

## TITLE VIII—READING EXCELLENCE ACT

Subtitle I—Reading and Literacy Grants

### SEC. 101. AMENDMENT TO ESEA FOR READING AND LITERACY GRANTS.

*(a) IN GENERAL.—Title II of the Elementary and Secondary Education Act of 1965 (20 U.S.C. 6601 et seq.) is amended—*

- (1) by redesignating parts C and D as parts D and E, respectively; and
- (2) by inserting after part B the following:

#### “PART C—READING AND LITERACY GRANTS.

#### “SEC. 2251. PURPOSES.

*“The purposes of this part are as follows:*

“(1) To provide children with the readiness skills they need to learn to read once they enter school.

“(2) To teach every child to read in the child’s early childhood years—

“(A) as soon as the child is ready to read; or

“(B) as soon as possible once the child enters school, but not later than 3d grade.

“(3) To improve the reading skills of students, and the instructional practices for current teachers (and, as appropriate, other instructional staff) who teach reading, through the use of findings from scientifically based reading research, including findings relating to phonemic awareness, systematic phonics, fluency, and reading comprehension.

“(4) To expand the number of high-quality family literacy programs.

“(5) To provide early literacy intervention to children who are experiencing reading difficulties in order to reduce the number of children who are incorrectly identified as a child with a disability and inappropriately referred to special education.

#### “SEC. 2252. DEFINITIONS.

“For purposes of this part:

“(1) **ELIGIBLE PROFESSIONAL DEVELOPMENT PROVIDER.**—The term ‘eligible professional development provider’ means a provider of professional development in reading instruction to teachers that is based on scientifically based reading research.

"(2) FAMILY LITERACY SERVICES.—The term 'family literacy services' means services provided to participants on a voluntary basis that are of sufficient intensity in terms of hours, and of sufficient duration, to make sustainable changes in a family, and that integrate all of the following activities:

"(A) Interactive literacy activities between parents and their children.

"(B) Training for parents regarding how to be the primary teacher for their children and full partners in the education of their children.

"(C) Parent literacy training that leads to economic self-sufficiency.

"(D) An age-appropriate education to prepare children for success in school and life experiences.

"(3) INSTRUCTIONAL STAFF.—The term 'instructional staff'—

"(A) means individuals who have responsibility for teaching children to read; and

"(B) includes principals, teachers, supervisors of instruction, librarians, library school media specialists, teachers of academic subjects other than reading, and other individuals who have responsibility for assisting children to learn to read.

"(4) READING.—The term 'reading' means a complex system of deriving meaning from print that requires all of the following:

"(A) The skills and knowledge to understand how phonemes, or speech sounds, are connected to print.

"(B) The ability to decode unfamiliar words.

"(C) The ability to read fluently.

"(D) Sufficient background information and vocabulary to foster reading comprehension.

"(E) The development of appropriate active strategies to construct meaning from print.

"(F) The development and maintenance of a motivation to read.

"(5) SCIENTIFICALLY BASED READING RESEARCH.—The term 'scientifically based reading research'—

"(A) means the application of rigorous, systematic, and objective procedures to obtain valid knowledge relevant to reading development, reading instruction, and reading difficulties; and

"(B) shall include research that—

"(i) employs systematic, empirical methods that draw on observation or experiment;

"(ii) involves rigorous data analyses that are adequate to test the stated hypotheses and justify the general conclusions drawn;

"(iii) relies on measurements or observational methods that provide valid data across evaluators and observers and across multiple measurements and observations;

and

"(iv) has been accepted by a peer-reviewed journal or approved by a panel of independent experts through a comparably rigorous, objective, and scientific review.

**"SEC. 2253. READING AND LITERACY GRANTS TO STATE EDUCATIONAL AGENCIES.**

**"(a) PROGRAM AUTHORIZED.—**

"(1) IN GENERAL.—Subject to the provisions of this part, the Secretary shall award grants to State educational agencies to carry out the reading and literacy activities authorized under this section and sections 2254 through 2256.

"(2) LIMITATIONS.— "(A) SINGLE GRANT PER STATE.—A State educational agency may not receive more than one grant under paragraph (1).

"(B) 3-YEAR TERM.—A State educational agency that receives a grant under paragraph (1) may expend the funds provided under the grant only during the 3-year period beginning on the date on which the grant is made.

**"(b) APPLICATION.—**

"(1) IN GENERAL.—A State educational agency that desires to receive a grant under this part shall submit an application to the Secretary at such time and in such form as the Secretary may require. The application shall contain the information described in paragraph (2).

"(2) CONTENTS.—An application under this sub-section shall contain the following:

"(A) An assurance that the Governor of the State, in consultation with the State educational agency, has established a reading and literacy partnership described in subsection (d), and a description of how such partnership—

"(i) assisted in the development of the State plan;

"(ii) will be involved in advising on the selection of subgrantees under sections 2255 and 2256; and

"(iii) will assist in the oversight and evaluation of such subgrantees.

"(B) A description of the following:

"(i) How the State educational agency will ensure that professional development activities related to reading instruction and provided under this part are—"(I) coordinated with other State and local level funds and used effectively to improve instructional practices for reading; and "(II) based on scientifically based reading research.

"(ii) How the activities assisted under this part will address the needs of teachers and other instructional staff, and will effectively teach students to read, in schools receiving assistance under section 2255 and 2256.

"(iii) The extent to which the activities will prepare teachers in all the major components of reading instruction (including phonemic awareness, systematic phonics, fluency, and reading comprehension).

"(iv) How the State educational agency will use technology to enhance reading and literacy professional development activities for teachers, as appropriate.

"(v) How parents can participate in literacy-related activities assisted under this part to enhance their children's reading.

"(vi) How subgrants made by the State educational agency under sections 2255 and 2256 will meet the requirements of this part, including how the State educational agency will ensure that subgrantees will use practices based on scientifically based reading research.

"(vii) How the State educational agency will, to the extent practicable, make grants to subgrantees in both rural and urban areas.

"(viii) The process that the State used to establish the reading and literacy partnership described in subsection (d).

"(C) An assurance that each local educational agency to which the State educational agency makes a subgrant—

"(i) will provide professional development for the classroom teacher and other appropriate instructional staff on the teaching of reading based on scientifically based reading research;

"(ii) will provide family literacy services based on programs such as the Even Start family literacy model authorized under part B of title I, to enable parents to be their child's first and most important teacher;

"(iii) will carry out programs to assist those kindergarten students who are not ready for the transition to first grade, particularly students experiencing difficulty with reading skills; and

"(iv) will use supervised individuals (including tutors), who have been appropriately trained using scientifically based reading research, to provide additional support, before school, after school, on weekends, during noninstructional periods of the school day, or during the summer, for children preparing to enter kindergarten and students in kindergarten through grade 3 who are experiencing difficulty reading.

"(D) An assurance that instruction in reading will be provided to children with reading difficulties who—

"(i) are at risk of being referred to special education based on these difficulties; or

"(ii) have been evaluated under section 614 of the Individuals with Disabilities Education Act but, in accordance with section 614(b)(5) of such Act, have not been identified as being a child with a disability (as defined in section 602 of the such Act).

"(E) A description of how the State educational agency—

"(i) will build on, and promote coordination among, literacy programs in the State (including federally funded programs such as the Adult Education and Family Literacy Act and the Individuals with Disabilities Education Act), in order to increase the effectiveness of the programs in improving reading for adults and children and to avoid duplication of the efforts of the programs;

"(ii) will promote reading and library programs that provide access to engaging reading material;

"(iii) will make local educational agencies described in sections 2255(a)(1) and 2256(a)(1) aware of the availability of subgrants under sections 2255 and 2256; and

"(iv) will assess and evaluate, on a regular basis, local educational agency activities assisted under this part, with respect to whether they have been effective in achieving the purposes of this part.

"(F) A description of the evaluation instrument the State educational agency will use for purposes of the assessments and evaluations under subparagraph (E)(iv).

"(c) APPROVAL OF APPLICATIONS.—

"(1) IN GENERAL.—The Secretary shall approve an application of a State educational agency under this section only—

"(A) if such application meets the requirement of this section; and

"(B) after taking into account the extent to which the application furthers the purposes of this part and the overall quality of the application.

