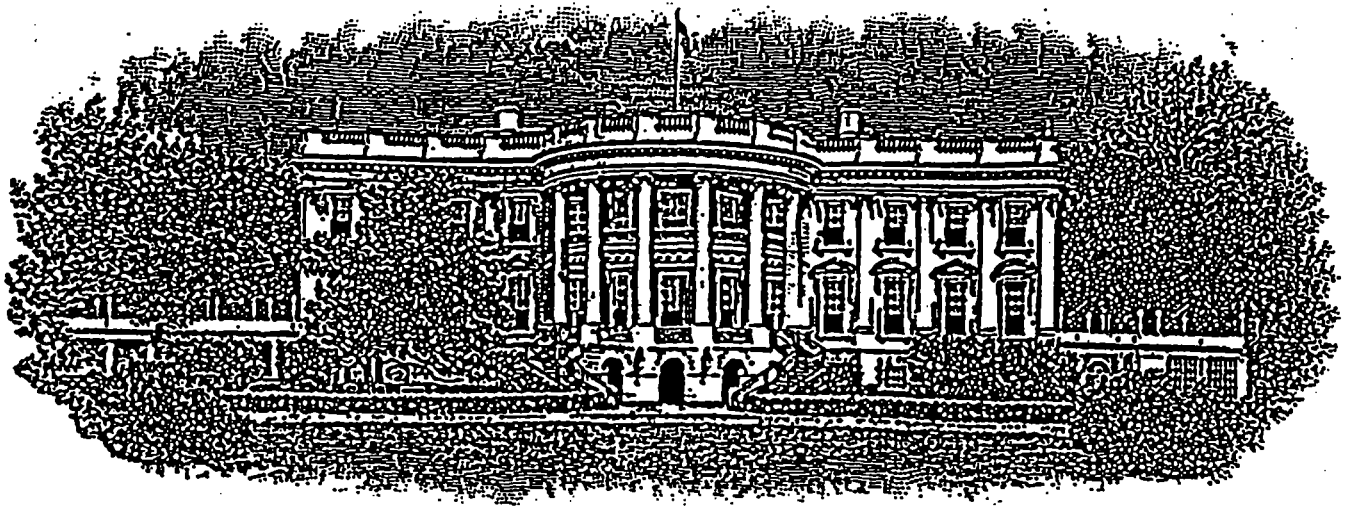
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FAX COVER SHEET

TO: Judy Wurtzel
FAX: 401-9027

FROM: BILL KINCAID

THIS FAX INCLUDES THE COVER SHEET PLUS 3 PAGES.

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

MESSAGE:

As discussed - I am also e-mailing
them to you

B

Helping Students Master Challenging Mathematics and Prepare for College

October 10, 1997 -- DRAFT

Today President Clinton returns from a Latin American trip which highlighted how countries around the world are striving to improve education for their people. In his weekly radio address, President Clinton released a new U.S. Department of Education report which shows that students in this country -- especially low-income students -- who take rigorous math and science courses in high school are much more likely to go on to college. The study also finds that while algebra is the gateway to advanced math and science in high school, most U.S. students do not take algebra during their middle school years. To help our students get on the right on track for a brighter future, and to address the sharp drop-off between the standing of U.S. 4th graders and 8th graders on international comparisons in mathematics, the President also announced a national action strategy to lift U.S. middle school math achievement.

Students Who Take Tough Math and Science Courses Go on to College. The study released today analyzes data from the National Educational Longitudinal Study (NELS) which show, for example, that 83% of students who take geometry in high school go on to attend college within 2 years of high school graduation, compared to just 35% of those not taking geometry. The impact of rigorous course-taking is most pronounced for low income students. Low income students who take geometry are almost 3 times as likely to attend college as those who do not; when course-taking is accounted for, income differences in college-going diminish dramatically.

Algebra is the Gateway to Advanced Math and Science, Yet Most Students Currently Don't Study Algebra During Middle School. While we know from the Third International Mathematics and Science Study (TIMSS) that students in other countries have begun to master the basics of algebra and some geometry by the end of 8th grade, today's report shows that only 25% of U.S. 8th graders enrolled in algebra during 1996, according to the National Assessment of Educational Progress (NAEP). However, students with parents who are deeply involved in their education are more likely to take challenging math courses early. The report also finds that math achievement is associated with student course-taking, not the type of school (public, private, or parochial) that the student attends.

An Action Strategy for Raising Middle School Math Achievement. TIMSS data released over the past year show that U.S. students perform above the world average in mathematics in 4th grade, but below average in 8th grade. The action strategy announced by the President today directly addresses this drop-off, placing a strong focus on middle school mathematics. The strategy will also help teachers, parents and students prepare for the voluntary national test in 8th grade math, which will be given for the first time in 1999.

Developed by the Department of Education and the National Science Foundation, working with other federal agencies and outside partners, the strategy addresses three key objectives: improving teaching; getting more challenging materials and the latest technology into the classroom; and strengthening public support for mastering challenging mathematics. Some highlights of the action strategy include:

- Intensifying federal investments in professional development targeted to middle school math teachers in low income districts and schools.
- Fostering closer ties among school districts, colleges of education, and university math faculties to insure new teachers are rigorously prepared for real-world classrooms;
- Preparing new guides to help schools and districts select high-quality, standards-based materials and software; and
- Supporting new partnerships to increase public understanding of challenging mathematics.

The President directed Secretary of Education Richard Riley and NSF Director Neal Lane to work with the math and science community, states, school districts, and other federal agencies to carry out the plan, and announced a national convocation on middle school math set for January.

Helping Students Master Reading and Mathematics and Compete

October 10, 1997 -- DRAFT

Today President Clinton returns from a Latin American trip which highlighted how countries around the world are striving to improve education for their people. In his weekly radio address, President Clinton criticized Republicans in Congress for slowing educational progress at home, by blocking his plan to create voluntary national tests in 4th grade reading and 8th grade math, and stalling his initiative to help every child read independently by the end of the third grade. The President urged Congress to move forward on these key educational priorities without further delay. President Clinton also announced a national strategy to lift U.S. middle school math achievement, helping our students get on the right track for a brighter future, and addressing the sharp drop-off between the standing of U.S. 4th graders and 8th graders on international comparisons in mathematics.

Republicans in Congress Must Stop Delaying Progress on National Standards and Reading.

...

A New Action Strategy for Raising Middle School Math Achievement. While Republicans in Congress have been stalled on the tests and reading, the Administration has been moving forward in address another key educational priority. TIMSS data released over the past year show that U.S. students perform above the world average in mathematics in 4th grade, but below average in 8th grade. The action strategy announced by the President today directly addresses this drop-off, placing a strong focus on middle school mathematics. The strategy will also help teachers, parents and students prepare for the voluntary national test in 8th grade math.

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Note to Daryl Chubin

Welcome back -- hope your time away was good.

I wanted to update you on some developments regarding the action strategy and related items. Please give me a call as soon as you return so we can discuss in greater detail.

1. Because of all the battling that is currently going on with the Hill regarding the President's education agenda, there is a great deal of interest in doing a number of strong education events in the near term--preferably while the Labor-H conference is still taking place. Mike and I spoke early this week and agreed that now is the time to get the action strategy wrapped up and ready to announce.

2. Furthermore, we think our chances of actually getting the strategy into a POTUS event are better if we can combine it with something else. A good possibility is a draft report (a copy of which I will forward up to you) that Education has prepared that highlights the link between taking challenging math courses and college-going (among other things, analyzing NELS data). Putting the two of these together would let us say A. it's critical for more students to be taking more challenging math courses and B. here's what we plan to do about it.

3. Wednesday I had a phone conversation with Sunley and Wurtzel in which we discussed what needs to happen to get the strategy wrapped up, and other items with respect to a possible event. Here's what we agreed to:

A. Wurtzel, Corwin and I have provided detailed comments to Sunley, who is working to get our comments incorporated by COB Friday or, more likely, first thing Monday morning. (I believe you had given Judy some feedback on this draft at an earlier juncture). Cohen is going to try to look at more intensively as well between now and Friday a.m. so any comments he has can be addressed in this iteration.

B. As she does this, Sunley is also going to extract a rough draft of an executive summary, which you and I can then play with.

C. Sunley is also preparing a transmittal letter, which incorporates but goes beyond the draft you prepared awhile back. Among other things, she wants to address the extent of other agency involvement in the process, what ED and NSF are planning to do together, make it clear that the working group considered both math and science but elected to focus on 5-8 math, and some other items. This draft probably will almost certainly be completed by the end of this week.

D. Early next week we will give OMB, NEC, OVP, OPL the revised (and close to final) draft report for quick review. Of course, OMB has been represented in the working group process already.

E. Unless you think otherwise, also early to mid- next week we will circulate the revised report to the other agencies and schedule a meeting to brief them and agree on next steps in implementing the strategy.

F. Larry Suter has already reviewed the ED-prepared report on math and college-going for NSF, but Wurtzel is providing this now to Sunley for NSF to review with an eye towards Lane co-signing the transmittal letter on that, as well. I will be forwarding you a copy of this so you can see when you return.

G. We may have little choice but to compress the schedule greatly on all of this, depending on the needs of the President's calendar, but in scheduling things (not just the event, but the other agency meeting) we should try to take into account that Lane, Sunley, and much of NSF will be in Houston most of next week, and then that Lane leaves with Gibbons to go to Japan and China Oct. 21st. A further complication is that the POTUS is scheduled to be in South America most of the week after next. If we have to go ahead and schedule the other agency briefing next week (say because we get slotted for the event late next week), Midge can probably sub for Sunley at the briefing with other agencies. I presume that Lane, Riley and anybody else who needs to would just have to readjust their schedule to participate if we do get this worked out.

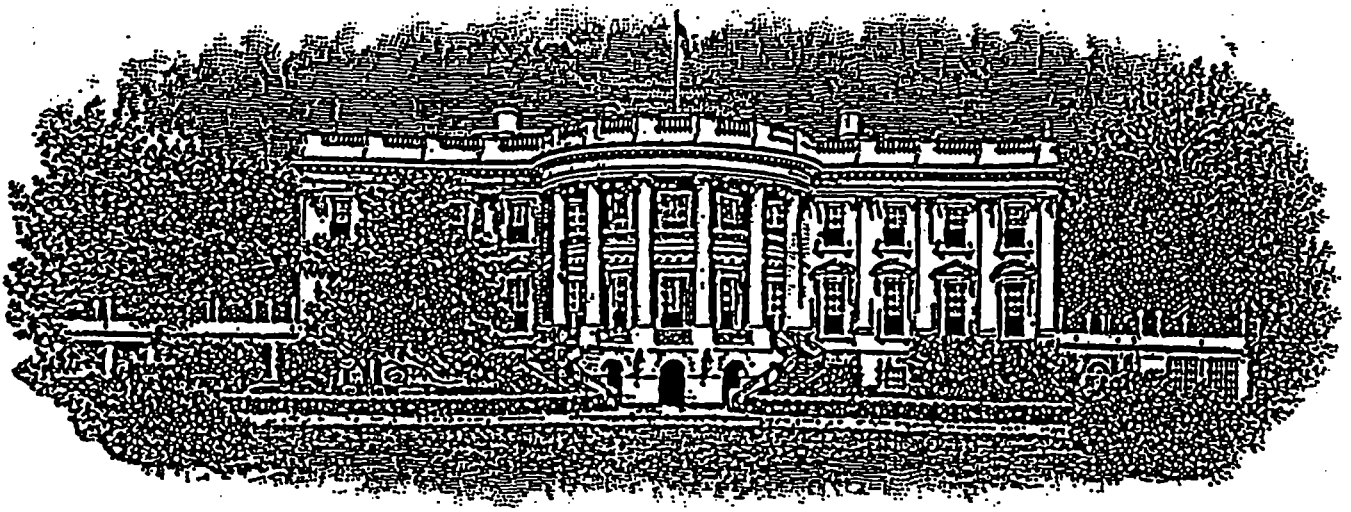
H. An additional possibility for the event would be to announce the RFP for the public engagement piece. Wurtzel and Midge are both doing separate cuts at that, and then going to put it into a combined document.

I. We agreed that, if and when we get something nailed down on an announcement date, we will also need to develop a strategy for briefing education and other groups.

Hope all this is helpful. Look forward to talking to you.

-- Bill K.

The White House



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FAX COVER SHEET

TO: Judy Sunley / Tom Corwin / Judy Wurtzel

FAX: 703-306-0109 / 401-6139 / 401-9027

FROM: BILL KINCAID

THIS FAX INCLUDES THE COVER SHEET PLUS 22 PAGES.

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

MESSAGE:

Attached are fairly detailed comments on the most recent version
of the Action Strategy that I have. I have only commented
on the main body of the report and the appendix on other
agency activities, for now. We can discuss more significant
comments this afternoon, if you want but should first
discuss process for wrapping up. I have not been able to
go over recs in detail w/ Mike Cohen yet. Thanks

Review TIMSS report re: findings
boxes - last?
Flag the agency activities
more prominently

Working DRAFT; 8/6/97

AN ACTION STRATEGY FOR IMPROVING ACHIEVEMENT IN MATHEMATICS AND SCIENCE

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

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

One of the immediate inspirations for this attention to high standards in mathematics and science education in eighth grade is the Third International Mathematics and Science Study (TIMSS),

involving 30,000 students in the United States. Results released in the Fall of 1996 show lackluster performance by U.S. 8th graders, with scores a bit above the international average in science but below the international average in mathematics. On the other hand, TIMSS 4th grade data released in the summer of 1997 show that our 4th graders are above the international average in both math and science -- and in science are outperformed only by Korea. These results clearly indicate that mathematics education in the middle school years should be an important focus for national efforts to help ensure that our students meet world class standards.

TIMSS results for the 4th grade are much more positive than the results of similar international comparisons in the past. They demonstrate that it is possible to make significant progress in international comparisons over time, and that US students can compete favorably with those of other nations in mathematics and science achievement. Our National Education Goals proclaim

The Third International Mathematics and Science Study (TIMSS) *Timss addendum?*

TIMSS is the largest and most ambitious of a series of international comparative studies of educational achievement. It includes a significant component of research about the educational environment that provides clues to how improvements in educational achievement might be made.

TIMSS involved more than half a million students in 45 countries ~~with testing in more than 30 different languages~~. The Department of Education and the National Science Foundation sponsored the U.S. testing, done in 1995, and subsequent analysis. Results for grades 4 and 8 are now available. At grade 4, U.S. students performed among the best in science and above the international average in mathematics. At grade 8, U.S. students performed just above the international average in science and below it in mathematics. The relative performance of U.S. students ~~in comparison to students of other countries~~ improved over performance on similar international comparisons of earlier years. However, ~~the U.S.~~ was the only country whose students performed above average at grade 4 and below average at grade 8 in either science or mathematics. *Timss*

TIMSS results show that

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

May want to place grade emphasis in some of the findings that better track of action strategy.

our intent that US students will be first in the world in mathematics and science achievement by the year 2000. In the early grades, we are making demonstrable progress toward that goal.

