U.S. DEPARTMENT OF EDUCATION

Report of the Academic Competitiveness Council

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U.S. Department of Education

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Margaret Spellings
Secretary

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The bedrock of America's competitiveness is a well-educated and skilled workforce. Education has always been a fundamental part of achieving the American Dream, and the No Child Left Behind Act *is helping to ensure that every student receives a high-quality education. Accountability and high standards are producing positive results in the classroom, and we can do more to provide American students and workers with the skills and training needed to compete with the best and brightest around the world.*

—President George W. Bush, letter announcing the American Competitiveness Initiative, Feb. 2, 2006

Executive Summary

Officials from federal agencies with education programs aimed at improving America's competitiveness in science, technology, engineering, and mathematics (STEM) engaged in a yearlong endeavor to assess their programs' success and to identify areas for improvement for current and future programs. This effort, carried out by the Academic Competitiveness Council (ACC) and led by Secretary of Education Margaret Spellings, lays the groundwork for sustained collaboration among STEM education programs across federal agencies that will greatly strengthen America's competitiveness.

The *Deficit Reduction Act of 2005* (P.L. 109-171) (the act) established the ACC. The statute charged the ACC to:

- Identify all federal programs with a mathematics or science education focus;
- Identify the effectiveness of those programs;
- Determine areas of overlap or duplication among those programs;
- Identify target populations served by such programs; and,
- Recommend processes to efficiently integrate and coordinate those programs.

In addition to assuming those responsibilities delineated in the act, the ACC set milestones to guide its mandate:

- Delineate the goals of the programs;
- Determine the extent to which the programs have undergone independent, external evaluation based on sound, scientific principles;
- Ascertain the extent to which the programs have quantitative evidence of achieving their stated goals;
- Establish standards for measuring and evaluating these programs, including common measures as appropriate; and
- Formulate recommendations for administrative or legislative action that, if carried out, would more efficiently integrate and coordinate federal spending on STEM education programs.

Agencies' catalogued programs focused on STEM education. The resulting inventories were then aggregated into an overall inventory for the federal government comprising 105 STEM education programs, with approximately $3.12 billion in total funding for Fiscal Year (FY) 2006. The programs cover kindergarten through postgraduate education and outreach as follows:

- 24 elementary and secondary school (K–12) programs, which received approximately $574 million, or 18.4 percent of total funding;
- 70 undergraduate, graduate and postgraduate programs, which received more than $2.4 billion, or 77.2 percent of total funding; and
- 11 informal education and outreach programs, which received close to $137 million, or 4.4 percent of total funding.

To perform its work, the ACC formed three working groups, each focused on an education category: K–12 Education, Postsecondary Education, and Informal Education and Outreach. Each working group developed common goals and measures for its programs: national goals to reflect the overarching education outcomes for a given group; national metrics to measure the nation's progress toward those outcomes; common goals and metrics to measure the impact of individual programs and projects; and plans to integrate these metrics into program and project operations and evaluations.

The K–12 Education working group adopted goals and metrics at both the national level and the program and project level that focus primarily on improving student achievement, teacher quality, and student engagement. The Postsecondary Education working group identified one overarching national goal for undergraduate programs: to increase the number of undergraduates who enroll in and complete STEM degree programs. Further, the group identified program-level goals and metrics in three areas: improving the STEM workforce; encouraging development of collaborative communities among the education, government, industry, and professional sectors; and strengthening higher education institutional capacity. The Informal Education and Outreach working group identified two national and program-level goals: increasing awareness, interest, engagement, and understanding of STEM concepts, processes, and careers by the general public and other targeted populations; and improving practice and building professional and institutional capacity by funding efforts that generate, develop, and apply innovative ideas and models for informal science education.

There are 27 graduate and postgraduate programs that represent nearly $1.46 billion or 47 percent of total FY 2006 funding for STEM education programs in the ACC program inventory. These programs are highly individualized, with the primary mission of strengthening the nation's research capacity rather than broadly improving the nation's education system. Notwithstanding the contributions of graduate and postgraduate programs to the fields of science and engineering, the ACC chose not to assign a national *education* goal to these programs. However, the Postsecondary Education working group developed metrics to help agencies assess the educational aspects of graduate and postsecondary programs. These metrics include the percentage of fellowship recipients who complete their degree program or are subsequently employed in a STEM field.