"(2) PEER REVIEW.—

"(A) IN GENERAL.—The Secretary, in consultation with the National Institute for Literacy, shall convene a panel to evaluate applications under this section. At a minimum, the panel shall include—

"(i) representatives of the National Institute for Literacy, the National Research Council of the National Academy of Sciences, and the National Institute of Child Health and Human Development;

"(ii) 3 individuals selected by the Secretary;

"(iii) 3 individuals selected by the National Institute for Literacy;

"(iv) 3 individuals selected by the National Research Council of the National Academy of Sciences; and

"(v) 3 individuals selected by the National Institute of Child Health and Human Development.

"(B) EXPERTS.—The panel shall include experts who are competent, by virtue of their training, expertise, or experience, to evaluate applications under this section, and experts who provide professional development to teachers of reading to children and adults, and experts who provide professional development to other instructional staff, based on scientifically based reading research.

"(C) PRIORITY.—The panel shall recommend grant applications from State educational agencies under this section to the Secretary for funding or for disapproval. In making such recommendations, the panel shall give priority to applications from State educational agencies whose States have modified, are modifying, or provide an assurance that not later than 18 months after receiving a

grant under this section the State educational agencies will increase the training and the methods of teaching reading required for certification as an elementary school teacher to reflect scientifically based reading research, except that nothing in this Act shall be construed to establish a national system of teacher certification.

"(D) MINIMUM GRANT AMOUNTS.—

"(i) STATES.—Each State educational agency selected to receive a grant under this section shall receive an amount for the grant period that is not less than \$500,000.

"(ii) OUTLYING AREAS.—The Virgin Islands, Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands selected to receive a grant under this section shall receive an amount for the grant period that is not less than \$100,000.

"(E) LIMITATION.—The Republic of the Marshall Islands, the Federated States of Micronesia, and the Republic of Palau shall not be eligible to receive a grant under this part.

"(d) READING AND LITERACY PARTNERSHIPS.—

"(1) REQUIRED PARTICIPANTS.—In order for a State educational agency to receive a grant under this section, the Governor of the State, in consultation with the State educational agency, shall establish a reading and literacy partnership consisting of at least the following participants:

"(A) The Governor of the State.

"(B) The chief State school officer.

"(C) The chairman and the ranking member of each committee of the State legislature that is responsible for education policy.

"(D) A representative, selected jointly by the Governor and the chief State school officer, of at least one local educational agency that is eligible to receive a subgrant under section 2255.

"(E) A representative, selected jointly by the Governor and the chief State school officer, of a community-based organization working with children to improve their reading skills, particularly a community-based organization using tutors and scientifically based reading research.

"(F) State directors of appropriate Federal or State programs with a strong reading component.

"(G) A parent of a public or private school student or a parent who educates their child or children in their home, selected jointly by the Governor and the chief State school officer.

"(H) A teacher who successfully teaches reading and an instructional staff member, selected jointly by the Governor and the chief State school officer.

"(I) A family literacy service provider selected jointly by the Governor and the chief state school officer.

"(2) OPTIONAL PARTICIPANTS.—A reading and literacy partnership may include additional participants, who shall be selected jointly by the Governor and the chief State school officer, and who may include a representative of—

"(A) an institution of higher education operating a program of teacher preparation based on scientifically based reading research in the State;

"(B) a local educational agency;

"(C) a private nonprofit or for-profit eligible professional development provider providing instruction based on scientifically based reading research;

"(D) an adult education provider;

"(E) a volunteer organization that is involved in reading programs; or

"(F) a school library or a public library that offers reading or literacy programs for children or families.

"(3) **PREEXISTING PARTNERSHIP.**—If, before the date of the enactment of the Reading Excellence Act, a State established a consortium, partnership, or any other similar body, that includes the Governor and the chief State school officer and has, as a central part of its mission, the promotion of literacy for children in their early childhood years through the 3d grade and family literacy services, but that does not satisfy the requirements of paragraph (1), the State may elect to treat that consortium, partnership, or body as the reading and literacy partnership for the State notwithstanding such paragraph, and it shall be considered a reading and literacy partnership for purposes of the other provisions of this part.

#### **"SEC. 2254. USE OF AMOUNTS BY STATE EDUCATIONAL AGENCIES.**

"A State educational agency that receives a grant under section 2253—

"(1) shall use not more than 5 percent of the funds made available under the grant for the administrative costs of carrying out this part (excluding section 2256), of which not more than 2 percent may be used to carry out section 2259; and

"(2) shall use not more than 15 percent of the funds made available under the grant to solicit applications for, award, and oversee the performance of, not less than one subgrant pursuant to section 2256.

#### **"SEC. 2255. LOCAL READING IMPROVEMENT SUBGRANTS.**

"(a) **IN GENERAL.**—

"(1) **SUBGRANTS.**—A State educational agency that receives a grant under section 2253 shall make subgrants, on a competitive basis, to local educational agencies that either—

"(A) have at least one school that is identified for school improvement under section 1116(c) in the geographic area served by the agency;

"(B) have the largest, or second largest, number of children who are counted under section 1124(c), in comparison to all other local educational agencies in the State; or

"(C) have the highest, or second highest, school-age child poverty rate, in comparison to all other local educational agencies in the State.

For purposes of subparagraph (C), the term 'school-age child poverty rate' means the number of children counted under section 1124(c) who are living within the geographic boundaries of the local educational agency, expressed

as a percentage of the total number of children aged 5-17 years living within the geographic boundaries of the local educational agency.

"(2) SUBGRANT AMOUNT.—A subgrant under this section shall consist of an amount sufficient to enable the subgrant recipient to operate a program for a 2-year period and may not be revoked or terminated on the grounds that a school ceases, during the grant period, to meet the requirements of subparagraph (A), (B), or (C) of paragraph (1).

"(b) APPLICATIONS.—A local educational agency that desires to receive a subgrant under this section shall submit an application to the State educational agency at such time, in such manner, and including such information as the agency may require. The application—

"(1) shall describe how the local educational agency will work with schools selected by the agency to receive assistance under subsection (d)(1)—

"(A) to select one or more programs of reading instruction, developed using scientifically based reading research, to improve reading instruction by all academic teachers for all children in each of the schools selected by the agency under such subsection and, where appropriate, for their parents; and

"(B) to enter into an agreement with a person or entity responsible for the development of each program selected under subparagraph (A), or a person with experience or expertise about the program and its implementation, under which the person or entity agrees to work with the local educational agency and the schools in connection with such implementation and improvement efforts;

"(2) shall include an assurance that the local educational agency—

"(A) will carry out professional development for the classroom teacher and other instructional staff on the teaching of reading based on scientifically based reading research;

"(B) will provide family literacy services based on programs such as the Even Start family literacy model authorized under part B of title I, to enable parents to be their child's first and most important teacher;

"(C) will carry out programs to assist those kindergarten students who are not ready for the transition to first grade, particularly students experiencing difficulty with reading skills; and

"(D) will use supervised individuals (including tutors), who have been appropriately trained using scientifically based reading research, to provide additional support, before school, after school, on weekends, during non-instructional periods of the school day, or during the summer, for children preparing to enter kindergarten and students in kindergarten through grade 3 who are experiencing difficulty reading;

"(3) shall describe how the applicant will ensure that funds available under this part, and funds available for reading instruction for kindergarten through grade 6 from other appropriate sources, are effectively coordinated, and, where appropriate, integrated with funds under this Act in order to improve existing activities in the areas of reading instruction, professional development, program improvement, parental involvement, technical assistance, and other activities that can help meet the purposes of this part;

"(4) shall describe, if appropriate, how parents, tutors, and early childhood education providers will be assisted by, and participate in, literacy-related activities receiving financial assistance under this part to enhance children's reading fluency;

"(5) shall describe how the local educational agency—

"(A) provides instruction in reading to children with reading difficulties who—

"(i) are at risk of being referred to special education based on these difficulties; or

"(ii) have been evaluated under section 614 of the Individuals with Disabilities Education Act but, in accordance with section 614(b)(5) of such Act, have not been identified as being a child with a disability (as defined in section 602 of the such Act); and

"(B) will promote reading and library programs that provide access to engaging reading material; and

"(6) shall include an assurance that the local educational agency will make available, upon request and in an understandable and uniform format, to any parent of a student attending any school selected to receive assistance under subsection (d)(1) in the geographic area served by the local educational agency, information regarding the professional qualifications of the student's classroom teacher to provide instruction in reading.