Beyond indicating a need to focus emphasis on grades 5 through 8, TIMSS also provides a wealth of data on how and what we teach our students -- and important clues about ways to improve both. TIMSS researchers collected not only achievement data in each participating country, but also much information about teachers and teaching, about curricula and instructional materials, about classroom lessons and interactions, and about student attitudes and habits outside the classroom. Thus, TIMSS results have become a source of constructive motivation for mounting an action strategy, taking the issue well beyond the simple comparison of scores in international test taking.

Eighth grade is a critical point in mathematics education, as achievement at that stage paves the way for students to take the advanced high school mathematics and science courses that are keys to college entrance and well-paid jobs. Today, too many students enter high school without this solid grounding in mathematics and never gain it, closing doors to opportunities for further education and careers. Often, students (and their families) do not even know that the doors are closing, leading to a mismatch between their expectations for their futures and their actions in the present. For example, a 1995 survey conducted by the National Action Council for Minorities in Engineering found that over 70 percent of minority 9th and 11th graders viewed being a scientist or engineer as an interesting career, with 78 percent showing interest in taking college level mathematics. Yet 60 percent of the students planned to drop high school mathematics as soon as possible.

The President has proposed a voluntary national test in mathematics, to be taken near the end of eighth grade, as a very visible part of an ambitious, sustained drive for higher, more challenging standards of learning for all students. The test will be available by the spring of 1999 for those States and districts that wish to participate. Parents and teachers will receive an individual score for each student who takes the test. That score will be linked to national and international benchmarks, which will provide additional context. States, districts, and schools will be able to use data from the test in combination with other information on curriculum and teaching practice and with the results of other assessments to create a more complete picture of individual and aggregate performance. For more information, see Appendix 2.

and improve learning by showing

The test is only one element of the comprehensive effort needed to accomplish the objective of having all students achieve challenging national standards for performance in eighth grade mathematics. This effort will require many individuals -- parents, students, teachers, and community leaders -- working in concert with a common understanding of what they are trying to accomplish. All parties to the effort will need a clear picture of what students should know by the end of eighth grade and what world-class performance looks like. Only then can we, as individuals and as a nation, begin to aspire to the high standards that a significant number of our students do not yet reach.

Raising Achievement for Disadvantaged Students

National Test Initiative

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

On July 25, 1997, fifteen urban school districts, including the three largest (New York, Los Angeles and Chicago) pledged to participate in the voluntary national test. They sent a clear signal that students in inner city schools can and should be held to the same challenging standards that are being set for all students throughout the nation. These communities recognize that setting high standards in the basic skills for all students is a prerequisite for improved teaching and learning. Research and experience shows that students can meet high standards, and that low expectations lead to low achievement. While this step alone will not improve teaching and learning for students in urban schools, it will guide and catalyze efforts to strengthen curriculum, provide training to teachers, increase parental and community involvement, and support the necessary investments at the local, state, and national levels to improve our schools.

The test, in combination with a national effort to boost achievement, will provide a powerful lever to amplify the effects of existing efforts at local, State and national levels to improve K-8 mathematics and science education. This action strategy is aimed at laying the basis for such a national effort, concentrating, for the near term, on mathematics in grades 5-8, where the TIMSS results tell us we need to focus.

Response to the Presidential Directive

In response to the memorandum from the President, the Department of Education and the National Science Foundation formed an interagency working group comprised of staff experienced in the areas under review. Officials of the Office of Science and Technology Policy, the Domestic Policy, and the Office of Management and Budget provided oversight. (A listing of the members of the interagency group is attached as Appendix 3).

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

The Department of Energy's STEM Initiative

Department of Energy (DOE) Secretary Pena has launched for FY 1998 a renewed effort to support science, mathematics, technology, and engineering education consistent with DOE's energy and defense missions. The Science, Technology, Engineering, and Math Education (STEM) Initiative will coordinate DOE resources to promote the public's understanding of science and provide a diverse workforce for the Nation's science and technology (infrastructure industry?).

DOE plays an important role in science education due especially to its premier national laboratories, which have a history of staff working in cooperation with the Nation's education system and other agencies. By opening DOE's laboratories to students and teachers, agency staff offer hands-on research opportunities and technical support for developing Internet and other technical tools to enhance educational experiences.

Among DOE's five goals, two are particularly relevant to this action strategy:

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

To implement the STEM Initiative, DOE will create an Education Council consisting of representatives from across DOE headquarters and all laboratory facilities. The Education Council will oversee the evaluation of education proposals that the Department will support. The Council will work directly with the Secretary to fulfill specific goals.

Not sure

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Internet?

on its analysis of the TIMSS results and other information collected, Based on the relevant information collected, the TIMSS results, and the need to provide a strategic set of core activities, the interagency group focused on raising achievement in mathematics in grades 5-8. In support of this objective, the resulting action strategy challenges:

- The Department of Education and the National Science Foundation to mesh their disparate modes of operation and to draw in other agencies in a coordinated effort to strengthen the impact of Federal resources;
- Superintendents, mathematics supervisors, school boards, principals, and others in state and local education organizations to reformulate their approaches to the use of Federal resources in order to make them more effective;
- Families to invest the time and effort to understand the importance of high standards of achievement in mathematics for all students and to support their children in attempts to reach these high standards;
- The Nation's colleges and universities to develop new standards for teacher preparation, particularly for potential teachers of mathematics in grades 5-8, and to take a more active role in enhancing today's teachers, in conjunction with State and local education agencies and with local schools; and
- Professional organizations in mathematics, science, engineering and technology to work with schools, parents, students, community organizations, and business and industry to develop a vibrant network of local partnerships to raise achievement in mathematics in grades 5-8.

Excellence in Mathematics by the End of Eighth Grade as the Core of a National Action Strategy for Improving Achievement in Mathematics and Science

Our vision is that all American students leave eighth grade prepared to pursue the higher-level mathematics and science courses that are the gateway to college, citizenship, productive employment, and lifelong learning. Whatever their status in life, all of our students deserve an education that will help them prepare for a successful future.

Reaching this vision will require:

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

Suggested revision of challenges section of math strategy:

Based on the TIMSS results, and other information analyzed, the interagency group focused on raising student achievement in mathematics at grades 5-8. For America to succeed in this objective, there are several national challenges which must be addressed:

- At the state and local level, Superintendents, mathematics supervisors, school boards, principals, and other educators should step back and take a fresh, critical look at their use of Federal resources in light of TIMSS and other current research -- in many cases, substantially reformulating their approach to improve effectiveness;
- In households across the U.S., families need to devote the extra time and effort necessary to understand the importance of high standards of achievement in mathematics and to fully support their children's efforts to reach high standards;
- On the nation's campuses, our colleges and universities must develop rigorous new standards for teacher preparation, particularly for potential teachers of mathematics in grades 5-8, and take a far more active role in enhancing the skills and knowledge of today's teachers, working closely with States, local school districts, and schools in the process;
- In cities and towns from coast to coast, professional organizations in mathematics, science, engineering and technology, in partnership with schools, parents, students, community organizations, and business and industry, should develop a vibrant network of local partnerships aimed at raising student achievement.
- And finally, here in Washington, the Department of Education and the National Science Foundation must work much harder to mesh their separate operating modes and partner with other federal agencies in a concerted effort to strengthen the classroom impact of Federal investments in math and science education.

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While achievement of ~~our~~ vision will ~~rely on~~ each of these elements, progress in one area will often depend on and demand improvement in others. For instance, the introduction of high-quality instructional materials will have little impact if teachers are not trained to use those materials effectively. Effective instruction during the school day will have limited results if parents (and, indeed, the entire community) do not support student achievement and let students know how important success in mathematics is to their future opportunities for college and careers. We must ~~be working~~ on all fronts -- high standards, effective curriculum, technology in the classroom, teacher training and licensure, assessments, and support from parents and the public -- to make progress towards this vision.

Achievement in mathematics by the end of the eighth grade is a critical factor in the ability of students to pursue advanced work in mathematics and science in high school and beyond. By moving to enable students to meet challenging national standards in mathematics toward the end of eighth grade, using the voluntary national test as an indicator of accomplishment, this action strategy provides both a model for and a key element in a broader, sustained effort to improve achievement in K-12 mathematics and science.

Improving Mathematics Education: Building on Strength

The action plan builds on the considerable efforts underway across the country to improve elementary and secondary mathematics and science education. Some of these activities began more than a decade ago in schools, colleges, States, and professional organizations. They were given impetus by the establishment of the National Education Goals, including the goal of being first in the world in mathematics and science educational achievement by the year 2000. Taken together, they provide a solid foundation for focused attention to mathematics in grades 5-8 that can catalyze improvements in K-12 mathematics and science education. Some of the most important current or completed activities include:

- The National Council of Teachers of Mathematics (NCTM) introduced standards for mathematics curriculum and evaluation in 1989, followed by standards for teaching and assessment in mathematics. States and communities have made these voluntary standards the basis of many of their efforts to improve mathematics education. (As is appropriate in any effort to raise standards, NCTM is now reviewing the mathematics curriculum and evaluation standards and plans to update them over the next few years.)
- A new generation of rigorous mathematics curricula aligned with the NCTM standards is ~~beginning to appear~~ in classrooms. By the fall of 1997, these materials will account for about 25 percent of all new textbooks purchased, and that figure should grow in succeeding years.
- TIMSS and other new assessments, coupled with in-depth research, are providing valuable information about how and what we are teaching and how students learn, and point to critical factors for improving achievement in mathematics in grades 5-8.
- Approximately 65 percent of all schools are now connected to the Internet, providing the opportunity for communication on improving mathematics education and for the use of distance learning and advanced technologies. Federal support has helped to make this possible, and the newly enacted "E-rate" will substantially reduce the cost of Internet connections for schools and allow more schools to take advantage of this learning tool.

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- Many States, with support through Goals 2000, the reauthorized Elementary and Secondary Education Act, systemic initiatives, and other Federal programs, have undertaken comprehensive, system-wide education improvements geared to high standards in mathematics and science. States ~~that were~~ in the forefront of reforms are now beginning to enjoy the benefits in improved student performance.

Critical Areas for the Strategy

Consistent with the President's directive, this action strategy identifies steps that Federal agencies, along with their partners, can take to help students reach challenging mathematics standards and to ensure that Federal resources will effectively support State and local reforms. ~~It places special emphasis on mathematics in grades 5-8.~~ Through consultation with outside organizations and review of Federal programs, the working group has identified three priority areas:

- Equipping teachers in grades 5-8 with the skills and knowledge to teach challenging mathematics content in effective ways, with high expectations for their students;
- Implementing high-quality, standards-based curricula and instructional materials, including effective use of educational technologies, in grade 5-8 mathematics classrooms; and
- Building public understanding of what challenging mathematics looks like in grades 5-8, and gaining public support for raising student achievement toward high standards.

Accountability in the States

In March 1996, the Nation's governors met at the National Education Summit to reaffirm their commitment to school reform. They invited the voters to hold them accountable, calling for "an external, independent, nongovernmental effort to measure and report each state's annual progress." On January 22, 1997, *Education Week* published *Quality Counts*. This report presents more than 75 indicators and grades individual states on their policies and performance in four categories (academic standards, quality of teaching, school climate, and resources).

In report card fashion, the *Education Week* editors summarize in what they call "the state of the states" the progress being made toward higher student achievement. The report card shows: B, C+, C, and two C-. But these are averages around which individual states are distributed. A few states -- New Jersey, Kentucky, New Mexico, Texas, and West Virginia -- have instituted their own grade 8 accountability and reporting systems and obtained impressive results by, for example, granting or taking away districts' administrative autonomy based on state test achievement levels. As other states adapt or adopt what works elsewhere, further gains can be expected.

The core of this action strategy is making more effective use of Federal resources in addressing these priorities in light of the Federal Government's limited role in education, which, while a national priority, is primarily a State and local responsibility. The Federal role is to provide good information, effective tools, and financial support that will assist States and local communities in ensuring that all of their students have the mathematical skills they need to succeed in the workplace as productive citizens. This includes promoting effective partnerships that mobilize support from the community -- students, parents, educators, business people, volunteers, and concerned citizens from all walks of life -- to that end.

Strengthening the Impact of Federal Resources on Mathematics Achievement in Grades 5-8

Strategies for use of Federal resources in addressing these three priority areas are interrelated and overlapping. The bulk of the Federal resources for improvement in K-12 mathematics and science education flows from the programs of the Department of Education and the National Science Foundation. (See Appendix 3 for a summary.) Developing a coherent, coordinated approach to strengthening the impact of Federal resources used to improve mathematics achievement in grades

5-8 requires taking differences among these programs into account. Drawing ^{on the revision of} ~~in~~ other agencies in an effective manner can then follow.

Report going out in Feb 98

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

challenging

Open CESAME! Interest addition

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

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

Any evidence that this project has succeeded?

The Department of Education (will allocate) approximately \$8 billion (in FY 1997) through three primary formula-driven programs (Goals 2000; Eisenhower Professional Development State Grants; and Title I: Education for the Disadvantaged) that include improved achievement in mathematics and science education among their objectives. Goals 2000 aids States and school districts to develop and implement challenging academic standards and upgrade teaching and learning in order to reach the National Education Goals, including the goal of becoming first in the world in mathematics and science. The Eisenhower program places an explicit focus on science and mathematics. At least \$250 million out of the FY 1997 appropriation of \$310 million must be spent in these subject areas. The 1994 reauthorization of the program requires that States and localities use Eisenhower funds for sustained professional development that makes a difference in classroom practice. The 1994 reauthorization of Title I places new emphasis on helping disadvantaged students meet the same challenging academic standards expected of all children. States are currently developing standards and plans for moving toward them. The Department of Education works actively with

Title I Schoolwide Programs

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

Interest?

States and school districts on identifying actions that can be taken to achieve significant change, provides information and examples, and makes technical assistance available as needed.

The programs of the two agencies have different approaches and strengths. The Department of Education generally provides large-scale, flexible support directly to State and/or local education agencies for improving teaching and learning to high standards, coupling this support with technical assistance. The National Science Foundation's portfolio is much smaller in scale, is targeted at improving mathematics, science, and technology education, and is established through competitive processes. This action strategy combines the agencies' strengths, ^{allowing} those involved with upgrading mathematics professional development and instruction through major Department of Education programs to draw on NSF's competitive programs to ^{initiate} change. This approach will increase the impact of Federal resources ^{by creating synergy among these programs, realizing a significant concentration of resources for} improving mathematics achievement in grades 5-8.