The ACC employed a methodological framework to address the requirement to determine STEM program effectiveness. The ACC used the framework not only to review existing evaluations of a project's effectiveness, but also to serve as a guide for designing such evaluations in the future. This Hierarchy of Study Designs (fig. 2) encompasses only those study designs intended to estimate a project's impact on educational outcomes, such as student math and science

achievement, or Ph.D. completion. (These are sometimes called "impact" studies.) For such study designs, the hierarchy provides guidance on designs most likely to produce valid estimates of a project's true impact.

The ACC solicited support from the Coalition for Evidence-Based Policy (coalition), a nonprofit, nonpartisan organization sponsored by the Council for Excellence in Government, to assess evaluations. Each agency submitted its best evaluations for this review. Of the 115 total evaluations, the coalition found 10 impact evaluations that were scientifically rigorous, four of which concluded that the educational activity evaluated had a meaningful positive impact. Three of them had results published in academic journals. Based on the 115 evaluations, the ACC's review revealed that, despite decades of significant federal investment in science and math education, **there is a general dearth of evidence of effective practices and activities in STEM education**. Even the 10 well-designed studies would require additional replication and validation to be used as the basis for decisions about education policy or classroom practice.

The act also charged the ACC with identifying areas of overlap and duplication. Many of the programs in the ACC's inventory share similar goals. While such duplication is not inherently bad, the ACC found coordination among agencies could be improved. For example, grants to some projects that supported similar interventions appeared uninformed by the results of earlier projects. Agencies with similar STEM programs sometimes do not share information about the work they fund.

Based on its analysis, the ACC makes the following recommendations:

Recommendation 1: The ACC program inventory and goals and metrics should be living resources, updated regularly and used to facilitate stronger interagency coordination.

Recommendation 2: Agencies and the federal government at large should foster knowledge of effective practices through improved evaluation and-or implementation of proven-effective, research-based instructional materials and methods.

Recommendation 3: Federal agencies should improve the coordination of their K–12 STEM education programs with states and local school systems.

Recommendation 4: Federal agencies should adjust program designs and operations so that programs can be assessed and measurable results can be achieved, consistent with the programs' goals.

Recommendation 5: Funding for federal STEM education programs designed to improve STEM education outcomes should not increase unless a plan for rigorous, independent evaluation is in place, appropriate to the types of activities funded.

Recommendation 6: Agencies with STEM education programs should collaborate on implementing ACC recommendations under the auspices of the National Science and Technology Council (NSTC).

When these recommendations are implemented, the body of evidence of the effectiveness of STEM practices will grow and the impact of federal programs on STEM goals will improve. American students will be the beneficiaries and the nation's overall competitiveness will be strengthened.

I. Introduction

On Feb. 8, 2006, President Bush signed into law the *Deficit Reduction Act of 2005* (P.L. 109-171). Section 8003 of the act calls for, under Section 401A (a)(2) of the *Higher Education Act of 1965*, the establishment of the Academic Competitiveness Council (ACC).

The statute mandated that the ACC be chaired by the secretary of education and that its membership consist of officials from federal agencies with responsibility for managing federal mathematics and science education programs. The law charged the ACC with accomplishing the following:

- Identify all federal programs with a mathematics or science education focus;
- Identify the effectiveness of those programs;
- Determine areas of overlap or duplication among those programs;
- Identify target populations served by such programs; and
- Recommend processes to efficiently integrate and coordinate those programs.

Further, the law called for the ACC to report to Congress, within one year of the enactment of the authorizing legislation, on its findings and recommendations in the above areas, including recommendations for legislative or administrative action[1]. This report responds to that directive from Congress. It describes ACC activities and presents the ACC's findings and recommendations.

There is increasing concern about U.S. economic competitiveness, particularly the future ability of the nation's education institutions to produce citizens literate in STEM concepts and to produce future scientists, engineers, mathematicians, and technologists. Such experts are needed to maintain U.S. preeminence in science, technology, engineering and mathematics. While other countries around the world strive to improve their own education systems and to expand their economies, the U.S. will have to work even harder in the coming years to maintain its competitive edge.