*"(c) SPECIAL RULE.—To the extent feasible, a local educational agency that desires to receive a grant under this section shall form a partnership with one or more community-based organizations of demonstrated effectiveness in early childhood literacy, and reading readiness, reading instruction, and reading achievement for both adults and children, such as a Head Start program, family literacy program, public library, or adult education program, to carry out the functions described in paragraphs (1) through (6) of subsection (b). In evaluating subgrant applications under this section, a State educational agency shall consider whether the applicant has satisfied the requirement in the preceding sentence. If not, the applicant must provide information on why it would not have been feasible for the applicant to have done so.*

*"(d) USE OF FUNDS.—*

"(1) IN GENERAL.—Subject to paragraph (2), a local educational agency that receives a subgrant under this section shall use amounts from the subgrant to carry out activities to advance reform of reading instruction in any school that is (A) described in subsection (a)(1)(A), (B) has the largest, or second largest, number of children who are counted under section 1124(c), in comparison to all other schools in the local educational agency, (C) has the highest, or second highest, school-age child poverty rate (as defined in the second sentence of subsection (a)(1)), in comparison to all other schools in the local educational agency. Such activities shall include the following:

"(A) Securing technical and other assistance from—

"(i) a program of reading instruction based on scientifically based reading research;

"(ii) a person or entity with experience or expertise about such program and its implementation, who has agreed to work with the recipient in connection with its implementation; or

"(iii) a program providing family literacy services.

"(B) Providing professional development activities to teachers and other instructional staff (including training of tutors), using scientifically based reading research and purchasing of curricular and other supporting materials.

"(C) Promoting reading and library programs that provide access to engaging reading material.

"(D) Providing, on a voluntary basis, training to parents of children enrolled in a school selected to receive assistance under subsection (d)(1) on how to help their children with school work, particularly in the development of reading skills. Such training may be provided directly by the subgrant recipient, or through a grant or contract with another person. Such training shall be consistent with reading reforms taking place in the school setting. No parent shall be required to participate in such training.

"(E) Carrying out family literacy services based on programs such as the Even Start family literacy model authorized under part B of title I, to enable parents to be their child's first and most important teacher.

"(F) Providing instruction for parents of children enrolled in a school selected to receive assistance under subsection (d)(1), and others who volunteer to be reading tutors for such children, in the instructional practices based on scientifically based reading research used by the applicant.

"(G) Programs to assist those kindergarten students enrolled in a school selected to receive assistance under subsection (d)(1) who are not ready for the transition to first grade, particularly students experiencing difficulty with reading skills.

"(H) Providing additional support for children preparing to enter kindergarten and students in kindergarten through grade 3 who are enrolled in a school selected to receive assistance under subsection (d)(1), who are experiencing difficulty reading, before school, after school, on weekends, during noninstructional periods of the school day, or during the summer, using supervised individuals (including tutors), who have been appropriately trained using scientifically based reading research.

"(I) Providing instruction in reading to children with reading difficulties who—

"(i) are at risk of being referred to special education based on these difficulties; or

"(ii) have been evaluated under section 614 of the Individuals with Disabilities Education Act but, in accordance with section 614(b)(5) of such Act, have not been identified as being a child with a disability (as defined in section 602 of the such Act).

"(J) Providing coordination of reading, library, and literacy programs within the local educational agency to avoid duplication and increase the effectiveness of reading, library, and literacy activities.

"(2) LIMITATION ON ADMINISTRATIVE EXPENSES.— A recipient of a subgrant under this section may use not more than 5 percent of the subgrant funds for administrative costs.

*"(e) TRAINING NONRECIPIENTS.—A recipient of a subgrant under this section may train, on a fee-for-service basis, personnel from schools, or local educational agencies, that are not a beneficiary of, or receiving, such a subgrant, in the*

*instructional practices based on scientifically based reading research used by the recipient. Such a non-recipient school or agency may use funds received under title I of this Act, and other appropriate Federal funds used for reading instruction, to pay for such training, to the extent consistent with the law under which such funds were received.*

## **"SEC. 2256. TUTORIAL ASSISTANCE SUBGRANTS.**

### **"(a) IN GENERAL.—**

**"(1) SUBGRANTS.—**Except as provided in paragraph (4), a State educational agency that receives a grant under section 2253 shall make at least one subgrant on a competitive basis to—

**"(A) local educational agencies that have at least one school in the geographic area served by the agency that—**

**"(i) is located in an area designated as an empowerment zone under part I of sub-chapter U of chapter 1 of the Internal Revenue Code of 1986; or**

**"(ii) is located in an area designated as an enterprise community under part I of subchapter U of chapter 1 of the Internal Revenue Code of 1986;**

**"(B) local educational agencies that have at least one school that is identified for school improvement under section 1116(c) in the geographic area served by the agency;**

**"(C) local educational agencies with the largest, or second largest, number of children who are counted under section 1124(c), in comparison to all other local educational agencies in the State; or**

**"(D) local educational agencies with the highest, or second highest, school-age child poverty rate, in comparison to all other local educational agencies in the State.**

For purposes of subparagraph (D), the term 'school-age child poverty rate' means the number of children counted under section 1124(c) who are living within the geographic boundaries of the local educational agency, expressed as a percentage of the total number of children aged 5-17 years living within the geographic boundaries of the local educational agency.

### **"(2) NOTIFICATION.—**

**"(A) TO LOCAL EDUCATIONAL AGENCIES.—**A State educational agency shall provide notice to all local educational agencies within the State regarding the availability of the subgrants under this section.

**"(B) TO PROVIDERS AND PARENTS.—**Not later than 30 days after the date on which the State educational agency provides notice under subparagraph (A), each local educational agency described in paragraph (1) shall, as a condition on the agency's receipt of funds made available under title I of this Act, provide public notice to potential providers of tutorial assistance operating in the jurisdiction of the agency, and parents residing in such jurisdiction, regarding the availability of the subgrants under this section.

**"(3) APPLICATION.—**A local educational agency that desires to receive a subgrant under this section shall submit an application to the State educational

agency at such time, in such manner, and including such information as the agency may require. The application shall include an assurance that the local educational agency will use the subgrant funds to carry out the duties described in subsection (b) for children enrolled in any school selected by the agency that (A) is described in paragraph (1)(A), (B) is described in paragraph (1)(B), (C) has the largest, or second largest, number of children who are counted under section 1124(c), in comparison to all other schools in the local educational agency, or (D) has the highest, or second highest, school-age child poverty rate (as defined in the second sentence of paragraph (1)), in comparison to all other schools in the local educational agency.

"(4) EXCEPTION.—If no local educational agency within the State submits an application to receive a subgrant under this section within the 6-month period beginning on the date on which the State educational agency provided notice to the local educational agencies regarding the availability of the subgrants, the State educational agency may use funds otherwise re-served under 2254(2) for the purpose of providing local reading improvement subgrants under section 2255 if the State educational agency certifies to the Secretary that the requirements of paragraph (2) have been met and each local educational agency in the State described in subparagraph (B) of such paragraph has demonstrated to the State educational agency that no provider of tutorial assistance described in such subparagraph requested the local educational agency to submit under paragraph (3) an application for a tutorial assistance subgrant.

**"(b) USE OF FUNDS.—**

"(1) IN GENERAL.—A local educational agency that receives a subgrant under this section shall carry out, using the funds provided under the subgrant, each of the duties described in paragraph (2).

"(2) DUTIES.—The duties described in this paragraph are the provision of tutorial assistance in reading, before school, after school, on weekends, or during the summer, to children who have difficulty reading, using instructional practices based on scientifically based reading research, through the following:

"(A) The creation and implementation of objective criteria to determine in a uniform manner the eligibility of tutorial assistance providers and tutorial assistance programs desiring to provide tutorial assistance under the subgrant. Such criteria shall include the following:

"(i) A record of effectiveness with respect to reading readiness, reading instruction for children in kindergarten through 3d grade, and early childhood literacy, as appropriate.

"(ii) Location in a geographic area convenient to the school or schools attended by the children who will be receiving tutorial assistance.