The work of improving ^{student} achievement must be done at the State and local level, and, most fundamentally, within individual schools.

State and local educational agencies can ^{maximize} ~~strengthen~~ the impact of Federal resources by choosing to use them in a ^{state-} ~~coordinated~~, concentrated way. Thus, the National Science Foundation and the Department of Education will support State and local education agencies in the ^{coordinated} use of all types of Federal, State and local funds toward improving mathematics achievement, offer examples of effective coordination in the use of such funds, and provide incentives to initiate ^{change at the State and local levels.} ~~change at the State and local levels.~~

- The Department of Education will actively encourage and support State and local educational agencies in the coherent use of all types of Federal funds in their efforts to meet the high content and performance standards for mathematics in grades 5-8 ^{that they have established under Goals 2000 and Title I,} providing ^{information and technical assistance and opportunities} to pool resources originating in the Department, as appropriate.
- The National Science Foundation will support development and implementation of State and local strategies for improving mathematics education in grades 5-8 and, through its competitive awards, will provide additional incentives for effective, targeted use of Title I and Eisenhower funds. In particular, the Foundation will provide competitive planning grants to jump-start intensive, coherent efforts to upgrade mathematics instruction that use Federal, State, and local funds to sustain long-term improvements.

A Title I Schoolwide Example

Kenton Elementary School in Portland Oregon, and 12 other schools in the region ^{jointly hired a mathematics consultant.} During the 1995-96 school year, the ^{consultant} held full-day, weekly workshops on best teaching practices identified by the school principals. The principals developed a regional Title I plan and, with the help of the consultants, have all staff working together to implement it. Title I staff worked with regular classroom teachers on new strategies, and Kenton staff agreed to use Title I benchmarks and assessments for all students.

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

Clear structure

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- 1/10/97

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Working DRAFT; 8/6/97

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- School and district implementation of improvement strategies are particularly important for long-term change.

The principal target for the agencies' cooperative activities will be middle schools with schoolwide Title I programs and districts with many such schools. This focus permits large numbers of disadvantaged students to benefit from the enhanced impact of Federal funding. It leverages effectively the funds awarded competitively by the Foundation to schools and districts with the large resource base of the Department's Title I program. The agencies will work with principals and superintendents to address the importance of providing their students with high-quality mathematics instruction aimed at challenging national standards; to help make more concrete their understanding of what such a program of instruction means for students and teachers; and to consider mechanisms to implement such instruction in their schools.

Texas Statewide Systemic Initiative

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

→ Achievement data.

Internet?

As a first step, the Department and NSF

The two agencies will convene a national conference of State and local leaders of Eisenhower, Title I, Goals 2000, and State, urban and rural systemic initiatives, and other key actors to help participants maximize the impact of federal funding in improving mathematics education in grades 5-8.

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

TIMSS Resource Kit

The release of results from the Third International Mathematics and Science Study (TIMSS) has generated a strong interest among policy makers to use TIMSS as a benchmark to compare their systems to those of other countries. The Department of Education has supported development of tools (expected completion: Fall, 1997) to assist officials in answering the question: How do mathematics and science achievement, teaching, curriculum, and assessment frameworks in my state or district compare to other countries? The Resource Kit contains four modules; the first provides an overview of TIMSS while the other three focus on the critical issues of achievement, curriculum and teaching. The Overview Module describes TIMSS and what can be learned from it about American education. The Achievement Module examines what was expected of students on TIMSS and how to understand U.S. results. It contains an analysis of student performance by content domain, shows how students performed on representative items, and compares student performance in the U.S. and other nations. The Curriculum Analysis Module considers how to evaluate curriculum and instructional materials in relation to state, local and voluntary national standards as well as to the TIMSS framework. It contains a guidebook with four tested procedures for evaluating curriculum and instructional materials, including that used in TIMSS. The Teaching Module examines how teaching differs in the U.S., Japan and Germany and offers ways for teachers to reflect on their own classroom practices. It contains a 75-minute video of eighth grade mathematics lessons filmed in conjunction with the TIMSS study along with a moderator's guide for using the video in professional development activities.

This fall the Department and NSF held a conference to familiarize state/local math/science educators with the kit and are conducting a broader dissemination nationally. [something to this effect] to get the word out so curriculum experts, teachers, others can learn from and benefit from the TIMSS findings.

Internet?

enhanced
leverage
of

in these schools
districts

Don't want
Federal money
to help
them with research

Is this
set?

at both
state &
local
levels

*Should this be more concrete? —
electronic networks, regular
workshops, something concerted but non-
bureaucratic?*

Systematically

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

clearly

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

which aspects

critical

Mathematics Education and the Department of Defense

Two agencies within the Department of Defense (DoD) represent contrasting approaches to introducing rigorous national standards in their education activities.

Unique among the agencies are the DoD Dependents Schools (DoDDS), which ~~run as essentially autonomous school systems~~ overseas and on military bases in the U.S. They certify teachers and develop leader-teachers, tutors, and mentors who, like the DoDDS math curriculum used worldwide (K-8 and 9-12), ~~embrace~~ *build on* the NCTM standards.

*skill weak
basic concepts
math topics*

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

Equipping teachers in grades 5-8 with the skills and knowledge to teach challenging mathematics content in effective ways, with high expectations for their students

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

both needed here?

In line 7
Quantitative Literacy Program for Alabama K-12 Teachers
The Quantitative Literacy Program for Alabama K-12 Teachers, a project administered by the University of Alabama and supported by the Eisenhower Professional Development Program, assists elementary and secondary teachers in implementing the probability and statistics goals for grades K-12 as outlined in the ~~National Council of Teachers of Mathematics~~ standards. The program's workshops teach quantitative concepts in the context of solving meaningful problems, with content taught in reference to teaching strategies that participants use when they return to their classrooms. The program includes a pre-workshop orientation, an intensive one-week training workshop, and two follow-up sessions. In the follow-up sessions, teachers describe how they planned, taught, and assessed their own Quantitative Literacy units. They also present examples of their students' projects. The project is currently operating in 14 of the 67 counties of the State.

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

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

The coordinated efforts of the Department of Education and the National Science Foundation described above should stimulate greater use of Title I and Eisenhower resources for high-quality professional development for grade 5-8 teachers of mathematics.

However, the increased demand for high-quality professional development could, without action now, exceed the capacity of those individuals and organizations ~~to~~ currently supplying it. Thus, an

essential component of fully equipping teachers will be ensuring the presence of a sufficient cadre of individuals and institutions skilled in providing professional development. The two agencies will work with the mathematics communities, institutions of higher education, and other Federal agencies to help ensure the capacity to respond effectively, particularly by supporting the development of exemplary materials and by providing training opportunities for those who will become leaders in teacher professional development and teacher preparation.

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

- Support sustained, intensive, high-quality professional development of teachers of mathematics in grades 5-8 as the cornerstone of their cooperative efforts to enhance the impact of Federal resources. These efforts will emphasize professional development for all teachers of mathematics in grades 5-8 in schools or districts, focusing on middle schools with Title I schoolwide programs and districts with many such schools. This focus will permit professional development for a significant fraction of the approximately 320,000 teachers of mathematics in grades 5-8, with particular attention to those who teach the largest numbers of disadvantaged students. (#)

See next page

PRIME in Pittsburgh

The Pittsburgh Reform in Mathematics (PRIME) project supports teachers in the classroom implementation of standards-based mathematics instruction and assessment in grades K-12 through the use of exemplary materials (e.g., *Everyday Mathematics* in grades K-5 and *Connected Mathematics* in grades 6-8). PRIME provides teachers with a broad knowledge base in both the mathematics content and the successful mathematics pedagogy needed to implement the new materials successfully.

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

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

Inter net?

The separate
Foundation

in teaching
challenging
math

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aggs

Refers
to
your
time
Soul

- Initiate a short-term effort to strengthen the pool of talented, committed individuals able to provide exemplary professional development for classroom teachers. The agencies will support projects that will provide intensive training ~~experiences~~ *at strengthening teacher knowledge & skills.* for those who will lead future teacher training efforts.
- Support the creation of materials for professional development of teachers of mathematics in grades 5-8 that are grounded in the NCTM standards, tied to newly emerging educational materials and technologies, and assist teachers to link mathematics to real-world skills and applications.
- *skil* Support *wider* opportunities for teachers to help one another with content knowledge and teaching skills through activities such as dissemination of information about effective forms of professional development, encouraging the development of master teachers (including those recognized through Presidential Awards for Excellence in Mathematics and Science Teaching or National Board for Professional Teaching Standards Certification), *mathematics specialists,* and teacher networks.

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

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

Teacher Preparation in Louisiana

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

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

The central principal is to *model* ^{*democratic*} in the education of future teachers the new methods of teaching mathematics that they will be expected to implement in the classroom, for example, working in small groups on challenging problems and using technology resources such as calculators or the Internet. One student at Northeast Louisiana University who is preparing to teach third grade said he will never take another course that does not similarly challenge him to think things through and discuss his ideas with others.

Should include some other federal agency like here -

Why not say something like:

"Where appropriate, the Department and NSF will encourage projects that draw on the resources of other federal agencies with relevant ~~research~~ missions, such as Department of Energy laboratories." 12

*↑
could be strengthened.
Internet?*

You could see multiple
Title II
Gismon 28

Working DRAFT; 8/6/97

- Challenge the Nation's colleges and universities to step up to the needs for preparing a new generation of teachers for the 21st century by encouraging and supporting the development of teacher preparation approaches that:
 - more tightly link college departments of mathematics and schools of education;
 - include mathematics courses focusing on the deep concepts in mathematics related to the mathematical content that future teachers of mathematics in grades 5-8 will teach;
 - demonstrate effective classroom practices; and
 - involve local K-12 schools in the design of teacher preparation requirements.
- Support the development of materials for preparation of K-8 mathematics teachers that are grounded in the NCTM standards and tied to newly emerging instructional materials and educational technologies.

New Initiatives in Teacher Preparation

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

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

Internet?

Improving Teaching Through Distance Learning

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

The Star Schools: The Next Generation project of Oklahoma State University and Northern Arizona University delivers the "Getting Ready for Algebra" program, which provides simultaneous student instruction and teacher training to middle school students and teachers. Its units are student-centered and activity-oriented and emphasize learning by discovery. They focus on the big ideas common to arithmetic and algebra. Similarly, the United Star Distance Learning Consortium project led by Education Service Center--Region 20 in San Antonio, Texas, offers the *Algebra and Geometry Applications for Teachers* program, inservice training that models worthwhile mathematical tasks and helps teachers improve their ability to develop these tasks. The focus of the project is on mathematical topics that illustrate connections to real-life problems and exciting mathematics.

Internet?

Implementing high-quality, standards-based curricula and instructional materials, including curricula that use educational technologies, in grade 5-8 mathematics classrooms

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

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

In a nation as large and diverse as ours, it is not surprising that there is a very large number of different text books and other instructional materials available to schools or that textbooks tend to include a wide variety of topics in order to appeal to the greatest number of teachers and schools. However, alternatives to these widely used traditional materials are now available. New, comprehensive mathematics instructional materials, linked with high standards for mathematical content and pedagogy and aligned with the NCTM standards, are now emerging from development and reaching the market. These newer materials provide a range of different approaches to classroom instruction, generally focusing on 15 or fewer topics per year.

Everyday Mathematics

The University of Chicago's *Everyday Mathematics* materials for K-6 classrooms are designed to promote the success of all students. They are based on research showing that students can learn much more mathematics than typical traditional curricula contained. Students explore mathematics concepts, experiment with ways to solve everyday problems, learn essential skills, and perform mental mathematics.

The materials are being used in over 50,000 classrooms nationwide, affecting over one million students. Extensive evaluation with standardized tests shows that students using these materials outperform their peers using traditional materials. For example, a recent study, based on items developed for an international comparison of elementary school students in 1990, showed that students in today's *Everyday Mathematics* classes score significantly higher than did the U.S. students in the 1990 study and performed as well as the 1990 students from Japan and Taiwan on a majority of the questions.

to find the correct solution to

typical/standard

In fact?

Many schools supplement their comprehensive instructional materials -- incorporating, for example, the use of instructional technologies -- in ways that permit teachers to tailor instruction to particular classrooms. Supplementary materials can facilitate a transition to the newly emerging comprehensive materials and help take advantage of new and emerging learning technologies. They can be particularly important in grades 5-8 where students develop the conceptual foundations for the study of more advanced mathematics.

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

- Make upgrading of mathematics instruction easier, particularly for middle schools with Title I school-wide programs, through encouragement and support for coordinated planning and action aimed at:

- purchase of appropriate new instructional materials; geared to rigorous standards
- necessary professional development aimed at their implementation; and
- employment of highly skilled mathematics specialists who are prepared to teach the new materials and guide others in their implementation.

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

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

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

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

Eisenhower Regional Consortia for Science and Mathematics Education

^{Eisenhower}
The mission of the ten regional consortia is to provide a field-based ~~support infrastructure for systemic~~ improvement of science and mathematics education. Projects provide information on curriculum, assessment, and teaching practice; conduct workshops and training; and serve as advisors to the field.

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

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

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

Beyond the Department of Education and NSF,
while several other Federal agencies have long worked
to support state/local education improvement efforts,

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as described in Appendix

However, few other agencies have, in the past, few have contributed to the development of standards-based instructional materials in mathematics and science. This is changing, and the working group feels there are significant contributions that other agencies can make in this area, consistent with their primary missions. The development of supplementary materials with mission-oriented and the delivery of such materials through technology are key potential contributions.

?

engaging,

what is status of this?

- Agencies will work in cooperation with NASA and NCTM to develop standards-based materials along the lines of NASA's "Mission Mathematics." These materials illustrate the use of mathematics in real world examples related to the agency mission.
- The Department of Education is chairing a Federal Government-wide working group that has already begun to promote and develop -- and make it easier for teachers and others to find -- high-quality educational materials, including instructional units and related materials, for use on the Internet. The first priority of this group will be to identify materials that support teaching of challenging mathematics.

NASA's Mission Mathematics

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

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

Internet address?

- The Departments of Defense and Education and the National Science Foundation are leading an interagency review of Federal activities related to research in learning technologies.

purpose?