Even after decades of education reforms, and some improvement in K–12 education achievement in the U.S., the results from recent national and international assessments are sobering. Although the mathematics achievement of American students in grades 4 and 8 has risen steadily since 1990, average scores remain unacceptably low, and achievement levels appear to decline as students progress to higher grades. In the 2005 National Assessment of Educational Progress (NAEP), only 36 percent of students in grade 4 and 30 percent of students in grade 8 scored at the "proficient" or "advanced" levels[2]. Further, while differences in mathematics achievement among racial and ethnic groups have fluctuated over the years, academic year 2005 saw the achievement gap generally as wide as it had been since the early 1990s. For example, the gap between white and black students in the average "scale score" on the eighth-grade NAEP was 33 points in 1990 and 34 points in 2005. The gap between the averages for white and Hispanic eighth-graders was 24 points and 27 points, respectively, in those two years[3].

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1. The complete legislative language is included as Appendix A to this report.
2. National Center for Education Statistics, *The Nation's Report Card: Mathematics 2005* (NCES 2006-453), p. 3.
3. Ibid, pp. 4-5.

The results for NAEP science assessments reveal little improvement. Scores for fourth-graders have improved slightly over the past decade, but have remained flat for eighth-graders and declined for 12th-graders. In the fourth and eighth grades, only 29 percent of students scored at the "proficient" level or higher in 2005, declining to 18 percent for 12th-graders. As in mathematics, there are significant gaps between the scores of black and Hispanic students and those of white students. In contrast, the gaps at the fourth-grade level have narrowed since 2000[4].

At the postsecondary level, while U.S. institutions of higher education are often considered the envy of the world, the recent report by the Secretary of Education's Commission on the Future of Higher Education cautions that complacency could jeopardize our future as a global leader. That commission, in its review, found much to applaud, but also highlighted problems in higher education. Areas requiring improvement include access to higher education (limited because of inadequate information and a confusing financial aid system), preparation of incoming students to succeed in higher education, and student development in the basic reading, writing, and analytical skills expected of college graduates.

In recent decades, the federal government has established and supported numerous programs designed to improve student learning, reform instructional delivery, and update curricula and facilities to meet the rapidly changing needs of the knowledge-based economy. Yet it is unclear which programs or activities are effective in generating positive outcomes. While many ideas have been tested in small case studies, few have been evaluated at the necessary scale to prove their efficacy for a broad range of students in an array of instructional settings. Without such evidence, it is nearly impossible for educators or administrators to know which activities, curricula, or materials to use to achieve the results that our nation demands.

In October 2005, the Government Accountability Office (GAO) released the report *Federal Science, Technology, Engineering, and Mathematics Programs and Related Trends* (GAO report), a review of the federal science, technology, engineering, and mathematics (STEM) education portfolio. In conducting this study, GAO asked federal agencies to provide information about their STEM education programs, including program names, target audiences, total funding, and whether those programs had been evaluated. Through this effort, GAO identified 207 separate STEM education programs administered by 13 federal agencies (excluding the Department of Defense) and totaling $2.8 billion in federal funding[5].

Accountability, American Competitiveness, and the Academic Competitiveness Council

From the start of his administration, President Bush has made improving the quality of education and maintaining America's global leadership in science and technology top priorities. The *No Child Left Behind Act* (*NCLB*), signed by the president on Jan. 8, 2002, calls for education reforms grounded in scientific research and evaluated for effectiveness through yearly assessments of student performance.

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4 National Center for Education Statistics, *The Nation's Report Card: Science 2005* (NCES 2006-453),

5 Government Accountability Office, Higher Education: *Federal Science, Technology, Engineering, and Mathematics Programs and Related Trends* (GAO-06-114), October 2005. The reasons for the differences between this inventory and the ACC STEM inventory are given in chap. III.

As school systems across the country implement *NCLB*, educators have been frustrated by the lack of proven-effective, research-based instructional materials and methods available for use in their classrooms. In 2004, a committee of the National Research Council (NRC) identified 698 studies evaluating 19 different mathematics curricula, 13 of which were supported by the National Science Foundation and six of which were commercially generated. Of those 698 studies, 147 met minimal criteria for consideration of effectiveness and were, therefore, reviewed by the committee. Based on that analysis, the committee concluded that, "the corpus of evaluation studies as a whole … does not permit one to determine the effectiveness of individual programs with a high degree of certainty, due to the restricted number of studies for any particular curriculum, limitations in the array of methods used, and the uneven quality of the studies."[6] The committee found many evaluations incomplete, missing adequate controls, biased in design, or conducted by individuals who were, themselves, involved in designing or marketing the curriculum. In its report, *On Evaluating Curricular Effectiveness: Judging the Quality of K—12 Mathematics Evaluations*, the committee recommended that future curriculum studies be based on a scientifically valid framework and that explicit standards be developed for use in determining when curricula can be considered effective enough for classroom adoption.