"(iii) The ability to provide tutoring in reading to children who have difficulty reading, using instructional practices based on scientifically based reading research and consistent with the reading instructional methods and content used by the school the child attends.

"(B) The provision, to parents of a child eligible to receive tutorial assistance pursuant to this section, of multiple choices among tutorial assistance providers and tutorial assistance programs determined to be eligible under the criteria described in subparagraph (A). Such choices shall include a

school-based program and at least one tutorial assistance program operated by a provider pursuant to a contract with the local educational agency.

“(C) The development of procedures—

“(i) for the provision of information to parents of an eligible child regarding such parents' choices for tutorial assistance for the child;

“(ii) for considering children for tutorial assistance who are identified under subparagraph (D) and for whom no parent has selected a tutorial assistance provider or tutorial assistance program that give such parents additional opportunities to select a tutorial assistance provider or tutorial assistance program referred to in subparagraph (B); and

“(iii) that permit a local educational agency to recommend a tutorial assistance provider or tutorial assistance program in a case where a parent asks for assistance in the making of such selection.

“(D) The development of a selection process for providing tutorial assistance in accordance with this paragraph that limits the provision of assistance to children identified, by the school the child attends, as having difficulty reading, including difficulty mastering phonemic awareness, systematic phonics, fluency, and reading comprehension.

“(E) The development of procedures for selecting children to receive tutorial assistance, to be used in cases where insufficient funds are available to provide assistance with respect to all children identified by a school under subparagraph (D), that—

“(i) give priority to children who are determined, through State or local reading assessments, to be most in need of tutorial assistance; and

“(ii) give priority, in cases where children are determined, through State or local reading assessments, to be equally in need of tutorial assistance, based on a random selection principle.

“(F) The development of a methodology by which payments are made directly to tutorial assistance providers who are identified and selected pursuant to this section and selected for funding. Such methodology shall include the making of a contract, consistent with State and local law, between the provider and the local educational agency. Such contract shall satisfy the following requirements:

“(i) It shall contain specific goals and timetables with respect to the performance of the tutorial assistance provider.

“(ii) It shall require the tutorial assistance provider to report to the local educational agency on the provider's performance in meeting such goals and timetables.

“(iii) It shall specify the measurement techniques that will be used to evaluate the performance of the provider.

“(iv) It shall require the provider to meet all applicable Federal, State, and local health, safety, and civil rights laws.

"(v) It shall ensure that the tutorial assistance provided under the contract is consistent with reading instruction and content used by the local educational agency.

"(vi) It shall contain an agreement by the provider that information regarding the identity of any child eligible for, or enrolled in the program, will not be publicly disclosed without the permission of a parent of the child.

"(vii) It shall include the terms of an agreement between the provider and the local educational agency with respect to the provider's purchase and maintenance of adequate general liability insurance.

"(viii) It shall contain provisions with respect to the making of payments to the provider by the local educational agency.

"(G) The development of procedures under which the local educational agency carrying out this paragraph—

"(i) will ensure oversight of the quality and effectiveness of the tutorial assistance provided by each tutorial assistance provider that is selected for funding;

"(ii) will provide for the termination of contracts with ineffective and unsuccessful tutorial assistance providers (as determined by the local educational agency based upon the performance of the provider with respect to the goals and timetables contained in the contract between the agency and the provider under subparagraph (F));

"(iii) will provide to each parent of a child identified under subparagraph (D) who requests such information for the purpose of selecting a tutorial assistance provider for the child, in a comprehensible format, information with respect to the quality and effectiveness of the tutorial assistance referred to in clause (i);

"(iv) will ensure that each school identifying a child under subparagraph (D) will provide upon request, to a parent of the child, assistance in selecting, from among the tutorial assistance providers who are identified pursuant to subparagraph (B) the provider who is best able to meet the needs of the child;

"(v) will ensure that parents of a child receiving tutorial assistance pursuant to this section are informed of their child's progress in the tutorial program; and

"(vi) will ensure that it does not disclose the name of any child who may be eligible for tutorial assistance pursuant to this section, the name of any parent of such a child, or any other personally identifiable information about such a parent or child, to any tutorial assistance provider (excluding the agency itself), without the prior written consent of such parent.

#### **"SEC. 2257. NATIONAL EVALUATION.**

"From funds reserved under section 2260(b)(1), the Secretary, through grants or contracts, shall conduct a national assessment of the programs under this part. In developing the criteria for the assessment, the Secretary shall receive recommendations from the peer review panel convened under section 2253(c)(2).

**"SEC. 2258. INFORMATION DISSEMINATION.**

*"(a) IN GENERAL.—From funds reserved under section 2260(b)(2), the National Institute for Literacy shall disseminate information on scientifically based reading research and information on subgrantee projects under section 2255 or 2256 that have proven effective. At a minimum, the institute shall disseminate such information to all recipients of Federal financial assistance under titles I and VII of this Act, the Head Start Act, the Individuals with Disabilities Education Act, and the Adult Education and Family Literacy Act.*

*"(b) COORDINATION.—In carrying out this section, the National Institute for Literacy—*

*"(1) shall use, to the extent practicable, information networks developed and maintained through other public and private persons, including the Secretary, the National Center for Family Literacy, and the Readline Program;*

*"(2) shall work in conjunction with any panel convened by the National Institute of Child Health and Human Development and the Secretary and any panel convened by the Office of Educational Research and Improvement to assess the current status of research based knowledge on reading development, including the effectiveness of various approaches to teaching children to read, with respect to determining the criteria by which the National Institute for Literacy judges scientifically based reading research and the design of strategies to disseminate such information; and*

*"(3) may assist any State educational agency selected to receive a grant under section 2253, and that requests such assistance—*

*"(A) in determining whether applications submitted under section 2253 meet the requirements of this title relating to scientifically based reading research; and*

*"(B) in the development of subgrant application forms.*

**"SEC. 2259. STATE EVALUATIONS; PERFORMANCE REPORTS.**

*"(a) STATE EVALUATIONS.—*

*"(1) IN GENERAL.—Each State educational agency that receives a grant under section 2253 shall evaluate the success of the agency's subgrantees in meeting the purposes of this part. At a minimum, the evaluation shall measure the extent to which students who are the intended beneficiaries of the subgrants made by the agency have improved their reading skills.*

*"(2) CONTRACT.—A State educational agency shall carry out the evaluation under this subsection by entering into a contract with an entity that conducts scientifically based reading research, under which contract the entity will perform the evaluation.*

*"(3) SUBMISSION.—A State educational agency shall submit the findings from the evaluation under this subsection to the Secretary. The Secretary shall submit a summary of the findings from the evaluations under this subsection and the national assessment conducted under section 2257 to the appropriate committees of the Congress, including the Committee on Education and the Workforce of the House of Representatives and the Committee on Labor and Human Resources of the Senate.*

**"(b) PERFORMANCE REPORTS.**—A State educational agency that receives a grant under section 2253 shall submit performance reports to the Secretary pursuant to a schedule to be determined by the Secretary, but not more frequently than annually. Such reports shall include—

"(1) with respect to subgrants under section 2255, the program or programs of reading instruction, based on scientifically based reading research, selected by subgrantees;

"(2) the results of use of the evaluation referred to in section 2253(b)(2)(E)(iv); and

"(3) a description of the subgrantees receiving funds under this part.

## **"SEC. 2260. AUTHORIZATIONS OF APPROPRIATIONS; RESERVATIONS**

**FROM APPROPRIATIONS; SUNSET.**

**"(a) AUTHORIZATIONS.**—

"(1) FY 1999.—There are authorized to be appropriated to carry out this part and section 1202(c) \$260,000,000 for fiscal year 1999.

"(2) FY 2000.—There are authorized to be appropriated to carry out this part and section 1202(c) \$260,000,000 for fiscal year 2000.

**"(b) RESERVATIONS.**—From each of the amounts appropriated under subsection (a) for a fiscal year, the Secretary—

"(1) shall reserve 1.5 percent to carry out section 2257(a);

"(2) shall reserve \$5,000,000 to carry out section 2258; and

"(3) shall reserve \$10,000,000 to carry out section 1202(c).

**"(c) SUNSET.**—Notwithstanding section 422(a) of the General Education Provisions Act, this part is not subject to extension under such section."