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

The Math Forum

on Internet site

The Math Forum is a virtual center and Internet community for mathematics education. It provides teachers with high-quality classroom mathematics materials and expertise, with a special emphasis on new educational strategies. It provides structured access for teachers to an expansive, but well-organized and indexed array of on-line resources that enable responses to mathematics questions coming directly from the classroom. The Forum guides and supports teachers as they become more proficient in helping their students attain deeper and more powerful mathematical abilities. It also provides students with engaging materials to explore opportunities for interactive conversations and mathematical projects. It provides parents with a fuller understanding of the nature of the NCTM Standards and facilitates their inclusion in a broad, national community of informed partners who insist that high-quality mathematics instruction should be available to all students. The Internet community supporting this effort includes teachers, college faculty, research mathematicians, mathematics education researchers, education administrators, and policy leaders. The Internet location for the Math Forum is: forum.swarthmore.edu.

and helps them to ensure that high quality math instruction is available to their children

challenging math standards

- 16 / (A) The purpose of this group is to take the rich informational resources of organizations like Census Bureau NOAA and the U.S. Geological Survey and make them easier for teachers and others to find and use.

Building public understanding of ^gwhat challenging mathematics looks like in grades 5-8, and gaining public support for raising student achievement toward high standards.

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

This section of the action strategy includes two complementary ^{aspect} ~~pieces~~. The first consists of efforts to make standards fully and clearly understood. If you don't know where you are trying to go, it is hard to get there. This is true if you are driving a car, building a house, or running a small business. To succeed, you need a vision of ~~what~~ ^{what} success looks like so you know how to work to achieve it. The same is true in education. If parents and students and teachers don't know where they should be headed -- what they agree students should know and be able to do -- it is hard to pull together to get there. Schools must have a clear sense of what they are doing and be able to communicate effectively with parents as well as work to invite active parental participation.

The second ^{aspect} ~~piece~~ builds on the first through partnerships that bring together
 - the many groups that can contribute to the
 - effort of helping students achieve high
 - standards in mathematics. These partnerships will elevate the importance of mathematics achievement and provide clear avenues for interested members of the mathematics, science, business and education communities, as well as parents and interested citizens, to contribute to efforts to raise mathematics achievement.

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

Saturday Schools Provide Tutoring Boost

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

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

too much
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ED w/SE's
 other group
 helping
 partners
 identify
 exemplary
 models

In order to support these strategies, the Department of Education and the National Science Foundation will:

- ^{all sponsor} ~~Convene~~ a national convocation on middle school mathematics to initiate a continuing dialogue on:
 - what we should expect our students to be able to achieve in mathematics by eighth grade and beyond;
 - exemplary practices in professional development, curricula, instructional materials, and technologies; and
 - opportunities for parental involvement and community support to help students meet high expectations.
- Seed the continuing national dialogue by providing a wide variety of sample items illustrating the level of standards, examples of student work, and information on curricula, instructional methods and technologies that support high standards.
- Make widely available materials on how teachers and other educators can use assessment in planning instructional improvement strategies. These materials will include information on how best to use results from the voluntary national mathematics test in efforts to interpret them to students and parents, place them in appropriate context, and improve mathematics instruction. ^{with}
- Create an easy-to-use mathematics Web site providing information on ^{national} the standards; standards-based instructional units for teachers; information on the national test, including sample problems and examples of student solutions; and all the other materials developed or identified as part of this action strategy. ^s

Partnership activities would be focused at State and local levels, with the Federal Government fostering their development, largely by drawing on the strengths of national organizations that would then work through their State and local affiliates. The Department and the Foundation will:

- Connect national organizations ^{interested} with interests in helping to raise levels of achievement in mathematics and science (for example, professional societies of mathematicians, scientists, and engineers) with State, local and community-based organizations having similar purposes, ^{including} particularly those already linked to on-going agency activities.
- Arrange for the development and dissemination of a weekly series of high-quality, engaging mathematical exercises for students in grades 5-8 that can be used as a common core activity in State and local partnership efforts. Exercises would appear in a recognizable format in many different places. ^{by families, teachers and} Each would be introduced by a different celebrity figure who would provide motivation for the exercise. Guides for use of the exercises within the partnership efforts and information on how to find hints, help and related materials would also be provided.

The partnership activities themselves might take many forms, with each dictated by the needs of the State or locality in which they are active. See Appendix 7 for some examples.

^{Federal} Need a bullet that breaks out & highlights potential potential for federal agency — local school partnerships such as those involving NSA & DOT. — federal agency power is a little too weak here

Acknowledging
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medium

Conclusion

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

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

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

A New Federal Education Partnership Program at the Department of Transportation

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

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

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

Internet address?

APPENDIX 6

FEDERAL AGENCY ACTIVITIES THAT SUPPORT K-12 MATHEMATICS EDUCATION

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

Executive Order 12821 of November 16, 1992, instructs those Federal departments and agencies with scientific missions, employees, or laboratories to "assist in the mathematics and science education of our Nation's students, teachers, parents, and the public by establishing programs at their agency to provide for training elementary and secondary school teachers to improve their knowledge of mathematics and science." Many agencies had such programs in place even before this Order was issued. The Eisenhower National Clearinghouse catalogues current programs in its "Guidebook of Federal Resources for K-12 Mathematics and Science" (see www.enc.org/reform/guidebk).

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

Some examples of works in progress can be cited (for more extended, specific examples, see sidebars in the report). NASA has completely revamped its educational programs to reflect the development of the National Council of Teachers of Mathematics' (NCTM) standards for mathematics and the more recent standards for science developed through the National Research Council (NRC). They have developed supplementary instructional materials in conjunction with NCTM that provide sample problems based on space-related examples. The Department of Defense schools have redesigned curriculum and teacher professional development to incorporate standards-based approaches. Other parts of DOD have outreach programs that stress the importance of mathematics to national security.

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

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

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

Suggested revision of challenges section of math strategy -- Take II:

Based on the TIMSS results, and other information analyzed, the interagency group focused on raising student achievement in mathematics at grades 5-8. For America to succeed in this objective, there are several national challenges which must be addressed:

- At the state and local level, superintendents, mathematics supervisors, school boards, principals, and other educators should take a fresh, critical look at curricula, instructional materials, and professional development strategies (and the use of Federal resources in these areas) in light of TIMSS and other current research -- in many cases, substantially reformulating current approaches to improve effectiveness;
- In households across the U.S., families need to provide strong support and encouragement for their children to reach high standards of achievement in mathematics;
- On the nation's campuses, our colleges and universities must develop rigorous new programs for teacher preparation, stressing both subject matter expertise and pedagogical mastery, particularly for potential teachers of mathematics in grades 5-8. Moreover, these institutions should take a far more active role in enhancing the skills and knowledge of today's teachers, working closely with States, local school districts, and schools in the process;
- In cities and towns from coast to coast, professional organizations in mathematics, science, engineering and technology, in partnership with schools, parents, students, community organizations, and business and industry, should develop a vibrant network of local partnerships aimed at raising student achievement.
- And finally, in Washington, D.C. and communities around the country, the Department of Education and the National Science Foundation must work together more closely and partner with other federal agencies in a concerted effort to strengthen the classroom impact of Federal investments in math and science education.

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- In households across the U.S., families need to ~~devote the extra time and effort necessary to understand the importance of high standards of achievement in mathematics and to fully provide~~ strong support and encouragement for their ~~children's efforts~~children to reach high standards of achievement in mathematics;
- On the nation's campuses, our colleges and universities must develop rigorous new ~~standards~~programs for teacher preparation, stressing both subject matter expertise and pedagogical mastery, particularly for potential teachers of mathematics in grades 5-8, ~~and~~ Moreover, these institutions should take a far more active role in enhancing the skills and knowledge of today's teachers, working closely with States, local school districts, and schools in the process;
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jsunley @ nsf.gov
08/23/97 05:35:00 PM

Record Type: Record

To: Daryl E. Chubin @ EOP, William R. Kincaid @ EOP

cc:

Subject: moving forward with the ED/NSF working group

Dear Colleagues,

Over the past two to three weeks, since forwarding the last draft of the ED/NSF working group policy document, I have heard little from most of you. I also sent forward some comments on America Counts/MathAmerica that stimulated some response, but again, not much. Finally, there has been some action with respect to getting some joint activities funded/getting proposals in. Since Judy W. returns this weekend and I am about to go on vacation, I would like to clear up as much of this activity as possible so that we can arrange a meeting of the principles (Lane and Riley + appropriate people from the White House offices) to sign off on the document and forward it to the President. Here are a few thoughts to get the ball rolling.

1. The policy document

Those from whom I have heard seem reasonably pleased with the document. I have had requests for some relatively minor edits from Daryl and Bill. Daryl coordinated getting comments from other agency representatives. [Daryl, please send me those comments so I can get them incorporated into the final version.] I have not heard from anyone at ED. Tom and Judy, what has the response been? Is there anything substantive that needs to be done? I also have a few comments from NSF people that will help embed a bit more about diversity into the document.

There are a couple of issues that came up in the comments of NSF people.

- The document is still titled to include both math and science achievement, but the bulk of the text is focused on math. While we have explained that in the text, we may need to highlight that in the transmittal letter -- that this effort, with its near-term focus on grade 5-8 math, is only the first step. I might even argue that being effective in grade 5-8 math requires some attention to science as well, but I am concerned about blurring the focus of the document.

- I had comments on the treatment of the other agencies ranging from "It doesn't look like the other agencies are playing in this very much. Why? Can you do more?" to "Does the treatment of other agencies (appendix and sidebars) enhance the strategy or simply convey a lack of coherence?" Perhaps Daryl has something to contribute to this discussion from the comments he got from other agencies.

– We talk about this as a real partnership between ED and NSF, and we have phrased the strategy so that it is very difficult to distinguish clearly which agency does what. However, as I read through the draft carefully, it appears to me that we really have to parallel sets of activities with a few tenuous connections. Would a well-connected person in the field (i.e., someone active in reform activities and aware of ED and NSF programs) really find anything new in this document? If it were someone in a city or state committed to taking the voluntary national exam, would they feel the federal government was providing a significant new option for getting assistance?

I am particularly concerned about the last of these items. I would like to suggest the addition, either in the body of the text or in the transmittal letter from Riley and Lane, of a truly joint program between the two agencies that would start on a pilot basis in 98, moving to full activity in 99 using new funds requested through the 99 budget process. See number 3 below.

2. America Counts/MathAmerica (ac/ma)

If anyone needs to see the memo I sent two weeks ago on this, let me know, and I will forward it again. In the meantime, NSF (Midge Cozzens) asked that MSEB not send the proposals related to ac/ma to NSF. It appears that she and Luther had concerns similar to mine, but had not voiced them clearly prior to seeing a copy of my e-mail. I have since checked with NSF's General Counsel and with the National Science Board office, and both expressed concerns about initiating an activity with high visibility and significant NSF involvement that did not incorporate competitive merit review. In the course of NSF's attempting to provide a venue for a fund transfer from ED on another activity, we discovered that OERI funds are now constrained to competitive review of unsolicited proposals. The ED General Counsel would not permit the fund transfer because the vehicle being used at NSF was an unreviewed conference proposal. (Judy, you might want to check out that I have this right. I don't know if it affects all OERI funding, or if it is more limited in scope.)

Thus, I believe the issue of how we support the ac/ma activities is real, and we need to address it now. NSF is willing to fund a jointly convened workshop to explore the concepts around ac/ma and determine how we might best implement it. The workshop could be pulled together in September.

This is a really exciting idea, with a lot of potential for reaching groups as yet uninvolved in math education reform. It must be implemented properly, or we pose risks for both agencies, the White House, and any potential partners.

3. A joint program for ED and NSF

Finally, I would like to suggest that we add to our action strategy a joint ED/NSF program to be started on a pilot basis in FY 1998 and implemented



fully in FY 1999 through additional funds to be requested by both agencies in the FY 1999 budget process. This would add something truly new to the strategy and would be a powerful signal to the community that NSF and ED were serious about cooperation.

I envision three components to the effort:

- planning and implementation grants for local education agencies to develop and initiate implementation of rational plans for use of Federal and local funds in support of standards-based education in middle school math; focus would be on teacher training and implementation of new curricula and instructional materials; keep at planning grants for FY98 (\$50K max); add implementation component (up to \$500K) in FY99
- expanded support for development and use of networking and other learning technologies in middle school math education with an emphasis on prototypes and testbeds
- putting math appropriate to high standards for grades 5-8 constantly in front of the public -- students, parents, teachers, community leaders, business people, etc -- in a consistent, engaging format; use this to build on local partnerships for education and to draw in community organizations and professional scientists, engineers, and mathematicians to provide mentoring to students in grades 5-8 (similar to the America Counts/MathAmerica suggestions currently under consideration, possibly even under such a name, highlighting the concept of the problem of the week)

All aspects of the program would be administered using competitive merit review. We could consider limiting eligibility in the first year (e.g., to districts with significant Title I schoolwide participation). This would recognize the importance of getting a critical mass of districts with functioning models of standards-based education in math in grades 5-8 to provide visible evidence to other districts that there are models that work and that are worth the effort to change. It would also recognize that it may be hard to tackle all aspects of standards-based education reform at once; that if districts try the grade 5-8 math piece of the problem, they may find that an initial success can stimulate broader efforts.

My suggestion is that the two agencies try to scrape up between \$10M and \$20M total to do the pilot effort in FY 1998. NSF would be willing to request about \$25M in new money in FY 1999, the bulk of which would go into the joint program. If ED were to request a like amount, there would be great leverage. As I understand it, at present ED plans to request additional funds for the Math Initiative largely through OERI. I see this as representing a partnership between OERI and NSF that uses competitive processes to leverage the ED formula funding. This is in contrast to trying to create a separate pool of Title I funds, or something of that sort as we discussed earlier.

If we were to make this work, we would need to make sure that both the ED and NSF portions of this request were addressed under the President's education priority. NSF's preliminary OMB budget guidance for FY 1999



reflects that our education programs have, in the past, not been considered among the education priorities. Our base guidance is actually below our FY 1997 Current Plan, which means that we must stretch our resources even further just to be able to make the kinds of adjustments we had planned to make in order to emphasize 5-8 mathematics within an FY 1999 budget anticipated to be at the same level as FY 1998.

That's about it for now. I look forward to hearing from you all. Welcome back, Judy!

Judy S.

EDITORIAL

70. USA Today

September 2, 1997

Our View: Schools cheat on math

If you want to improve your children's chances of academic success, here's a proven strategy: Make sure they take algebra by the eighth grade and geometry by the ninth.

Heavy doses of reading, writing and science are important, too. Yet it's early exposure to algebra and geometry that studies link not just to future math achievement, but also to overall academic success and, ultimately, college enrollment.

Given the clear connection, requiring these advanced math courses of all students in their early teens makes sense.

Other developed countries require the math early. But U.S. schools lag badly. By the end of eighth grade, only 20% of American students have taken algebra - primarily the elite few picked for their schools' most advanced education tracks.