NRC's findings were reinforced by the work of the Department of Education's Institute of Education Science's What Works Clearinghouse. In its reviews of evidence supporting the effectiveness of curricula and programs across a wide range of education topics, the clearinghouse typically found that most lacked the evidence necessary to determine their effectiveness. For example, the clearinghouse's review of 75 middle school mathematics programs determined that only three had strong evidence of effectiveness (as demonstrated through well-designed experimental studies) and only 11 others had evidence of effectiveness "with reservations" (as demonstrated through strong quasi-experimental studies or experimental studies that had problems in design or implementation). The remainder had insufficient evidence of effectiveness.

The results of these studies, coupled with performance by U.S. students on national and international assessment exams, demonstrate the need to do more to improve both the quality of education research and the quality of education. In his 2006 State of the Union address, President Bush announced his American Competitiveness Initiative (ACI), a carefully targeted set of spending and tax policies to increase investments in research and development; strengthen STEM education; and encourage entrepreneurship. This initiative offers significant new funding for education, research and development investments, and tax credits. The following education initiatives are components of ACI and are relevant to the work of the ACC:

- Expansion of the Department of Education's *Advanced Placement Incentive* program in order to prepare additional teachers to teach Advanced Placement (AP) and International Baccalaureate (IB) mathematics, science, and critical foreign language courses and to create more opportunities for students to take and pass AP and IB courses;
- Establishment by executive order of the *National Mathematics Panel*, to identify effective mathematics content and instructional principles, thus creating a research base on which to improve mathematics teaching and instructional materials;

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6 *On Evaluating Curricular Effectiveness: Judging the Quality of K–12 Mathematics Evaluations*, National Research Council of the National Academies, Washington, D.C., 2004, pp. 2-3.

- Launch of the *Math Now for Elementary School Students* program to improve mathematics instruction for students in kindergarten through the sixth grade, based in part on the findings of the National Mathematics Panel, and to prepare those students to take rigorous courses in the later grades;
- Initiation of the *Math Now for Secondary School Students* program, to fund research-based interventions to improve the mathematics instruction of middle school students whose level of mathematics proficiency is below grade level;
- Creation of the *Adjunct Teacher Corps* to encourage well-qualified individuals outside the education system, including mathematics and science professionals, to take adjunct teaching positions in schools and bring critical subject-matter expertise and real-world knowledge to the classroom; and
- Evaluation of the success and effectiveness of existing STEM education programs across the federal government. The ACC addressed this priority by providing an opportunity to begin an immediate governmentwide assessment of the available evidence of success and effectiveness of STEM education programs.

II. The Structure and Activities of the Academic Competitiveness Council

The ACC was chaired by Secretary of Education Margaret Spellings and included officials from federal agencies responsible for managing programs that promote mathematics and science education. Participating agencies included the departments of Agriculture, Commerce, Defense, Energy, Health and Human Services, Homeland Security, the Interior, and Labor; the Environmental Protection Agency; the National Aeronautics and Space Administration; and the National Science Foundation. Within the Executive Office of the President, the Office of Management and Budget, the Domestic Policy Council, and the Office of Science and Technology Policy participated. Additionally, the ACC relied on the expert services of the Coalition for Evidence-Based Policy, a nonprofit, nonpartisan organization sponsored by the Council for Excellence in Government, to provide guidance on the appropriate standards for scientifically valid evaluations and to conduct an independent review of current STEM education evaluations.

The full ACC met on March 9, 2006, to launch its activities and again on July 19, 2006, to receive an interim report on the progress and accomplishments of the work groups. President Bush spoke at the inaugural meeting, articulating his support for the ACC and reiterating the importance of this effort. The ACC accepted a definition of success, shown in figure 1, to guide its work and meet its statutory mandate.