**(b) CONFORMING AMENDMENTS.**—

**(1) AUTHORIZATION OF APPROPRIATIONS.**—Section 2003 of the Elementary and Secondary Education Act of 1965 (20 U.S.C. 6603) is amended—

(A) in subsection (a), by striking "title," and inserting "title (other than part C)"; and

(B) in subsection (b)(3), by striking "part C" and inserting "part D".

**(2) PRIORITY FOR PROFESSIONAL DEVELOPMENT IN MATHEMATICS AND SCIENCE.**—Section 2206 of the Elementary and Secondary Education Act of 1965 (20 U.S.C. 6646) is amended by inserting "(other than part C)" after "for this title" each place such term appears.

**(3) REPORTING AND ACCOUNTABILITY.**—Section 2401 of the Elementary and Secondary Education Act of 1965 (20 U.S.C. 6701) is amended by striking "under this part" each place such term appears and inserting "under this title (other than part C)".

**(4) DEFINITIONS.**—Section 2402 of the Elementary and Secondary Education Act of 1965 (20 U.S.C. 6701) is amended by striking "this part—" and inserting "this title (other than part C)—".

(5) GENERAL DEFINITIONS.—Section 14101(10)(C) of the Elementary and Secondary Education Act of 1965 (20 U.S.C. 8801(10)(C)) is amended by striking "part C" and inserting "part D".

(6) PARTICIPATION BY PRIVATE SCHOOL CHILDREN AND TEACHERS.—Section 14503(b)(1)(B) of the Elementary and Secondary Education Act of 1965 (20 U.S.C. 8893(b)(1)(B)) is amended by striking "part C" and inserting "part D".

## SUBTITLE II—AMENDMENTS TO EVEN START FAMILY LITERACY PROGRAMS

### SEC. 201. RESERVATION FOR GRANTS.

Section 1202(c) of the Elementary and Secondary Education Act of 1965 (20 U.S.C. 6362(c)) is amended to read as follows:

"(c) RESERVATION FOR GRANTS.—

"(1) GRANTS AUTHORIZED.—From funds reserved under section 2260(b)(3), the Secretary shall award grants, on a competitive basis, to States to enable such States to plan and implement statewide family literacy initiatives to coordinate and, where appropriate, integrate existing Federal, State, and local literacy resources consistent with the purposes of this part. Such coordination and integration shall include funds available under the Adult Education and Family Literacy Act, the Head Start Act, this part, part A of this title, and part A of title IV of the Social Security Act.

"(2) CONSORTIA.—

"(A) ESTABLISHMENT.—To receive a grant under this subsection, a State shall establish a consortium of State-level programs under the following laws:

"(i) This title (other than part D).

"(ii) The Head Start Act.

"(iii) The Adult Education and Family Literacy Act.

"(iv) All other State-funded preschool programs and programs providing literacy services to adults.

"(B) PLAN.—To receive a grant under this subsection, the consortium established by a State shall create a plan to use a portion of the State's resources, derived from the programs referred to in subparagraph (A), to strengthen and expand family literacy services in such State.

"(C) COORDINATION WITH PART C OF TITLE II.—The consortium shall coordinate its activities with the activities of the reading and literacy partnership for the State established under section 2253(d), if the State educational agency receives a grant under section 2253.

"(3) READING INSTRUCTION.—Statewide family literacy initiatives implemented under this subsection shall base reading instruction on scientifically based reading research (as such term is defined in section 2252).

"(4) TECHNICAL ASSISTANCE.—The Secretary shall provide, directly or through a grant or contract with an organization with experience in the development and operation of successful family literacy services, technical assistance to States receiving a grant

under this subsection.

"(5) MATCHING REQUIREMENT.—The Secretary shall not make a grant to a State under this sub-section unless the State agrees that, with respect to the costs to be incurred by the eligible consortium in carrying out the activities for which the grant was awarded, the State will make available non-Federal contributions in an amount equal to not less than the Federal funds provided under the grant."

#### SEC. 202. DEFINITIONS.

Section 1202(e) of the Elementary and Secondary

Education Act of 1965 (20 U.S.C. 6362(e)) is amended—

(1) by redesignating paragraphs (3) and (4) as paragraphs (4) and (5), respectively; and  
(2) by inserting after paragraph (2) the following: "(3) the term 'family literacy services' means services provided to participants on a voluntary basis that are of sufficient intensity in terms of hours, and of sufficient duration, to make sustainable changes in

a family, and that integrate all of the following activities:

"(A) Interactive literacy activities between parents and their children.

"(B) Training for parents regarding how to be the primary teacher for their children and full partners in the education of their children.

"(C) Parent literacy training that leads to economic self-sufficiency.

"(D) An age-appropriate education to prepare children for success in school and life experiences.

#### SEC. 203. EVALUATION.

Section 1209 of the Elementary and Secondary Education

Act of 1965 (20 U.S.C. 6369) is amended—

(1) in paragraph (1), by striking "and" at the end;

(2) in paragraph (2), by striking the period at the end and inserting "; and"; and

(3) by adding at the end the following: "(3) to provide States and eligible entities receiving a subgrant under this part, directly or through a grant or contract with an organization with experience in the development and operation of successful

family literacy services, technical assistance to ensure local evaluations undertaken under section 1205(10) provide accurate information on the effectiveness of programs assisted under this part."

SEC. 204. INDICATORS OF PROGRAM QUALITY.

(a) IN GENERAL.—The Elementary and Secondary Education Act of 1965 is amended—

- (1) by redesignating section 1210 as section 1212; and
- (2) by inserting after section 1209 the following:

"SEC. 1210. INDICATORS OF PROGRAM QUALITY.

"Each State receiving funds under this part shall develop, based on the best available research and evaluation data, indicators of program quality for programs assisted

under this part. Such indicators shall be used to monitor, evaluate, and improve such programs within the State.

Such indicators shall include the following:

"(1) With respect to eligible participants in a program who are adults—

"(A) achievement in the areas of reading, writing, English language acquisition, problem

solving, and numeracy;

"(B) receipt of a high school diploma or a general equivalency diploma;

"(C) entry into a postsecondary school, job retraining program, or employment or career

advancement, including the military; and

"(D) such other indicators as the State may develop.

"(2) With respect to eligible participants in a program who are children—

"(A) improvement in ability to read on grade level or reading readiness;

"(B) school attendance;

"(C) grade retention and promotion; and

"(D) such other indicators as the State may develop."

(b) STATE LEVEL ACTIVITIES.—Section 1203(a) of the Elementary and Secondary Education Act of 1965 (20 U.S.C. 6363(a)) is amended—

- (1) in paragraph (1), by striking "and" at the end;
- (2) in paragraph (2), by striking the period at the end and inserting "; and"; and
- (3) by adding at the end the following: "(3) carrying out section 1210."

(c) AWARD OF SUBGRANTS.—Paragraphs (3) and (4) of section 1208(b) of the Elementary and Secondary Education Act of 1965 (20 U.S.C. 6368) are amended to read

as follows:

"(3) CONTINUING ELIGIBILITY.—In awarding subgrant funds to continue a program under this part for the second, third, or fourth year, the State educational agency shall evaluate the program based on the indicators of program quality developed by the

State under section 1210. Such evaluation shall take place after the conclusion of the startup period, if any.

"(4) INSUFFICIENT PROGRESS.—The State educational agency may refuse to award subgrant funds if such agency finds that the eligible entity has not sufficiently improved the performance of the program, as evaluated based on the indicators of program quality

developed by the State under section 1210, after—

"(A) providing technical assistance to the eligible entity; and

"(B) affording the eligible entity notice and an opportunity for a hearing."

#### SEC. 205. RESEARCH.

The Elementary and Secondary Education Act of 1965, as amended by section 204 of this Act, is further amended by inserting after section 1210 the following:

#### "SEC. 1211. RESEARCH.

"(a) *IN GENERAL.*—The Secretary shall carry out, through grant or contract, research into the components of successful family literacy services, to use—

"(1) to improve the quality of existing programs assisted under this part or other family literacy programs

carried out under this Act or the Adult Education and Family Literacy Act; and

"(2) to develop models for new programs to be carried out under this Act or the Adult Education and Family Literacy Act.