Not-so-elite students are forced to mark time in pabulum courses that repeat

basic arithmetic operations. More disturbing, many never move on to more advanced math. Among high school graduates, 34% receive a diploma without passing basic algebra, and 30% never take geometry.

That math deficiency, according to researchers, explains why U.S. students perform well through grade school on international math exams, only to see their math standings plummet in high school. After graduation, these same students find themselves ill prepared for today's high-tech jobs - a common complaint of employers.

It's a unique failing. Comparative international studies show the United States is the only country that uses education tracks to exclude all but the academically gifted.

But tracking itself is not the problem. Used correctly, tracking students by ability can allow all to move at a smooth

pace. The problem is that those outside the top track aren't adequately challenged.

In a few places, that's changing. The College Board is conducting a pilot program with 16 school districts aimed at enrolling all students in algebra by grade 9 and geometry by grade 10. Students in Milwaukee and San Jose schools take both courses by their early teens. And after boosting the number of students in advanced math, Nashville increased the number of public high school grads advancing to college.

Other school districts should follow the simple, successful formula. And the Clinton administration should include it in forthcoming national education standards.

Until all students get equal access to advanced math, many will continue to be left out of the employment equation. ■

71. USA Today

September 2, 1997

Opposing View: Don't force standards

By D.L. Cuddy

When I hear that all students should be required to take algebra by grade eight, I wonder, why the lack of choice?

Some would argue that if students are to succeed academically, they must have algebra by grade eight or be closed out of necessary higher math classes later.

I didn't take "Algebra I" until the ninth grade, but before my junior year in college, I had successfully completed two junior-level math classes.

Why push to require algebra by grade eight, as opposed to nine? Could it be because President Clinton called for national education standards and said the federal government would help develop a national math test to be taken in grade eight?

Remember, he declared that "every

state and school must shape the curriculum to reflect these standards."

Former U.S. commissioner of education Ernest Boyer said in 1994: "If I had ever whispered national standards, I think I would have lost my job."

National standards are an attempt by politicians to centralize power. As Kenneth Goodman, past president of the International Reading Association, has said, controlling education outcomes allows power brokers to control schools while claiming to support local control.

Each state should decide if and when algebra, or other subjects, should be required.

Another national effort under way seems to be the elimination of tracking students based upon their abilities.

One may be able to make a case that doing away with ability grouping in certain academic areas such as social studies would allow a wide variety of students to get to know one another better.

But in technical areas, that argument is lacking. For advanced math and science students to reach fullest potential, they shouldn't have to take classes slowed to the learning speed of less advanced students.

Unfortunately, this too often happens in today's outcome-based education.

D.L. Cuddy has been a senior associate with the U.S. Department of Education and is the author of a 200-year education chronology. ■

performance. It confirms (once again) that students from poor, disadvantaged urban communities who attend Catholic schools perform much better than those who attend public schools. Because of growing evidence like this, school choice can no longer be considered a fringe issue, as it was a decade ago.

Today, choice is a central part of the education debate — and public support for it continues to grow. According to last week's Phi Delta Kappa/Gallup Poll, 55% of public-school parents favor vouchers. This is the first time a majority of parents with children in public schools have voiced support for choice for those attending public, private and religious schools. Other encouraging signs abound:

— In Minnesota, GOP Gov. Arne Carlson won a major victory when he persuaded the Democratic legislature to provide every family either a tax deduction or tax credit if it is used for public, private or religious school expenses. In the process, the governor dealt a body blow to his state's teachers unions.

— Charter schools — public schools that are freed of many regulations in exchange for greater autonomy and more accountability — are flourishing. There are now more than 700 charter schools in 28 states.

— Cleveland is the first city in the nation with a state-supported voucher program that allows children from disadvantaged homes to attend religious schools. In Milwaukee, private donors have given enough money to allow thousands of low-income children to attend religious schools, a state court ruling having denied children public funds to do so. In New York, Mayor Rudolph Giuliani backed a scholarship program to send 1,300 of the city's lowest-achieving public school students to religious and other private schools;

more than 17,000 children applied. In California, the grass-roots group English for the Children is working to put a referendum on the 1998 ballot to end "bilingual education" — a euphemism for many programs that essentially keep Hispanic children from learning English.

Some congressional Republicans are trying to expand those local gains. In the last congressional session, Sen. Paul Coverdell (R., Ga.) introduced an innovative Education Savings Account proposal for a tax-free savings account in which \$2,000 a year can be placed toward any child's cost of schooling.

In short, there is momentum for education reform and there are solid gains to show. Opponents are increasingly on the defensive. Social science research confirms traditional, common-sense views about education. And the national debate continues to move in the direction of greater competition. Nevertheless, many high hurdles still have to be cleared. President Clinton, the teachers' unions and the courts continue to obstruct genuine reform. The congressional GOP leadership has lost its nerve — witness its quick capitulation when Mr. Clinton threatened to veto the budget deal if it included Sen. Coverdell's proposal.

Clearly, much work remains to be done. Who will do it? Education is and should remain primarily a state, local and family matter. But there is an important place for political leadership. The Democratic Party is beholden to the education special interest groups, with a few honorable exceptions like Sen. Joseph Lieberman (D., Conn.), Rep. Floyd Flake (D., N.Y.) and Chicago Mayor Richard Daley. So it is mostly up to the Republican Party to provide that leadership.

Right now, however, the GOP is not winning the public's confidence. Here's why: Republicans have not offered a

sufficiently compelling vision of what would replace the existing monopoly-run public school system. Too often, they sound as if they are on a search-and-destroy mission, or they speak about education the way many husbands speak about, say, interior decorating: stiffly, halfheartedly, without a sense of familiarity, nuance or confidence. In either case, it is better to say nothing at all.

Republicans should speak with passion and conviction on behalf of achievement, assessment and accountability. They need to explain why there is less human misery, more justice and greater opportunity when sound education ideas prevail. It is not mere speculation when we declare our ideas are better. We know what works in American education. Republicans should publicize and replicate success stories, and fashion public policies that foster, encourage and reward success.

A final point: Often, Republicans talk about education in terms of economic competitiveness. That is appropriate but insufficient. We should also talk about education as a way of conveying America's moral and political principles and nurturing the character of the young. We should speak about education in the context of human excellence, high standards and national greatness. We must demonstrate an understanding of, and a willingness to articulate and defend, the fundamental purpose of education, which is to engage in the architecture of the soul. That is not only the best way to win; it is also the best way to justify the public's trust.

—
Mr. Bennett was President Reagan's secretary of education from 1985 to 1988. He is currently a co-director of Empower America and a fellow at the Heritage Foundation. ■

the 50 percent of parents who say the quality of their local newspaper's education coverage was either fair or poor. In trying to find useful information about schools in their communities, only 22 percent rely on the local media, while 72 percent rely on personal observations and conversations.

The media can probably never match the power of personal observations and conversations, something I tell parents who want to find the best schools for their children.

Nevertheless, we're trying to be a better source for parents, and the Press' package on student misconduct — as discomfiting as it was for some school administrators — was an attempt to do just that.

By highlighting those districts with the best and worst records, we were trying to be helpful. One of the aggrieved superintendents saw it differently, accusing us of doing it to "sell papers."

At the time, I took offense. But afterward, I thought, "Sure, I want my

work to be interesting and important enough that people are willing to pay for it. As long as I don't pander or distort, that should be my goal."

Of course, deciding what kind of work meets that criteria isn't easy, and I'm never quite sure if I'm guessing correctly.

Public Agenda tried to find out. When it asked members of the public to choose between various education-related stories, 54 percent wanted stories about ideas and programs that offer solutions, 22 percent wanted "good news," 15 percent wanted "problems" and 6 percent wanted school politics (which usually means reports from school board meetings).

At first, I considered this a rejection of my news-gathering priorities. Like so many other reporters, I tend to focus on problems and conflicts. The package on student misconduct (which was topped by the eye-catching headline, "Learning Disorder," and accompanied by photos of school vandalism) seemed to fit that

category.

But there was more to it. For some districts, including those with spotless records, it was good news, and for a few that were mentioned in the story, it was a story about solutions.

O.K., so that article turned out to be a particularly well-chosen example for the purposes of this column. (Honestly, I didn't plan it that way.) But while I'm at it, I might as well milk it.

As "Learning Disorder" demonstrated, articles that disturb some educators often wind up pleasing others. More important, such articles are helpful — or intended to be helpful — to readers. And despite the public's stated preferences, such articles accomplish that goal by addressing problems, as well as solutions.

Whew! How's that for dodging criticism?

Brian Kladko covers education for the Asbury Park Press state staff. Learning Curve appears once a month. ■

69. The Wall Street Journal

09/02/97

School Reform: What Remains to Be Done

By William J. Bennett

This morning a record 52 million children will walk into America's classrooms. And this year Americans will spend more than a quarter-trillion dollars trying to educate them. These numbers alone ensure that education will be at or near the top of the national political agenda. In addition, there is greater political emphasis on social issues — and education is how many people talk about the condition of our children, cultural decline and the nation's moral well-being. As the debate intensifies, I think it is useful to discuss how much progress has been made in education reform; the obstacles that remain; and how Republicans can do a better job at winning the education debate.

Some progress is being made on the educational front. A variety of indicators — including the National Assessment of Educational Progress math test scores, high school dropout rates, and American College Testing scores — have shown some improvement in the last few years. (Scholastic Assessment Test scores received artificial boosts because of

changes made since 1994.)

But almost 15 years after a presidential commission warned in a report titled "A Nation at Risk" that "a rising tide of mediocrity" threatened America's public schools, student achievement is still mediocre at best. In recent international comparisons, U.S. eighth-graders placed an embarrassing 28th in the world in math and 17th in science. Grade inflation continues unabated. According to the College Board, since 1987 the portion of students with an A average rose to 37% of SAT test-takers from 28% — even though those A students' combined verbal and math scores dropped 14 points at the same time. Pernicious ideas like "whole-language reading," "constructivist [fuzzy] math" and radical multiculturalism infect much of the curriculum. Good ideas like voluntary national testing have been politicized and undermined by the Clinton administration. A recent NBC/Wall Street Journal poll shows that only 27% of the public thinks public schools adequately prepare students for the job

market. And teachers rightly complain that more and more parents are not upholding their end of the education bargain (for example, by turning off the TV and making sure children do their homework).

Faced with these problems, some public schools are trying to mend their ways. In the notorious Chicago public school system, poorly performing elementary schools have been put on academic probation, 1,100 employees of failing schools must reapply for their jobs, and a back-to-basics curriculum is under consideration. Even teachers' unions are beginning to acknowledge the need for change. In January, a Washington, D.C., consulting group prepared an internal document for the National Education Association urging that the NEA position itself as an agent of reform or risk "further marginalization and possibly even organizational death."

But the NEA still can't abide the change we need — more choice in education. Earlier this year University of Chicago economist Derek Neal released a statistical analysis of Catholic school

education.

CALIFORNIA remains the undisputed champion of the bizarre.

At Southern Cal, Annabel Chong, a porn queen who once proudly boasted of the world's record for most sex partners in a day, was permitted to create her own major. As a class project last fall, Ms. Chong and two other women "undressed and performed sex acts on each other," according to the YAF report. "The bottom line," said one disgusted student, "is a girl got penetrated in a class with two dildos for a grade."

That example is of course extreme, but fringe courses with politicized agendas are commonplace. Courses in "women's studies" now outnumber economics programs in every Ivy League

college except Princeton. Gay and lesbian studies, which didn't exist a decade ago, is now a full-fledged program at 50 universities, with courses at hundreds of others.

Shallow stuff is driving out the substantive. The National Alumni Forum, which is chaired by Lynne Cheney, found last December that two-thirds of elite American universities no longer require English majors to study Shakespeare. In place of classic literature, English departments are focusing more on popular culture, and sex, sex, and more s-e-x. Videos are substituting for books.

Virginia certainly is not exempt from this sacking of the liberal arts. Two

trustees at James Madison University raised a ruckus recently when they advocated the reinstatement of American history as a required course.

What an outrage, to think that one could graduate from JMU with no clue as to who James Madison was or his role in creating the Constitution. Sadly, it turns out that none of the state's universities has such a requirement anymore.

What a shame it is that thousands of bright freshmen are entering prestigious, pricey colleges this fall with the expectation of superior education but the likelihood of getting a load of politically correct garbage. University trustees have a duty to stop this destruction of liberal education. ■

68. Asbury Park Press

September 2, 1997

Learning Curve: There's no pleasing educators in writing about schools

By BRIAN KLADKO
STAFF WRITER

Judging from the number of newspapers around the country creating "education teams" and publishing detailed statistical compendiums on school performance, the subject of teaching and learning has become a higher priority for the press.

I'm hardly an objective authority on this subject, since my title is "education writer." But I believe one reason for the shift is competition.

In the effort to retain readers and differentiate ourselves from television, newspapers are focusing on areas where the printed word still has an advantage over video. One of those areas is explaining abstract issues, including education.

Such stories also have another appeal: They hit close to home, because so many people have kids in school. Those without children or teen-agers most likely went to school themselves, so they can relate to stories about school. And, of course, a significant share of the public's wealth helps pay for schools.

If all this seems too self-serving, I'll now proceed to knock myself down a few notches.

The Education Writers Association, a 50-year-old group to which I belong, recently commissioned a survey about the quality of education reporting, interviewing school administrators and teachers, members of the general public, and education writers themselves. The survey was conducted by Public Agenda, an opinion research organization that had already probed the attitudes of teachers, students and parents on a variety of education issues.

I wasn't surprised to learn that 76 percent of superintendents and teachers believe that much of the decline in confidence of public schools is due to negative press coverage, and 86 percent believe the press "unfairly dwells upon conflict and failure in schools."

Such harsh judgments are hard to avoid, as I know all too well.

On July 20, the Asbury Park Press published statistics on student misconduct for the 80 districts in Monmouth and Ocean counties. In our attempt to make the comparisons reader-friendly, we used the numbers to classify some districts as the "best" and some as the "worst."

I wasn't surprised when a couple of superintendents, whose districts fell into the latter category, called to complain. They weren't used to seeing these numbers in the newspaper, and certainly weren't prepared to be ranked on the basis of student violence, vandalism and drug use.

I knew the numbers were potentially misleading, because they were tabulated by the districts themselves, and there were likely to be inconsistencies in the diligence and competence each district brought to the task. So I carefully explained those problems in the article accompanying the chart.

But that didn't remove the sting of that chart, at least for the two superintendents who called me. The sting will likely linger, no matter how many positive stories the Asbury Park Press has written — or will write — about those districts. Stories about retiring principals, improvements in test scores or conflict-resolution programs just don't have the same kind of impact.

Pleasing educators, therefore, is probably a lost cause.