Because of the size of the task to be accomplished and the number and diversity of STEM programs across the federal government, the full ACC delegated many of its activities to three working groups comprising representatives of relevant federal agencies. The three working groups are:

- The K–12 Education working group, co-chaired by the Department of Education and the National Science Foundation (NSF);
- The Postsecondary Education working group, co-chaired by the NSF and the Office of Science and Technology Policy; and
- The Informal Education-Outreach working group, chaired by the NSF.

Figure 1—Definition of Success for the Academic Competitiveness Council

The council will be successful if, by Feb. 8, 2007, agencies:

- Set outcome-oriented goals for their science, technology, engineering and mathematics (STEM) education programs;
- Establish procedures and timelines for evaluating the performance of their STEM education programs toward outcome-oriented goals; and
- Target their investments toward high-performing programs.

To fulfill the requirements of the *Deficit Reduction Act*, the council will:

- Identify all federal education programs with a STEM focus;
- Identify the target populations served by these programs;
- Identify the stated goals of these programs;
- Identify the extent to which the programs have undergone independent, external evaluations based on sound, scientific principles;
- Identify the extent to which the programs have quantitative evidence of achieving stated goals;
- Identify or develop standards for measuring and evaluating these programs, including common measures as appropriate; and
- Recommend administrative or legislative action to efficiently integrate and coordinate federal spending on STEM education programs.

Source: Academic Competitiveness Council, 2006

III. The Program Inventory

First on the list of ACC tasks was to identify all STEM education programs supported by the federal government. The ACC requested program information from each agency, which was validated and compiled by the Office of Management and Budget (OMB) into the comprehensive STEM Education Program Inventory. In response to a May 3, 2006, letter from the Senate Health, Education, Labor, and Pensions (HELP) Committee to federal agencies requesting data about STEM education programs included in the 2005 GAO report, the ACC prepared a preliminary version of the program inventory and delivered it to the committee in lieu of individual agency submissions.

The ACC STEM program inventory prepared in summer 2006 and refined in recent months differs from that published in the GAO report for three reasons. First, programmatic changes occurred between the time of the GAO study and the time of the ACC effort. Second, the ACC program inventory and GAO report used different definitions and guidelines for program inclusion. Specifically, the ACC effort included all federal agencies that supported STEM education programs while the GAO report did not. Lastly, differences in the program inventories arose because the GAO report was based solely on agency-reported data, whereas the ACC program inventory was also verified by the Office of Management and Budget. Highlighted below are the key definitions formulated by the ACC to facilitate reporting consistency across the federal government.

STEM Education Program

Science, Technology, Engineering, and Mathematics education programs are defined as those primarily intended to provide support for, or to strengthen, science, technology, engineering, or mathematics (STEM) education at the elementary and secondary through postgraduate levels, including adult education.

Program

A "program" is the largest identifiable set of projects or activities that have generally similar objectives, strategies, and target audiences. For some agencies, programs appear as separate line items in their budgets, while, for others, programs are embedded within a larger line-item budget total.

Programs in the ACC inventory support activities in a wide variety of areas, including STEM curriculum development; teacher professional development, recruitment, and retention; institutional support (including programs to strengthen the educational capabilities of minority-serving or similar institutions); mentoring; student financial assistance; outreach and recognition to motivate interest in or continued work in STEM fields; and research aimed at improving STEM education. The program inventory includes congressionally directed projects and programs as well as those established by statute or under the authority of the sponsoring agencies[7].

7 Noteworthy is a recent complimentary report of the National Science Technology Council *Review and Appraisal of the Federal STEM Education Research Investment* (October 2006, National Science and Technology Council). It provides an overview and appraisal of STEM education sciences across the federal government.

The program inventory does *not* include programs with a broader purpose that might provide but do not target STEM education improvements. For example, the inventory does not include general employment, teacher training, or student financial assistance programs or disciplinary scientific research centers. Similarly, the inventory does not include programs that support basic research in learning or cognition, such as cognitive science, neuroscience, behavioral science, or brain imaging research.