"(b) *DISSEMINATION.*—The National Institute for Literacy shall disseminate, pursuant to section 2258, the results of the research described in subsection (a) to States

and recipients of subgrants under this part."

# An Action Strategy for Improving Achievement in Mathematics and Science

February 1998

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## **An Action Strategy for Improving Achievement in Mathematics and Science**

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U.S. Department of Education  
Washington, DC



National Science Foundation  
Arlington, VA

The President  
The White House  
Washington, DC 20500

Dear Mr. President:

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

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

Because mathematics and science provide many of the underpinnings necessary for students and society to navigate this ever changing technological and information age, in a March 6, 1997, Presidential Directive, you asked us to convene a working group to develop an "action strategy" for using Federal resources to assist State and local school systems to prepare students to meet challenging mathematics standards in the eighth grade and for involving the mathematics, science, and technical communities in those efforts. You asked that the action strategy include recommendations for using Federal resources to help States, local educational agencies, and schools implement their efforts to improve teaching, upgrade curriculum, and integrate technology and high-quality instructional materials into the classroom, and to motivate students and help them understand how mathematics concepts are applied in the real world. You asked the working group to review the current status of improvements in mathematics education and to identify and address critical areas of need, drawing on research and input from educators and professional organizations. Finally, you asked us to explore how Federal resources and partnerships with other organizations can help improve student achievement in mathematics and science.

We believe that the enclosed action strategy meets those objectives in all respects. Consistent with your Directive, and with the results of the Third International Mathematics and Science Study (TIMSS), the strategy focuses most prominently on the improvement of middle-school (grade 5-8) mathematics, but also addresses broader

needs in all of elementary and secondary mathematics and science education. More specifically, the strategy proposes a new Federal effort focusing on middle school mathematics, with an extension to other areas of mathematics and science in future years.

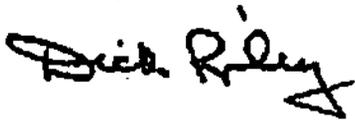
Also consistent with your Directive, the strategy focuses on three principal areas where Federal investments can achieve maximum leverage and impact: upgrading teaching, improving curriculum and instructional materials, and building parent and public awareness and engagement. In each of these areas,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

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

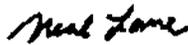
While we will initiate these efforts this year, the potential for bringing about significant improvements in the mathematics education of the Nation's 13.5 million middle school students, and in elementary and secondary mathematics and science education more broadly, will depend on the level of resources the Federal Government commits to this effort. In order to benefit a significant number of schools, teachers, and students in the coming years, we have included additional funds for activities linked to the action strategy in our respective fiscal year 1999 budget requests. The additional funding, if we can obtain it, should have a synergistic impact because our new activities should result in more effective use of the existing investments that the Federal Government now makes available to schools for mathematics and science education and for related education purposes.

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

Yours sincerely,



Richard Riley  
Secretary of Education



Neal Lane  
Director, National Science Foundation

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[Executive Summary]

## **Executive Summary**

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

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

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

The action strategy:

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

and industry in developing a strong network of local partnerships aimed at raising student achievement.

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

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

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

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

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

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

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

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

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

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[Cover Letter]



[Section I]

## I. Introduction

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

### The Presidential Directive

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

### The Need for Action

#### *The Third International Mathematics and Science Study*

Results of the Third International Mathematics and Science Study (TIMSS) make clear the need for action to improve mathematics and science education prior to eighth grade. Results of tests administered in 1995 to students in grades 4 and 8 are now available. The fourth grade results show U.S. students above the international average in both science and mathematics. In science, U.S. students were outperformed only by those in Korea. However, the eighth grade results show lackluster performance by U.S. students, with scores only a bit above the international average in science, and below the international average in mathematics. Results for the twelfth grade will be released shortly. They are expected to show even poorer performance than the eighth grade results.

TIMSS results for the fourth grade are much more positive than the results of similar international comparisons in the past. They demonstrate that our students are mastering the basics of arithmetic and introductory science, that it is possible to make significant progress in international comparisons over time, and that U.S. students can compete favorably with those of other nations in

#### The Third International Mathematics and Science Study

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

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

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

mathematics and science achievement in the early grades.

Our National Education Goals proclaim our dedication to making U.S. students first in the world in mathematics and science achievement by the year 2000. In the early grades, we are making demonstrable progress toward that goal. These results clearly indicate that mathematics and science education in the middle school years should be an important focus for national efforts to help ensure that our students meet world-class standards.

### *Opportunities for the Future*

Eighth grade is a critical point in mathematics education. Achievement at that stage lays the foundation for students to take the advanced high school mathematics and science courses that are keys to college entrance and well-paid jobs. Today, most students enter high school able to perform the basics of arithmetic, but far too many have failed to develop a foundation in the 21st century basics of algebra, geometry, and data analysis and cannot cope with multi-step problems. Unfortunately, many never gain these abilities, 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.

### *The Importance of Rigorous Standards*

In working toward the National Education Goals, States, districts, and national organizations have all supported the development of standards for benchmarking the performance of all students. The National Council of Teachers of Mathematics (NCTM)

was one of the first national organizations to develop sets of standards for content, teaching, and assessment, and many States and districts have modeled their standards on these. The NCTM framework emphasizes the importance of mastering the basics of arithmetic as well as more advanced topics and using them effectively in addressing complex problems. The National Research Council developed a comparable framework for science standards. It suggests more treatment in depth of fewer topics, in line with the TIMSS recommendations.

State and local educational agencies have worked to develop standards and approaches suitable to their circumstances, drawing as they find appropriate on frameworks established by national organizations such as these. Teachers teach and students respond to the level of expectations placed upon them. Thus, standards that are benchmarked to national and international norms can be used to raise expectations for achievement.

Another source of input to deliberations on standards is found in the content of TIMSS and the National Assessment of Educational Progress (NAEP). Managed by the independent National Assessment Governing Board, the content of the NAEP assessments reflects a collective judgment

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

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.

### **Standards and Improved Performance**

Standards improve student performance when they are combined with state and local strategies for curriculum improvement, teacher development, and assessment.

of State and local educational officials, content experts, and the community about what our children should know and be able to do in many fields. In mathematics and science, there is strong overlap between the NAEP framework and the NCTM and NRC standards, as well as State and local standards now being put in place.

### *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 NAEP framework and managed, as is NAEP, by the independent, bipartisan National Assessment Governing Board. It will be available by the spring of 2001. Parents and teachers will receive the results for each student, with scores linked to national and international benchmarks. Every year, all items on the test, along with answers, scoring guides, and other materials, will be released so that teachers, parents, and students can review performance on individual test items and know what is expected from students in reaching standards of excellence. For more information, see [Appendix 2](#).

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

### **Plan of Action: Place Immediate Focus on Mathematics**

The TIMSS results show the need for an immediate focus on mathematics education in grades 5-8, where the serious drop from above to below international norms in mathematics threatens achievement in both mathematics and science at higher grade levels. The President's proposed voluntary national 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 action strategy targets grades 5-8, building on a strong foundation of activity underway across the country to improve elementary and secondary mathematics and science education. It anticipates that these activities continue, at all levels in both mathematics and science, and lays the groundwork in both substance and process for expanded activities in the future.

### **Challenges for All Parties**

The goal of the action strategy is for all American

Seven years after a state judge ruled the school system "educationally bankrupted," Kentucky's comprehensive school reforms are generating substantial improvement in student performance. Since 1992, the percentage of elementary school students scoring in the "proficient" or "Distinguished" range in reading on the state's performance-based assessment has increased from 8 percent to 41 percent. The improvements are distributed across all grade levels, throughout every geographic region in the state, and in poor as well as wealthier communities.

Tougher graduation requirements in New York City public schools spurred thousands more high school students to take and pass college preparatory mathematics and science courses. The new course requirements grew out of a collaboration between the Chancellor of Education, the City University of New York (CUNY), and the United Federation of Teachers to increase the number of well-prepared students entering CUNY. By agreeing on challenging standards for what all high school students should learn, and by phasing in course requirements and professional development for teachers, New York City produced the best-prepared and most diverse freshman class at CUNY in two decades.

### **Raising Achievement for Disadvantaged Students**

Efforts to raise student achievement in mathematics and

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

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

Thus, the action strategy:

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

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

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

reach high standards of achievement in mathematics and science.