More surprising, and disturbing, was

too controversial for the administration to act without congressional review or authorization. The administration has no bill, nor has it indicated any intention of seeking legislation for this initiative. There is federal legislation allowing for NAEP.

The U.S. Department of Education has quickly planned these new tests without wide public input. In addition, valid tests take years to construct. The fast-track nature of this initiative has alarmed many educators and policy makers.

New national tests could lead to inappropriate and unfair comparisons of schools and students. For instance, we already know that suburban students in Upper St. Clair will, in all likelihood, outperform students from center city Pittsburgh. Why? Students from Upper St. Clair have more educational advantages. There is no reason to develop another test to show us the

deficiencies of disadvantaged students.

Tests don't generate higher academic performance. The administration and the U.S. Department of Education have talked as if a new national test will create better students. It won't. Standardized tests assess performance; they don't generate it. And, with any testing proposal we should be wary of the tendency of teachers to teach to the test.

New national tests could lead to a national curriculum. In developing new assessments, there is a tendency to create new curriculum to match those assessments. But, like new national tests, a national curriculum is something Americans don't want and don't need. Local control is a hallmark of American education.

Given what happened with the federally funded U.S. history standards project (a dismal initiative that generated political correctness rather than history) we don't need to engage in any effort that

could lead to a national curriculum.

Unlike the NAEP tests, which are governed by an independent board, these new tests will come from the U.S. Department of Education. That puts the department in an extremely powerful position in our local schools.

There is no significant support for new national tests. Since President Clinton announced his test proposal, only six governors have indicated interest in it.

Instead of developing new national tests, I want to direct federal resources to family literacy and preschool readiness. I also want to take steps to improve teacher preparation and improve the teaching and learning conditions in our schools. Those should be our priorities — not more testing.

Rep. Bill Goodling, R-Seven Valleys, is chairman of the U.S. House of Representatives' Committee on Education and the Workforce. ■

57. The New York Times

08/11/97; Edition: Late Edition - Final; Section: Section A; Editorial Desk; Page 15, Column 4

Dialogue: Creative Math, or Just 'Fuzzy Math'? *Mediocre Is Not Good Enough*

By Thomas Romberg

MADISON, Wis. — For the past quarter-century it has been obvious that Americans need a better understanding of mathematics, science and technology if our society is to prosper.

Although some schools, teachers and parents are satisfied with the way math is being taught, a recent study of math and science education in 41 countries described most math curriculums in the United States as "a mile wide and an inch deep." Given the fragmented, unchallenging material, taught by teachers who have little opportunity for professional development, it is no wonder that student performance is mediocre.

Mathematics is not just another subject to be covered in class. It is a human activity involving the ability to represent quantitative and spatial relationships in a broad range of situations, express those relations using the language of mathematics and use various techniques to carry out numerical procedures. Mathematics is also about making predictions, and interpreting results.

That is the view of the National Council of Teachers of Mathematics, which in 1989 drew up new standards for teaching math and evaluating student performance. The council carefully considered changes in mathematics and its applications in our increasingly technological society. Council members also examined how math was taught in other countries, and recent work of psychologists on how children learn.

The council maintains that the systems of signs and symbols of mathematics must be learned and experienced as genuine languages — languages everyone needs to communicate, reason, compute, generalize and formalize 20th-century experience, and to serve 21st-century needs.

Moreover, systematic logical forms of reasoning and argument must be learned through personal and social experiences.

Yes, students need to develop certain skills. They need to be able to construct, follow and judge arguments. They need to be able to deduce and induce from context and formulate counterexamples. They need to be able to apply spatial,

proportional, algebraic and graphic reasoning, and to construct proofs.

The standards the council created to help students learn these skills have received wide support from mathematicians and math educators. These standards consist of 50 brief statements about what all students should learn in math classes, organized into three levels through 12th grade. At each level, there are four general standards — problem-solving, communication, reasoning and connections — and specific content standards about topics like algebra, geometry and statistics. The council supports introducing some of these topics in earlier grades (algebra in the middle grades, for example), and putting more emphasis on subjects like statistics.

The council has provided schools and teachers with examples of lessons and instruction guidelines. Though the rhetoric in the council's recommendations argues for balance between proven procedures and new activities, the examples tend to emphasize the new activities.

For instance, students should see the

question of what kind of calculation procedure to use in a numerical problem as a decision that depends on the problem at hand. Although the council wants all students to learn to estimate and use mental calculation and to be equally comfortable using paper and pencil, calculators and computers, nowhere does it argue that students do not need to memorize multiplication facts. Nor does the council say that students should use a calculator for all computations.

Similarly, the examples the teachers council has produced often portray students working on real-world problems, providing oral or written explanations of how a problem was solved, or collaborating with other students. But the council never meant to imply that such approaches are appropriate for every lesson.

Many horror stories cited by the standards' critics, if accurately portrayed, are indeed bad. Sometimes teachers

initially put too much emphasis on the general standards without considering mathematical content. For example, they may teach problem-solving without having students learn algebraic procedures.

Sometimes honest attempts by well-meaning teachers to try a new method of instruction, like having students work in groups, have led them to initially give up class discussions or individual assignments. Sometimes publishers' claims that their texts met the council's standards were mere puffery. Sometimes material that in an author's mind seemed wonderful proved to be less than wonderful in a classroom. And sometimes even appropriate material is ineffective because the teacher using it doesn't have enough math background or the right training to turn the recommended activities into a learning experience for students.

Despite these problems, test scores tell us that teaching math by using the council's recommendations makes sense. Teachers and teacher trainers know that we need a new approach to math instruction, and most defend the standards. And while criticism is essential to refine the suggested techniques, it's unfair to attack the entire program because of initial missteps and isolated examples of misapplied guidelines.

Unless we reform math education so that our children can be prepared for the immense technological changes already occurring, our nation will lose — and so will our children.

About the Author: Thomas Romberg, a professor of mathematics education at the University of Wisconsin, was chairman of the commission on standards of the National Council of Teachers of Mathematics from 1986 to 1995. ■

58. The New York Times

08/11/97; Edition: Late Edition - Final; Section: Section A; Editorial Desk: Page 15, Column 1

Dialogue: Creative Math, or Just 'Fuzzy Math'? *Once Again, Basic Skills Fall Prey To a Fad*

By Lynne Cheney

WASHINGTON — For Stacy Christ, a fourth grader in Fairfax County, Va., a homework problem about pencils and packages was an exercise in frustration.

"The answer required division," her mother, Susan, explained to me, "but she'd never been taught to multiply."

Susan Christ saw this as one more sign of the miseducation of her child, but to advocates of what is sometimes called "whole math" (or "fuzzy math" or "new-new math"), Stacy's assignment was exactly right. Students don't need to know multiplication tables in order to divide, they say. Using objects and calculators, they can figure it out — and thus begin to create their own mathematical knowledge.

The idea that knowledge is something to be constructed, rather than acquired, has been moving into American schools since the 1970's. This approach is obvious, for example, in language-arts teaching that encourages invented spellings.

But now "constructivism," as it is sometimes called, has become a force in teaching mathematics — and the paradox

is immense. In a field distinguished by reliance on proof, an unproven approach is being taken in thousands of schools.

The saga of whole math began in earnest in 1989, when the National Council of Teachers of Mathematics published standards that denounced a "longstanding preoccupation with computation and other traditional skills." According to the council, stressing addition, subtraction and, worst of all, memorization made students into "passive receivers of rules and procedures rather than active participants in creating knowledge."

The standards recommended that students get together with peers in cooperative learning groups to "construct" strategies for solving math problems, rather than sit in class with teachers instructing them. Calculators were a necessity from kindergarten on, the council said, because students liberated from "computational algorithms" could pursue higher-order activities, like inventing personal methods of long division.

Dr. Frank Allen, a former council president and whole-math opponent, has

noted that as the standards were being developed, the council's research advisory committee expressed concern about the failure of the standards commission to provide research support for its recommendations. But the standards' writers were undeterred, and today their views drive the direction of curriculums and textbooks in both public and private schools.

Those who regard the council's recommendations as revealed truth have been rewarded: a panel named recently to oversee the development of President Clinton's national test in mathematics is composed entirely of supporters of the math teachers' council. Critics, meanwhile, have been shut out. In a recent speech, Prof. E. D. Hirsch of the University of Virginia noted that a leading journal, *Educational Researcher*, had refused to publish a section of an article debunking constructivist teaching even though its authors were "among the most distinguished cognitive scientists in the world."

The entry of whole math into the schools has angered many parents. Particularly in California, where schools

have enthusiastically embraced the constructivist fad, parents have complained about students unable to do simple mental computations, about high school graduates who get A's and B's in whole-math classes and have to do remedial work in college.

A woman in Occanside, Calif., wrote to The San Diego Union-Tribune that her child had been "used like a laboratory rat, experimented on with new, untested curricula." A parent whose child attended one of the overseas Defense Department schools, which have adopted two constructivist programs, MathLand and Interactive Mathematics, reported on a Web site, "We all feel our children are guinea pigs in a bad experiment."

Parental backlash has sent whole-math advocates scrambling for evidence to prove that what they do works. When American fourth graders did fairly well on an international test, a prominent whole-math advocate credited constructivist teaching. Her claim would have been more convincing had another leader in the movement not earlier explained away the dismal performance of eighth graders on the same test by saying that whole-math teaching had not sufficiently penetrated American classrooms.

Constructivist views were also undercut by survey data accompanying

the international results. In high-performing countries like Singapore, Japan and Korea, teachers primarily teach the whole class rather than having students in small groups invent knowledge for themselves, and classroom calculators are extremely rare.

Creative Publications, publisher of the MathLand program, recently released an analysis of eight California districts purporting to show that at the least its curriculum does no harm: after one year, "when compared to students across the nation, MathLand students showed one year's growth in both computation and concepts and applications." The districts were not identified, however, nor the reason for choosing them rather than others. The analysis also failed to explain whether the test scores of all students within a district were considered.

Meanwhile, new evidence bears out the gloomy assessment of parents. The median percentile scores in mathematics on the Comprehensive Test of Basic Skills taken by more than 37,000 students one year after the Defense Department introduced whole math show that students gained little in conceptual understanding from being encouraged to construct their own knowledge. Scores in concepts and applications were roughly the same as the previous year. De-emphasizing computation, on the

other hand, cost them dearly. Scores on that section of the exam dropped 9 points for third graders; 12 for fourth graders; 11 for fifth graders; 10 for sixth graders; 10 for seventh graders, and 4 for eighth graders.

After these results, the Pentagon decided to change its test to one "better aligned" with whole-math instruction. This move may produce better scores but at the price of masking student weaknesses in basic skills.

When medical researchers administering a protocol find it has negative consequences for human subjects, they do not ignore those results and change their test. They end the experiment to avoid imposing further harm.

Surely it is time for educators to realize that the same ethic should apply to them. In the face of strong evidence that constructivist mathematics does not help and even hurts, they should consider closing down the whole-math experiment. If we want our children to be mathematically competent and creative, we must give them a base of knowledge upon which they can build.

About the Author: Lynne Cheney, former chairwoman of the National Endowment for the Humanities, is a senior fellow at the American Enterprise Institute. ■

59. Baltimore Sun

August 10, 1997

Reading the test results

By Elise Armacost

WHAT. ANOTHER test?

That was my first thought when Baltimore County School Superintendent Anthony G. Marchione said last week that he is getting ready to release the results of a first-ever standardized assessment of early elementary students' ability to read.

Let's see, we already have the Maryland School Performance Assessment Program, which kids take in third, fifth and eighth grades.

Starting in seventh grade Maryland students take four "functional" tests of basic skills, which they must pass in order to graduate.

There's the Comprehensive Tests of Basic Skills (CTBS), a nationally recognized standardized test, which school systems give to all or some second-, fourth- and sixth-graders.

Baltimore City has just invented a new animal called the "Baltimore Quarterly Assessment."

Now comes Dr. Marchione, with a whole new testing program for kindergartners and first- and second-graders (actually, only the kindergarten and first-grade tests are new; the second-grade test is the CTBS).

As far as he knows, the superintendent says, this is the first early-grade assessment in Maryland. One can hardly blame parents if we roll our eyes and ask, "Aren't we testing kids enough already?"

But let us put our anti-testing biases aside for a moment. Let's leave the questions about whether MSPAP is all it's cracked up to be for another day, along with the debate over national testing standards.

Let's look specifically at what Baltimore County is trying to do with

and find out about early-grade reading.

If you believe that schools ought to make sure young children master the basics before they are promoted to higher grades, where with every passing year it becomes more difficult to help them catch up, Dr. Marchione's reading initiative makes considerable sense.

The superintendent has said that, before his tenure expires, he wants all second-graders reading and computing on or above grade level.

Focusing on reading first, last fall he imposed a new curriculum in kindergarten and first and second grades that stresses phonics and language structure in a literary context.

Dr. Marchione is not a phonics purist: children will be bored silly, he says, if reading class never includes anything fun to read, only drills and workbook activities.

24. Education Week

June 25, 1997

Cohen
Sunley***Curriculum Initiatives Often Seen Occupying Murky Federal Waters***By Jessica Portner
Washington

Come summer, the Environmental Protection Agency plans to issue a batch of grants to schools to help them acquire materials that foster students' appreciation of the environment.

Already this year, the Department of Agriculture has doled out \$10 million to 23,000 schools to teach "Team Nutrition," a curriculum designed to help elementary students learn healthy eating habits.

And the Department of Health and Human Services is set to disperse millions of dollars for sex education programs that promote abstinence until marriage.

Curriculum initiatives are tumbling out of nearly every agency in the Clinton administration. Washington, in fact, allocates more than \$100 million a year to curriculum-related education programs, according to federal estimates.

Critics argue that federal advocacy of a particular course of study amounts to unwelcome meddling into local matters—and, in some cases, may even constitute a breach of the law. But many inside and outside government say a steady stream of financial incentives to use certain classroom materials is appropriate and can yield important educational benefits.

Such academic inducements are hardly novel. Though the federal government is barred from dictating specific curricula, nearly all recent presidents, starting with Dwight D. Eisenhower, have managed to put their fingerprints on classroom learning.

The involvement runs the gamut from offering schools a grab bag of complimentary booklets and helpful hints to providing states and districts with grants to adopt specific government-approved programs. In addition, Washington gives grants to various types of organizations to design specific curricular materials, which, in turn, they market to schools.

Such federal action can influence the curriculum market. The

majority of drug education programs currently available for schools to purchase, for example, have been financed at least in part, by the federal government.

But unlike the strong-arm tactics that Washington has been accused of using on occasion, such as threatening to withhold aid if states do not pass laws forcing the expulsion of students who carry weapons to school, federal attempts to influence curricula carry no direct punitive measures. Instead, the administrations dangle grant money in front of districts and states and let them decide whether to reach for it.