The ACC questioned whether it was appropriate to include graduate and postdoctoral programs in the ACC inventory. Unlike traditional education programs, graduate and postdoctoral education programs are highly specialized, individualized, and focused on advancing scientific research as opposed to meeting traditional education goals. However, since these programs are also designed to prepare individuals for independent research and research-related careers, it was deemed appropriate to consider the education and training aspects of graduate and postdoctoral education in the ACC effort. The ACC inventory includes federally funded graduate and post-doctoral fellowship and trainee programs but not general research programs that may fund graduate student and postdoctoral fellows as part of their larger budget. The inclusion of research programs would have artificially inflated the number of programs and total funding reflected by the inventory since there is currently no mechanism to separate student support from the total expenditures of federal research grant awards.

During spring 2006, the ACC member agencies collected and compiled information on programs that met the common definitions and guidelines discussed above. On June 15, 2006, the Department of Education, on behalf of the ACC, submitted the preliminary program inventory to the Senate HELP Committee in response to its May letter to agencies requesting this information. Through the year, agencies continued to update and revise the program inventory to ensure its accuracy and to provide additional information about the listed programs, including the disciplinary focus of each program (mathematics or science) its goals, and its budget allocation in FY 2005, FY 2006, and in the President's 2007 Budget request. Due to the late date of final FY 2007 congressional appropriations, the program inventory does not yet include final funding levels for FY 2007 or from the President's FY 2008 Budget request.

IV. Scientifically Valid Methods for Evaluating Education Impacts: The Hierarchy of Study Designs

The ACC spent a great deal of time debating how to evaluate STEM program effectiveness. Successful, large-scale interventions to improve STEM education are unlikely to arise without serious study and trial and error. To optimize opportunities for success, interventions should be based on knowledge generated from many well-designed education research and development studies. There is a critical pathway for the development of successful educational interventions and activities, starting generally with small-scale studies to test new ideas and generate hypotheses, leading to increasingly larger and more rigorous studies to test the effect of a given intervention or activity on a variety of students and in a variety of settings. Different research methodologies are used along the development pathway, and corresponding evaluation strategies must be used to assess their progress. However, it is critical that government efforts push beyond basic research efforts and lead to activities that can be tested in rigorously designed studies.

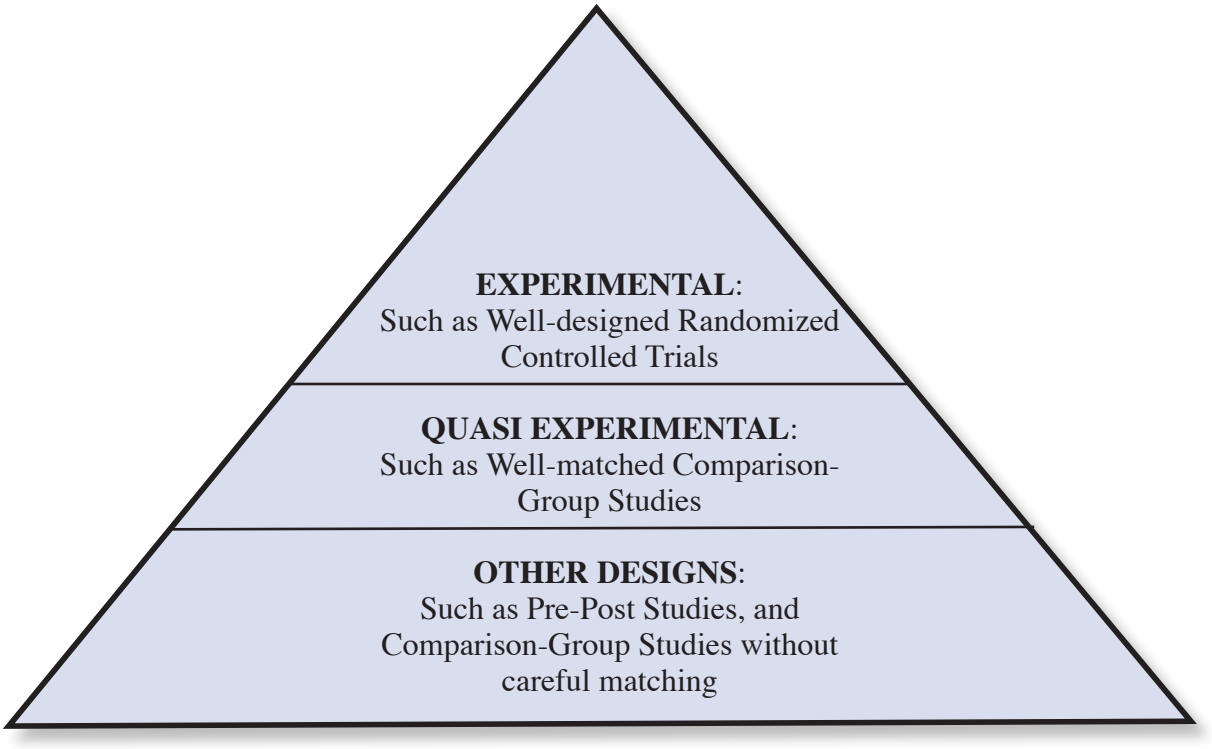
The statute creating the ACC charged it with evaluating the effectiveness of current STEM education programs. In order for the ACC to perform its evaluation function, it was imperative to establish a methodological framework and standards for conducting this review that would take into account the type of program or project being evaluated, its goals, and the maturity of the activity being assessed for impact. Through the establishment of the framework and standards, the ACC endeavored to ensure that all agencies were using the same basis for designing and assessing STEM education programs and, thus, would be held to the same evidentiary standards.