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

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[Executive Summary]  [Section II]

## II. Priorities for Action

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

### The Federal Role

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

### Priorities for Action

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

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

### Scope and Scale

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

The core of this action strategy is assisting all schools and districts to make more effective use of Federal resources in their efforts to address the above priorities with respect to mathematics in grades 5-8. The Department of Education and the National Science Foundation plan to provide opportunities for districts to accelerate their progress toward improved achievement in this area through incentives for enhanced coordination, planning, and implementation. Districts that serve large numbers of disadvantaged students will receive particular attention. The number of districts, schools, teachers, and students served will depend largely on the level of resources that can be devoted to the.

acceleration effort and the readiness of districts to respond.

At the same time, an effort at public information and engagement will provide a much-needed complementary mechanism to reach a broader base of students and their families. The participating Federal agencies, with their ties into the science, mathematics, engineering, and technology communities, are well-positioned to encourage these communities to cooperate in spurring such an effort.

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

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

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[Section I]  [Section III]

### III. Actions to Strengthen the Impact of Federal Resources

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

#### 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 developing their own standards and establishing assessment mechanisms to measure students' progress against them, in at least reading and mathematics. In addition, the reauthorization lowered the eligibility threshold for Title I schoolwide programs. Schools with at least 50 percent of students from low-income families may now use their Title I funds (along with other Federal, State, and local funds) to make comprehensive improvements in the instructional program of the entire school, rather than providing discrete services to individual children. This change gives those schools the flexibility, for instance, to use Title I funds to upgrade the mathematics curriculum for all students.

#### Current Federal Resources

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

establishes clear priorities for funding within the criteria for selection of awards, and holds grantees accountable for performance. Over the years, projects aimed specifically at mathematics in grades 5-8 have been comparatively scarce.

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

The 1994 reauthorization of Title I placed new emphasis on helping disadvantaged students meet the same challenging academic standards expected of all children. States are currently developing their own rigorous standards and assessments in reading and mathematics. The Department of Education works actively with States and school districts to identify actions that can be taken to achieve significant improvement,

#### Mathematics Education and the Department of Defense

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

The DoD Education Activity (DoDEA) provides education for military and civilian dependents overseas.

provides information and examples, and makes other 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. In general, their activities are related to their missions. For example, the U.S.

Environmental Protection Agency makes awards to schools, state agencies, nonprofit agencies and universities for activities that focus on environmental education. Most agencies offer staff and facilities, often on a volunteer basis, to support local schools and teachers and have developed and are sharing supplementary instructional materials on their Web sites.

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

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

## Strengthening the Impact of Federal Resources

### *Using Existing Programs*

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

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

### **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

### *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

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.

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.

## New Joint Activities

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

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

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

### 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 Title I, Eisenhower, and professional development activities in mathematics and science to more than 100 Title I schools serving more than 100,000 Title I students. In July, 1995, the SSI held an intensive summer institute designed to support Title I schools in (1) reconceptualizing the use of formula funds, (2) adopting mathematics curricula keyed to high standards, and (3) adopting effective schoolwide program models. As a result of the SSI/Title I collaboration, state mathematics and science leaders are now active members of school support teams engaged in mentoring over 700 Texas Title I schools. At the same time, increasing numbers of teachers in high poverty/high minority schools are being trained as SSI mathematics,

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

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

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

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

- **Public understanding and engagement mathematics initiative.**

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

- **Coordinated research and informational activities.**

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

- **Systematic involvement of other agencies.**

The Department and the Foundation will work systematically with other agencies to enhance the impact of Federal resources by

#### 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 the effective use of district funds toward improving achievement. In addition to the NSF funds,

upgrading their activities to reinforce an approach based on high standards for mathematics in grades 5-8.

an additional \$ 6.7 million from district funds and commitments from Eisenhower and other Federal dollars support the effort.

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.

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[Section II]    [Section IV]

## IV. Equip Teachers to Teach Challenging Mathematics

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

### 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.

This action strategy addresses both the professional development of teachers who are already in the classroom and the preparation of new teachers. In order to assist current teachers, the strategy promotes sustained and intensive professional development activities that are based on mastery of mathematical content and tied to high-quality instructional materials and

technology. Teacher preparation activities will aim at preparing future teachers of grades 5-8 to teach effectively the challenging mathematics content geared to national standards of excellence.

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

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

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

priorities for activities involving teachers of mathematics in grades 5-8, where feasible.

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

#### Improving Teaching Through Distance Learning

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

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

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

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

- Prepare and disseminate widely a study on State licensure requirements, focusing particularly on requirements for middle school teachers of mathematics, comparisons to other nations, and the impact of licensure requirements on the knowledge of mathematical concepts that teachers bring to their work in the classroom.
- Provide incentives for appropriate organizations to develop voluntary national standards for the preparation of teachers of mathematics.
- Support the development of materials for preparation of K-8 mathematics teachers that reflect both the basic skills and the critical thinking aspects of the NCTM standards, are tied to newly emerging instructional materials and educational

#### New Initiatives in Teacher Preparation: Reauthorization of Title V of the Higher Education Act

President Clinton has proposed a \$350 million initiative to attract talented people of all backgrounds into teaching at low-income schools across the U.S., and to improve dramatically the quality of training and preparation given to our future teachers, with an emphasis on mathematics and reading. Under the initiative, new scholarships would help bring nearly 35,000 outstanding new teachers into high-poverty

technologies, and reflect the rigor of the NAEP and TIMSS assessments.

- Challenge the Nation's colleges and universities to step up to the needs for preparing a new generation of teachers for the 21st century by encouraging, supporting, and funding the development of teacher preparation approaches that:

- more tightly link college departments of mathematics and schools of education;
- include courses focusing on developing the background concepts for the rigorous mathematical content that future teachers of mathematics in grades 5-8 will teach;
- demonstrate effective classroom practices; and
- involve local K-12 schools in the design of teacher preparation requirements.

schools in urban and rural areas over the next five years. These scholarships could cover costs of tuition, room, board, and other teacher preparation expenses -- and could help fund additional preparation during the first two years of teaching.

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

#### Teacher Preparation in Louisiana

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

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

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

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[Section III]



[Section V]

## V. Implement Curricula, Instructional Materials, and Educational Technologies in Classrooms

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

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

New, comprehensive mathematics instructional materials, linked with high standards for mathematical content and pedagogy and aligned with the NCTM standards, are now emerging from development and reaching the market. These materials are designed to permit students to master the traditional basics of arithmetic while also learning the fundamentals of algebra, geometry, data analysis and other topics. They provide a range of different approaches to classroom instruction, while focusing on 15 or fewer topics per year.

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

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

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

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

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

#### **Eisenhower Regional Consortia for Mathematics and Science Education**

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

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

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

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

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

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

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

#### NASA's Mission Mathematics

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

This linking to standards was accomplished by making "Mission Mathematics" a joint project of NASA and NCTM. Writing teams included teachers, supervisors, and university professors working in consultation with NASA representatives.

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[Section IV]



[Section VI]

## VI. Building Public Understanding and Support

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

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

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

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

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

### 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.

Collectively, the projects selected through this initiative will:

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

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

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

#### The Department of Energy's STEM Initiative

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

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

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

DOE strongly supports the revitalization of educational

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.

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

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

- Facilitate the connection of national organizations having interests in helping to raise levels of achievement in mathematics and science (for example, professional societies of mathematicians, scientists, and engineers) with State, local and community-based organizations having similar purposes.
- Develop systematic mechanisms for the headquarters and field offices of relevant Federal agencies to participate in the partnerships.
- Encourage and support efforts by business and professional organizations to use the Internet as a new tool for providing on-going tutoring, homework help, and motivation to students.
- Challenge colleges and universities to partner with middle and high schools to help ensure that students know what it takes to go to college and that they have access to a rigorous college preparatory mathematics curriculum.

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[Section V]



[Section VII]

## VII. Conclusion

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

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

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

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

But the action strategy is only the beginning of the effort. The interagency cooperation must continue and move to the substantive agenda of

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

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

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

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

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

to develop exciting materials with a transportation focus for teaching mathematics, science, and technology.