And more often than not, there are no strings attached to the largess, making it especially appealing to schools.

Interpreting the Law

Several legal prohibitions bar the federal government from requiring that instructional materials be mandated in schools.

When Congress passed the Department of Education Organization Act in 1979, establishing the department as a Cabinet-level agency, it constrained the new agency from exercising any control over curriculum. Critics of a federal Education Department were concerned that its powers would go unchecked in the classroom without an explicit restraint on curricular intervention.

Though the 1979 law bars only the Education Department from prescribing coursework, a law dating to 1965 restricts "any department, agency, officer, or employee of the United States ... from exercising control over curriculum."

Legal counsels for several government departments contend that this earlier law, the General Education Provisions Act, was intended to apply exclusively to the then-commissioner of education. But others, such as Diane Ravitch, a New York University professor and an assistant secretary of education under President Bush, says the

1965 law seems to apply to the entire federal government.

In any case, many federal agencies, such as the EPA and HHS, have separate legal checks, government officials say.

Federal agencies lack the authority to order schools to adopt curricula unless Congress authorizes the agencies to do so, according to Steve Pressman, a lawyer with the EPA.

But legal experts doubt that Congress could get away with such a fiat, especially if it prescribed curricula without proper funding, said Gwendolyn Gregory, the deputy general counsel for the National School Boards Association.

Constitutional Ban

The 10th Amendment to the U.S. Constitution prohibits Washington from interfering in areas that are traditionally state affairs, said Ms. Gregory, though, of course, it has strayed into the states' province on occasion. If a district needed legal grounds against federal intrusion into curriculum, she said, "they would have plenty of ammunition."

So far, no administration has violated these prohibitions, according to Ted Sky, a senior counsel for the Education Department. As long as the federal aid is not coercive—for example, schools are not compelled to teach a particular course—it's legal, he said.

Built-In Flexibility

Most of the grant programs, such as one administered by the National Endowment for the Arts, give schools lots of flexibility. The endowment recently awarded a community arts association in Los Angeles \$200,000 to write and implement a multicultural arts education curriculum in local secondary schools. Schools, however, can take it or leave it.

For more than a decade, the Education Department has fostered the formulation of various drug education curricula, particularly the Drug Abuse Resistance Education program, which is now the most widely used in the country.

"No state or school district is required to apply for the money," Mr. Sky said.

But just because no one has ever filed a complaint against the federal government claiming that it violated any law or constitutional ban doesn't mean the spirit of the measure hasn't been compromised, some experts argue.

"There's a clear prohibition that the federal government can't directly endorse or promote curriculum, but everybody skirts it," contended Ms. Ravitch. In particular, she eschews the government's aggressive marketing tactics.

The federal government circumvents the law with grants that are made contingent on teaching specific material, regulatory provisos, technical assistance, and free samples, argued Chester E. Finn Jr., the John M. Olin fellow at the Hudson Institute and an assistant secretary of education under President Ronald Reagan. "Most people say that providing information is a legitimate federal function, but they also think that the federal government should not dictate what schools teach," he said. "But in between is a vast gray area."

A History of Tinkering

Democratic and Republican presidents alike have been exploiting this murky middle ground for decades, largely to complement a national political agenda.

In 1958, President Eisenhower signed into law the National Defense Education Act, which funneled \$1 billion in grants and loans to schools and colleges to improve mathematics and science curriculum, according to Gordon Hoxie, the founder of the Center for the Study of the Presidency in New York City. The retired Army general saw the initiative —adopted after the Soviet Union alarmed Americans with its 1957 launch of Sputnik 1 —as a matter of national security.

Presidential historians credit the 34th president with being the first American chief executive to advance a large-scale curriculum program. Nearly every president since has backed curriculum proposals, though on a much smaller scale, Mr. Hoxie said. "It's sort of like mother's love," he remarked. "They're all for it."

But while these proposals often appeal to national politicians, some state and local leaders have been less enthusiastic about them. Last year, Gov. George F. Allen rejected a \$6.7 million

grant to draft academic standards in Virginia under President Clinton's Goals 2000 program. The Republican governor argued that acceptance of the grant would have given the federal government too much leverage over state policy.

"From our perspective, what we were concerned about was the issue of the federal government interfering with local school systems' ability to develop curriculum that is appropriate for its own schools," Beverly H. Sgro, Virginia's education secretary, said. Congress later amended the legislation, allowing states to use all the Goals 2000 money for school technology projects.

But Goals 2000 was just the most recent lightning rod for the debate over federal involvement in curriculum.

In the early 1970s, the National Science Foundation, a federal agency chartered by Congress, promoted a curriculum called "Man: A Course of Study," an anthropological course for 5th and 6th graders that focused on human development. Scores of schools adopted the curriculum, but the course soon aroused public and congressional concerns about specific units, particularly sections that focused on the lifestyle of the Netsilik Eskimos. These "materials are full of references to adultery; cannibalism, trial marriage, wife swapping. ... This is simply not the kind of material Congress or any federal agency should be marketing with taxpayers' money," said then-Rep. John B. Conlan, a Republican from Arizona during a 1975 House debate. The controversy ultimately provided fodder for legislators to curb the government's curricular powers a few years later when they created the Education Department.

State Involvement

Whether coercive or not, federal influence in curriculum can also be a force in the education publishing market, according to Michael Kirst, a professor of education at Stanford University. For example, critics of the voluntary national history standards, which were underwritten by federal grants, claim the new generation of social studies textbooks are heavily colored by the guidelines.

"We don't have a government ministry that publishes official curriculum and controls it like the French do," Mr. Kirst said. But as the federal government tries to increase its influence, groups that oppose the government-backed materials often respond by designing education products

of their own, he said.

Many former government leaders stress, however, that federal aid in promoting curricula can be extremely beneficial.

"Put aside the issue of whether that is entirely wise; it's a good way to go," said Jack Watson, a former chief of staff under President Jimmy Carter. Mr. Watson said that although it's important to be careful about infringing on local control, such financial incentives often help eliminate the regional disparities that districts face when implementing education reforms.

But Carl Kaestle, a professor of education at the University of Chicago, argues that Washington's financial inducements, however worthy, often have a dubious effect. Legislation advanced in 1975 by President Gerald R. Ford that provided districts with money to teach metric conversion hasn't changed the nation's standard of measurement, for example, Mr. Kaestle said.

"We need to attend to the central role of schools and not keep throwing money around for a smorgasbord of curriculum," he said.

But education observers say that federal involvement in school curriculum pales in comparison with the state role in shaping what students learn. While states have long had the legal authority to dictate subject matter, the practice has intensified in recent years, largely as a result of their attempt to raise academic standards, they say.

"All this federal stuff is phony baloney. The real shift is at the state level," said John F. Jennings, a former general counsel to the House Education and Labor Committee when it was under the Democrats' control.

States are often resistant to federal intervention because they want to be free to tinker with the classroom lessons themselves, Mr. Jennings asserted.

Last year, Gov. George E. Pataki of New York ordered public schools to teach students that the Irish potato famine of 1845-50 was a historical abuse of human rights that should be taught alongside lessons on the Holocaust and slavery. ("State Journal," Oct. 23, 1996.)

States often dream up courses that have a regional flavor as well. In Wisconsin, Mr. Kaestle said, there's a law that says children must be educated about the virtues of dairy products.

But the debates between

DOEd-NSF Working Group on Improving Math and Science Education

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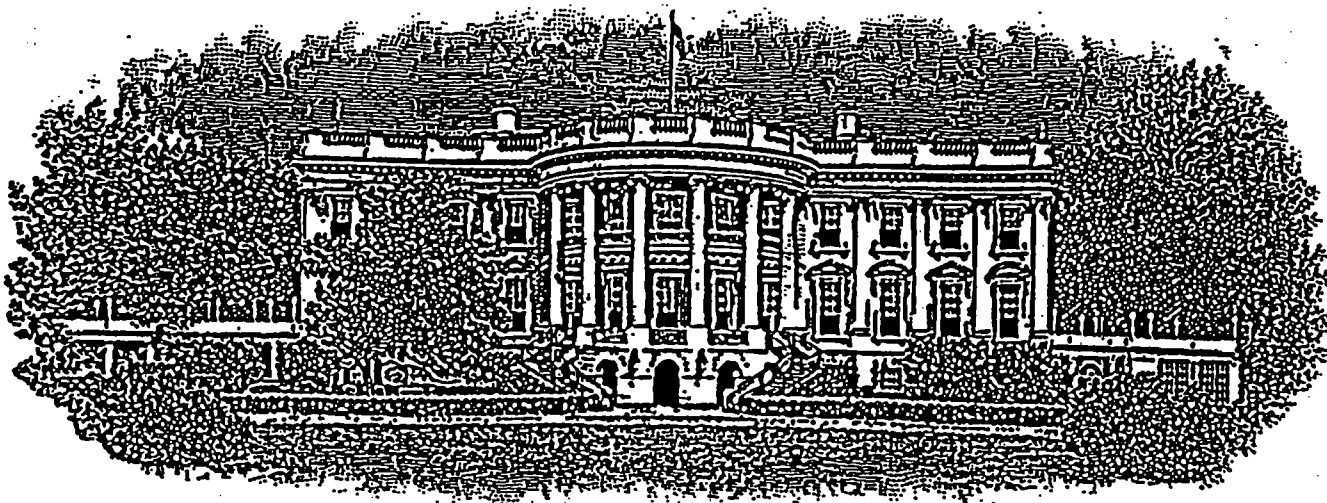
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10/13/97

AN ACTION STRATEGY FOR IMPROVING ACHIEVEMENT IN MATHEMATICS AND SCIENCE

I. INTRODUCTION

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

The Presidential Directive

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

The Need for Action

The Third International Mathematics and Science Study

One of the immediate inspirations for this attention to high standards in mathematics and science education in eighth grade is the Third International Mathematics and Science

Study (TIMSS), which involved 30,000 students in the United States. Results of tests administered in 1995 to students in grades 4 and 8 are now available. The fourth grade results show US students above the international average in both science and mathematics. In science, US students were outperformed only by those in Korea. However, the eighth grade results show lackluster performance by US students, with scores only a bit above the international average in science, and below the international average in mathematics. These results clearly indicate that mathematics and science education in the middle school years should be an important focus for national efforts to help ensure that our students meet world-class standards.

The Third International Mathematics and Science Study (TIMSS)

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

TIMSS involved more than half a million students in 45 countries. The relative performance of U.S. students in comparison to students of other countries improved over performance on similar international comparisons of earlier years. However, the U.S. was the only country whose students performed above average at grade 4 and below average at grade 8 in ~~either science or~~ mathematics.

TIMSS results show that

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

*Don't
make
science
out
grade 4/
8
1997*

TIMSS results for the fourth grade are much more positive than the results of similar international comparisons in the past. They demonstrate that it is possible to make significant progress in international comparisons over time, and that US students can compete favorably with those of other nations in mathematics and science achievement. Our National Education Goals proclaim our intent that US students will be first in the world in mathematics and science achievement by the year 2000. In the early grades, we are making demonstrable progress toward that goal.

While collecting achievement data in each participating country, TIMSS researchers also developed a wealth of information about teachers and teaching, about curricula and instructional materials, about classroom lessons and interactions, and about student attitudes and habits outside the classroom. Thus, the TIMSS results have become a source of constructive motivation for mounting an action strategy, taking the issue well beyond the simple comparison of scores in international test taking.

Opportunities for the Future

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

A Voluntary National Test in Mathematics

The President has proposed a voluntary national test in mathematics, to be taken near the end of eighth grade, as a very visible part of an ambitious, sustained drive for higher,

more challenging standards of learning for all students. The test will be based on the content strands of the National Assessment of Educational Progress (NAEP). It will be available by the spring of 1999 for those States and districts that wish to participate. Parents and teachers will receive an individual score for each student who takes the test. That score will be linked to national and international benchmarks, which will provide additional context. For more information, see Appendix 2.

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

Immediate Focus on Mathematics

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

To meet the challenges of the near term, this action strategy focuses on mathematics education in grades 5-8. It builds on a strong foundation of activity underway across the country to improve elementary and secondary mathematics and science education. It requires that these activities continue, at all

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

Raising Achievement for Disadvantaged Students

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

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

Challenges for All Parties

Our vision is that all American students will leave eighth grade prepared to pursue the higher-level mathematics and science courses that are the gateway to college, productive employment, lifelong learning, and effective citizenship. Reaching this vision will require:

- High expectations, held by teachers, school administrators, parents, and students themselves, for student performance in mathematics and science;
- Challenging standards for content of curriculum, teaching, assessment, and student achievement;
- Instructional materials and technology of high quality that incorporate these challenging standards;

- Teachers with the pedagogical skills and rigorous knowledge of mathematics and science needed to teach these subjects effectively; and
- Activities outside the classroom that reinforce the classroom experience by drawing on the support of parents, the professional communities of mathematicians, scientists, and engineers, business leaders, and the broader public.

Thus, the action strategy

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

- Challenges US families to provide strong support and encouragement for their children to reach high standards of achievement in mathematics and science.

To help meet these challenges, based on the rationale described above, the Department of Education and the National Science Foundation will focus their immediate actions -- individually and jointly -- on mathematics in grades 5-8. To be fully effective, this effort must broaden to include both mathematics and science in all grades once the immediate needs of mathematics in grades 5-8 have been addressed.

II. PRIORITIES FOR ACTION

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

Priorities for Action

- Equipping teachers in grades 5-8 with the skills and knowledge to teach challenging mathematics content in effective ways, with high expectations for their students;
- Helping States and school districts select and implement high-quality, standards-based curricula and instructional materials, including effective use of educational technologies
- Building public understanding of challenging mathematics in grades 5-8, and gaining public support for raising student achievement toward high standards.

While education is a national priority, it is primarily a State and local responsibility.

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

Scope and Scale

Department of Education statistics show that in grades 5-8 there are approximately 13.5 million students taught by about 320,000 teachers of mathematics. These students and teachers are found in about 34,000 schools in close to 15,000 districts. Many of these schools and districts are already actively involved in setting high standards for instruction and student achievement and are implementing plans to achieve them. Their priorities in such efforts are very similar to the school-based priorities identified above. }

The core of this action strategy is making more effective use of Federal resources in assisting schools and districts to make a focused effort to address these priorities with respect to mathematics in grades 5-8. The participating agencies will provide opportunities for districts to accelerate their progress toward improved achievement in this area through incentives for enhanced coordination, planning and implementation. [redacted] approximately 1,000 provided opportunities for districts to implement efforts in grades 5-8. Districts that serve large numbers of disadvantaged students will receive particular attention.