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

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[Section VI]  [Appendix I]

## APPENDIX 1

### PRESIDENTIAL DIRECTIVE

March 6, 1997

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

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

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

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

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

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

The action strategy should include recommendations for the use of federal resources to help states, local school districts and schools to improve teaching, upgrade curriculum, integrate technology and high-quality instructional materials into the classroom, as well as motivate students and help them

understand how math concepts are applied in the real world. The strategy should identify significant federal programs, activities, and partnerships available to improve teaching and learning, ensure that these resources are appropriately focused on helping students reach challenging math standards, and determine how these resources can best support state and local reforms. In developing this strategy, the inter-agency group should review the current status of improvements in math education, and identify and address critical areas of need, drawing on research and input from educators and professional organizations.

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

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

-- WILLIAM J. CLINTON\*

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

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[Section VII]



[Appendix 2]

## APPENDIX 2

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

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

Parents need to know that students have mastered the basics no matter where they live or move in this country. And they have the right to know how well their children are doing compared with students in other schools, states, and countries. To help give parents this information, the U.S. Department of Education is offering every state and school district the opportunity to use voluntary national tests of 4th grade reading and 8th grade mathematics, beginning in 2001.

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

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

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

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



[Appendix 1] [Appendix 3]

## APPENDIX 3

### Interagency Working Group

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

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

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

#### Participants in the Interagency Process

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

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

#### Members of the Working Group

##### Co-Chairs

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

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

### Committee Members

Carol Chelemer  
Office of Educational Research  
and Improvement  
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Diane Spresser  
Program Director, Teacher Enhancement  
(Mathematics)  
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Margaret Cozzens  
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Robert Stonchill  
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Office of Educational Research  
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Eric Hamilton  
Program Director,  
Educational System Reform  
National Science Foundation

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

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

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

Deborah Spitz  
Program Analyst  
Office of the Undersecretary  
Department of Education

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[Appendix 2]  [Appendix 4]

## APPENDIX 4

### Relevant Activities of the Department of Education and the National Science Foundation

#### DEPARTMENT OF EDUCATION

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

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

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

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

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

**Goals 2000: Educate America Act** -- currently funded at \$476 million, is the primary Federal program supporting states and districts to raise their standards of teaching and learning. All 50 States

now participate. Goals 2000 provides flexible funding to the States to enable them to develop and implement their own strategies for achieving the National Education Goals (including the goal of becoming first in the world in mathematics and science). With funding from the program, States are establishing challenging academic standards with which they are aligning their student assessment programs, teacher preparation and licensure requirements, parental and community involvement, and other aspects of their education systems.

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

The Carl D. Perkins Vocational Education Act current provides \$1.1 billion to support curriculum reforms, teacher professional development, and the building of Tech-Prep programs that increase student competencies in the core content areas, including mathematics. Likewise, the School-to-Work Opportunities program supports state and local activities to help all students attain high academic and occupational standards and improve the knowledge and skills of youths by integrating academic and occupational learning, integrating school-based and work-based learning, and building effective linkages between secondary and postsecondary education.

#### ***Professional Development in Mathematics and Science:***

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

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

The **Telecommunications Demonstration Project** (PBS Mathline) uses the professional teaching standards of the National Council of Teachers of Mathematics (NCTM) as the basis for its year-long professional development program called the Elementary School Mathematics Project. This project, which complements Mathline's already-successful Middle School Mathematics Project, allows teachers to learn at times and locations they find convenient. It uses a series of 20 videos, each accompanied by a guide that includes lesson plans, ideas for extending the lesson, additional resources, and discussion topics relating the video content to the NCTM standards. Teachers also

participate in a year-long, online learning community of 25-30 fellow teachers, with an accomplished practicing teacher serving as mentor and facilitator. Over the course of three years, PBS Mathline has provided more than 4000 teachers of K-8 mathematics in 36 states with in-depth, standards-based training and has been recognized by the NCTM as an effective professional development program.

### *Technical Assistance and Information Sharing:*

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

The **Eisenhower National Clearinghouse for Mathematics and Science Education (ENC)**, funded under Eisenhower Federal Activities, collects a wide range of materials in mathematics and science and makes them available on-line and on CD-ROM. As of September 1997, which concluded its fifth year of operation, ENC had collected a total of 10,514 items. Between October of 1995 and September of 1997, the Clearinghouse reported over fourteen million "hits" to its Web site. ENC Online ([www.enc.org](http://www.enc.org)) has been recognized as an exemplary Internet site by Classroom Connect, Syllabus Magazine, Geometry Forum, Education Index, and Multimedia Schools. ENC also works with the Regional Consortia to create demonstration sites throughout the country, where educators can interact with the latest technological developments and access information about the collection.

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

### *Research, Statistics, and Assessment:*

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

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

## **NATIONAL SCIENCE FOUNDATION**

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

## *PreK-12 Systemic Reform*

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

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

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

### *Building Blocks of System Reform:*

Systemic reform is built on a foundation of quality instructional materials, initial education and professional development of teachers in both content and pedagogy, new strategies for the assessment of student learning, a diverse teacher population, and appropriate use of technology. Thus a major focus of activities and budget at NSF is assuring that these building blocks are available and in place.

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

Over 40,000 teachers in 1,930 schools, reaching over 1.3 million students annually, participate in intensive professional development activities through the **Local Systemic Change (LSC) Initiatives**. Teachers of mathematics or science receive a minimum of 100 hours of professional development (for K-8 teachers) or 130 hours (for teachers in grades 7-12) and receive ongoing support through the

academic year. They implement quality standards-based instructional materials and reform the mathematics and science programs in their schools as a whole. Extensive leveraging of Title I, Eisenhower, district, and industry funds occurs in at least an amount equivalent to the NSF award in each LSC project. In addition to the Local Systemic Change projects, the Teacher Enhancement Program supports **leadership projects** that train teachers and other professionals to deliver quality professional development. NSF supports the enhancement of approximately 60,000 teachers annually, of whom, at this time, fewer than half are teachers of mathematics. Only about 10,000 are middle school teachers of mathematics.

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

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

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

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

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

**Technology:** Research efforts in technology are developing new methodology and pedagogy for improving the achievement of students in science and mathematics, especially those who have not been well served by the education system. The new methodologies will make use of advances in technologies such as visualization and simulation that build on different learning styles among students. Funded projects successfully create new forms of visualization of scientific and

mathematical concepts. NSF has supported more than 20 projects that successfully create new forms of visualization such as graphics, and simulations. Full and sustainable integration of technology into the fabric of the educational system is required for these to have wide impact on education systems.

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

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

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[Appendix 3]  [Appendix 5]

## APPENDIX 5

### Consultation with External Organizations

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

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

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

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

- Construct and sustain a Federal effort that brings together, in a coherent framework for decision-making, the various National Science Foundation and U.S. Department of Education programs that will significantly influence K-8 mathematics education.
- Devise a long-term plan (8-10 years, offset from political cycles) of interactive development involving test redesign and strategy adjustment, with ongoing monitoring and oversight.
- Invest in a sustained agenda of basic research to better understand what mathematical thinking is, how to foster it through curricular choices and instructional practice, and how to support teachers in doing so.

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

importance of an enhanced role for higher education in preparing teachers and in providing support for teachers through on-going professional development.

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

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

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[Appendix 4]  [Appendix 6]

## APPENDIX 6

### Federal Agency Activities that Support K-12 Mathematics Education

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

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

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

- NASA has completely revamped its educational programs to reflect the development of the National Council of Teachers of Mathematics' (NCTM) standards for mathematics and the more recent standards for science developed through the National Research Council (NRC). The agency has developed supplementary instructional materials in conjunction with NCTM that provide sample problems based on space-related examples.
- The Department of Defense schools have redesigned curriculum and teacher professional development to incorporate standards-based approaches. Other parts of DoD have outreach programs that stress the importance of mathematics to national security.
- The U.S. Environmental Protection Agency (EPA) has awarded grants to schools, state agencies, nonprofit organizations, and others to support environmental education programs, many of which take place in schools. More recently grants have also been directed toward programs that tie environmental education to state and local education reform goals. A consortium of nonprofit organizations and universities is delivering environmental education

training to K-12 teachers and other education professionals in all 50 states and several U.S. territories, using EPA funds. As part of this effort, national guidelines for environmental education are being developed and correlated to various national and state standards for mathematics, science, and other disciplines.

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

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[Appendix 5]