At the same time, an effort at public information and engagement is needed to reach a broader base of students and their parents in a more timely fashion than can be accomplished through these core activities. The participating agencies, with their ties into the science, mathematics, engineering and

technology communities, are well-positioned to encourage these communities to cooperate in spurring such an effort.

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

III. ACTIONS TO STRENGTHEN THE IMPACT OF FEDERAL RESOURCES

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

Current Federal Resources

In FY 1997, the National Science Foundation invested \$377 million in K-12 science and mathematics education, including investments in the undergraduate preparation of teachers. The funds go largely to colleges and universities, State and local educational agencies, and nonprofit organizations. They are awarded through competitive review of proposals for funding of specific projects. Over the past few years, the Foundation has placed a high priority on system-wide reform of mathematics and science education. It asks local and State educational agencies to align resources of all types, including those obtained through other Federal programs, to effect change. The Foundation highlights specific areas of emphasis within broader

programming, establishes clear priorities for funding within the criteria for selection of awards, and holds grantees accountable for performance. Over the years, projects aimed at mathematics in grades 5-8 have been scarce in comparison to those in science or to those in mathematics aimed at other grade levels.

The Department of Education allocated approximately \$8 billion in FY 1997 through three major formula-drive programs (Goals 2000; Eisenhower Professional Development State Grants; and Title I: Education for the Disadvantaged) that include improved achievement in mathematics and science among their objectives. Goals 2000 aids States and school districts to develop and implement challenging academic standards and upgrade teaching and learning in order to reach the National Education Goals, including the goal of becoming first in the world in mathematics and science. The Eisenhower program places an explicit focus on science and mathematics. Of the \$310 million appropriated for FY 1997, \$250 million was required to go to mathematics and science.

Title I Schoolwide Programs

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

The 1994 reauthorization of Title I placed new emphasis on helping disadvantaged students meet the same challenging academic

standards expected of all children. States are currently developing standards and plans consistent with that emphasis. The Department of Education works actively with States and school districts on identifying actions that can be taken to achieve significant change, provides information and examples, and makes technical assistance available as needed.

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

The Department of Energy's STEM Initiative

Department of Energy (DOE) Secretary Pena has launched for FY 1998 a renewed effort to support education consistent with DOE's energy and defense missions. The Science, Technology, Engineering, and Math Education (STEM) Initiative will coordinate DOE resources to promote the public's understanding of science and provide a diverse workforce for the Nation's science and technology infrastructure.

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

Among STEM's five goals, two are particularly relevant to this action strategy:

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

Strengthening the Impact of Federal Resources

Using Existing Programs

The first step in moving forward is to ^{and improve} maintain existing programs aimed at improving student achievement through standards-based education across all subject areas and all grade levels. Such programs provide a fundamental level of information and opportunity important for progress, but they have only a minimum of activity focused on mathematics in grades 5-8.

Within those existing programs, the participating agencies will create areas of emphasis for mathematics in grades 5-8. This can be done to a limited extent through reorganizing existing programs. However, such a reorganization of funds would have an impact on the scope of other aspects of the agencies' educational activities and ~~limit the number of teachers, schools, districts, and students served to approximately 100,000 students over five years~~. Expanding the scale of existing programs will help, as will new programs of individual agencies, but issues of scope and synergy would remain.

Creating Synergy

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

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

A Title I Schoolwide Example

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

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

IV. THE ELEMENTS OF AN ACTION PLAN

Three priorities for action are identified above. Progress in one area will often depend on and demand improvement in others. For instance, the introduction of high-quality instructional materials will have little impact if teachers are not trained to use those materials effectively. We must be working on all fronts in order to make progress toward improved student achievement. The elements of the action plan provided below are organized around the three priority areas, with an introductory section that describes plans for synergistic use of federal funds across the priority areas.

Cross-Cutting Elements

As noted above, the Department of Education and the National Science Foundation plan a set of joint activities, including the other participating agencies to the extent possible, aimed at addressing school-based priorities.

- The Department and the Foundation will assist State and local educational agencies in the strategic use of all types of Federal, State, and local funds toward improving mathematics achievement.

Federal

(Such as Through waivers)

The Department and the Foundation will provide active leadership and support in the development and implementation of a coordinated strategy for improving mathematics achievement in grades K-12.

The National Science Foundation will encourage the development and implementation of State and local strategies for improving mathematics education in grades K-12.

The Department and the Foundation jointly will provide ongoing planning and implementation of a coordinated strategy for improving mathematics education in grades K-12, and will provide models for this effort.

or are exploring the possibility of

- The principal target for the agencies' cooperative activities will be middle schools with schoolwide Title I programs and districts with many such schools. This focus permits large numbers of disadvantaged students to benefit from the enhanced leverage of funds awarded competitively by the Foundation to schools and districts with the large resource base of the Department's Title I program.

- The Department and NSF will convene a national conference of state and local mathematics education leaders, Title I school leaders, and other key actors to help participants maximize the impact of Federal resources in improving mathematics education in grades 5-8.

- The Department and NSF will undertake a coordinated effort of research and professional development activities in mathematics in grades 5-8. These activities include release of a 100,000 research kit that contains materials for professional development, curriculum analysis, and teacher and administrator training; and a series of workshops in 1997-98 and 1998-99 to provide information on our findings and to develop a program of research, information, and professional development. We will also develop and disseminate teacher guides and materials on the basis of research on teaching and learning of mathematics.

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

Each of the specific items above will be aimed at mathematics in grades 5-8, reflecting the urgent need to raise achievement at this stage of the educational process. However, the activities described above can also serve as models for more effective approaches to educational change in the broader arena of

mathematics and science education. The working group strongly endorses the idea of future efforts that would encompass additional aspects of K-12 mathematics and science education. *fully anticipate*

Texas Statewide Systemic Initiative

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

Equipping teachers in grades 5-8 with the skills and knowledge to teach challenging mathematics content in effective ways, with high expectations for their students

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

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

Quantitative Literacy Program for Alabama K-12 Teachers

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

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

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

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

- Support a national, intensive, high-quality professional development of teachers of mathematics in grades 5-8 as the cornerstone of their cooperative efforts to enhance the impact of Federal resources, emphasizing coverage of all teachers of mathematics in grades 5-8 in particular schools or districts. The agencies aim to help districts provide such professional development for every or nearly every person of the approximately 220,000 teachers of mathematics in grades 5-8, with particular attention to those who teach the largest numbers of disadvantaged students.
- Initiate a program to strengthen the pool of talented, committed individuals able to provide excellent professional development for classroom teachers. This program will support projects that will provide intensive training experiences for those who will lead mathematics teacher training efforts.
- Support the creation of materials for professional development of teachers of mathematics in grades 5-8 that are grounded in the NCTM standards, tied to newly emerging educational materials and technologies, and assist teachers to link mathematics to real-world skills and applications.

PRIME in Pittsburgh

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

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

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

- Support ~~with~~ opportunities for teachers to help one another with content knowledge and teaching skills through such activities as ~~the formation of~~ ~~informal~~ ~~groups~~ ~~for~~ ~~the~~ ~~purpose~~ ~~of~~ ~~professional~~ ~~development~~ ~~and~~ ~~collaborative~~ ~~learning~~ ~~and~~ ~~the~~ ~~development~~ ~~of~~ ~~master~~ ~~teachers~~ (including those recognized through the Presidential Awards for Excellence in Mathematics and Science Teaching and the National Board for Professional Teaching Standards Certification), ~~mathematics~~ ~~specialists~~, and ~~teacher~~ ~~networks~~.

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

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

Teacher Preparation in Louisiana

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

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

The central ^{principle} ~~principle~~ is to model in the education of future teachers the new methods of teaching mathematics that they will be expected to implement in the classroom, for example, working in small groups on challenging problems and using technology resources such as calculators or the Internet.

Louisiana red flag?

- Some of the most significant materials for high-temperature and high-pressure applications have been developed in the 1970-1980 period. These include high-temperature alloys, high-temperature polymers, and high-temperature composites. These materials are used in a wide range of applications, including aerospace, industrial, and automotive.

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

Improving Teaching Through Distance Learning

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

The Star Schools: The Next Generation project of Oklahoma State University and Northern Arizona University delivers the "Getting Ready for Algebra" program, which provides simultaneous student instruction and teacher training to middle school students and teachers. Its units are student-centered and activity-oriented and emphasize learning by discovery. They focus on the big ideas common to arithmetic and algebra. Similarly, the United Star Distance Learning Consortium project led by Education Service Center—Region 20 in San Antonio, Texas, offers the *Algebra and Geometry Applications for Teachers* program, inservice training that models worthwhile mathematical tasks and helps teachers improve their ability to develop these tasks. The focus of the project is on mathematical topics that illustrate connections to real-life problems and exciting mathematics.

Implementing high-quality, standards-based curricula and instructional materials, including curricula that use educational technologies, in grade 5-8 mathematics classrooms

The TIMSS results showed that the content of curricula and instructional materials used in US classrooms in the middle school years in 1995 differed from those in high performing countries in significant ways. The content taught in most U.S. eighth-grade mathematics classrooms would be found in

the seventh grade in high-performing nations. Our low expectations for student performance are also shown by the fact that only about 25 percent of U.S. eighth grade students are enrolled in algebra courses, while in high-performing nations virtually all students have the opportunity to master the foundations of algebra and geometry by the end of eighth grade.

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

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

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

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

Open CESAME!

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

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

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

- Encourage and support coordinated efforts aimed at:
 - Facilitate upgrading of mathematics instruction through encouragement and support for coordinated planning and action aimed at:
 - purchase of new instructional materials geared to rigorous standards; *providing high quality*
 - necessary professional development *aimed at their implementation*; and *connected to new material implementation*
 - employment of highly skilled mathematics specialists who are prepared to teach the new materials and guide others in their implementation.
- such efforts*
Each of these, for example, would be eligible for use of Title I funds, and could be part of the coordinated plans described in the section on cross-cutting activities.
of this report

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

outside

- [redacted] NSF-supported curriculum implementation sites dedicated to mathematics materials for grades 5-8 will work with broader technical assistance providers, including the Department's Eisenhower Regional Consortia and National Clearinghouse, as needed.

- [redacted] with new [redacted] mathematics materials to assist schools and districts in making the transition to standards-based comprehensive materials.

- [redacted] This will include support for critical expansion and evaluation efforts preceding commercialization of these models. K-8 mathematics will be a high priority in the near term.

Eisenhower Regional Consortia for Science and Mathematics Education

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

jargon

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

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

verb phrases?

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

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

achieve to high standards play an important role in all these Federal activities.

NASA's Mission Mathematics

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

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

Building public understanding of challenging mathematics in grades 5-8, and gaining public support for raising student achievement toward high standards.

All American students should leave eighth grade prepared to pursue the higher-level mathematics and science courses that are the gateway to college, good citizenship, productive employment, and lifelong learning. In realizing this vision, it is essential that educators, parents, and students themselves understand what high standards in mathematics look like and why they are important. This outcome requires activities

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

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

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

Each of these efforts could make new types of materials and capabilities possible in the future. Activities that enable students to

and information that reinforce the classroom experience and convey the importance of mathematics achievement. Such activities should draw on the support of parents, the professional community of mathematicians, scientists, and engineers, business, and the broader public.

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

Saturday Schools Provide Tutoring Boost

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

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

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

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

In order to support these strategies, the Department of Education and the National Science Foundation will:

- Sponsor ~~national dialogue on middle school mathematics~~ to initiate a continuing dialogue on:
 - what we should expect our students to be able to achieve in mathematics by eighth grade and beyond;
 - exemplary practices in professional development, curricula, instructional materials, and technologies; and
 - opportunities for parental involvement and community support to help students meet high expectations.
- Seed the continuing national dialogue by providing a wide variety of sample items illustrating the level of standards, examples of student work, and information on curricula, instructional

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methods and technologies that support high standards.

Vehicles?

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

national standards?

and possibly link to other math-related

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

high?

Partnership activities will be focused at State and local levels, with the Federal Government fostering their development, largely by drawing on the strengths of national organizations that would then work through their State and local affiliates. These partnerships will be designed to draw students, parents, teachers, and others important in influencing student decisions on course-taking into an engaging setting for the practice of mathematics. If such partnerships could reach 1 million students in grades 4-12, they could have a significant impact on improving mathematics achievement for all students in those grades.

The Department and the Foundation will

- Connect national organizations with interests in helping to raise levels of achievement in mathematics and science (for example, professional societies of mathematicians, scientists, and engineers) with State, local and community-based organizations having similar purposes, particularly those already linked to on-going agency activities.

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

- Arrange for the development and dissemination of a variety of seed and high-quality engaging materials developed by students in grades 4-12 that can be used as a common core activity in State and local partnership efforts. It is such anticipated that exercises would appear in a recognizable format in many different places using a variety of media. Each would have introductory material designed to provide motivation for the exercise, possibly through the use of celebrities or through a clear description of how the material was generated from real-life situations. Guides for use of the exercises within the partnership efforts and information on how to find hints, help and related materials would also be provided.

could

- Support a community campaign of public information and engagement through existing and newly developing joint programs.

The partnership activities themselves might take many forms, with each dictated by the needs of the State or locality in which they are active. Some may require seed funding from Federal agencies, while others will form of themselves. Examples of partnership options that currently exist, might be expanded, or might be incorporated in newly forming partnerships at local, State, or national levels include:

- Institutions of higher education or Federal agencies partnering with local K-12 schools and their parent organizations to build understanding and support for teachers and administrators implementing reform activities;
- Professional societies in mathematics, science, and engineering providing guidance for their members on interacting with schools and teachers productively;

- Summer mathematics efforts that keep students growing mathematically, modeled after the Department of Education's successful summer reading effort;
- Mathematics ~~fitness~~ ^{discussion} circles or networks taking advantage of the weekly problems, including discussions of how these problems illustrate the standards and the importance of mathematics for future education and work;
- Support for students via telementoring by adults actively using mathematics in their work;
- After school and evening use of facilities (such as space or computers) of local businesses, academic institutions, local government, and community organizations for mathematics-oriented activities for students and their parents.

high standards

Mathematics Education and the Department of Defense

Two agencies within the Department of Defense (DoD) represent contrasting approaches to introducing rigorous national standards in their education activities.

Unique among the agencies are the DoD Dependents Schools (DoDDS), which run as essentially autonomous school systems overseas and on military bases in the U.S. They certify teachers and develop leader-teachers, tutors, and mentors who, like the DoDDS math curriculum used world-wide (K-8 and 9-12), ~~embrace the NCTM standards~~ ^{based on} *challenging* standards.

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

V. CONCLUSION

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

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

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

A New Federal Education Partnership Program at the Department of Transportation

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

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

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