The ACC called upon the Coalition for Evidence-Based Policy (coalition), a Washington-based, expert, independent organization whose mission is to promote government policymaking based on rigorous evidence of effectiveness. The coalition has advised a number of agencies, including the Department of Education and OMB, on the development of high-quality, rigorous program evaluations and standards for measuring the impact of federal investments.

Critical to understanding the impact of an education activity is the use of an appropriate study design and evaluation. Recognizing that no single study design or evaluation methodology is appropriate for all education studies, and that the appropriate methodology should be selected based on the maturity of the activity, the intended use of the data, and the inferences to be drawn from the study results, the coalition proposed a *Hierarchy of Study Designs for Evaluating the Effectiveness of a STEM Educational Intervention* (hierarchy).

Shown in figure 2, the hierarchy was adopted by the ACC as its methodological framework for evaluating current and future federal STEM education investments. The hierarchy encompasses only those study designs whose purpose is to estimate a project's impact on education outcomes, such as student math and science achievement, or Ph.D. completion rates. (These are sometimes called "impact" studies.) For such studies, the hierarchy provides guidance on which designs are the most likely to produce valid estimates of a project's true impact.

Figure 2—Hierarchy of Study Designs for Evaluating the Effectiveness of a STEM Education Intervention, by Expected Distribution of Study Type



Source: Coalition for Evidence-Based Policy, 2006

The hierarchy describes three categories of evaluation design: experimental methods, primarily well-designed randomized controlled trials, which are the preferred trials; quasi-experimental methods, primarily well-matched comparison-group studies, which are preferred when randomized control is not feasible; and non-rigorous, preliminary reviews such as those based on pre- and post-tests or self-reported outcomes, which are the weakest evaluation alternatives but useful for other purposes. Figure 2 illustrates these three evaluation design categories and provides a graphical representation of the expected distribution of each study type within the federal STEM education investment portfolio. It is expected that many studies begin at the bottom level, where activities in the early stages are tested under less-than-rigorous circumstances in order to develop hypotheses about their performance. Then, promising activities will be identified from this group of studies and subjected to increasingly rigorous evaluations, with a small number of highly promising studies being evaluated, when feasible, through the use of randomized controlled trials. These categories are explained in more detail below.

1. **Experimental Methods such as Randomized Controlled Trials (RCTs)**: Generally, the strongest study design for evaluating an intervention's effectiveness, RCTs enable one to determine with a high degree of confidence if the intervention alone caused observed outcomes[8]. RCTs are appropriate and feasible for some projects but not for others. For example, a well-designed randomized controlled trial may well be the appropriate tool for evaluating a highly promising, well-defined classroom curriculum that, if found to have a meaningful, positive impact on education achievement, could then be replicated on a larger scale using large and diverse samples. However, for a classroom curriculum that is still in the early stages of development, such a study might be premature, and other methods would likely be more appropriate.
2. **Quasi-experimental Methods such as Well-Matched Comparison Group Study**: A second-best alternative when a program does not meet RCT requirements or when an RCT would not be appropriate. Evidence suggests that if comparison groups are closely matched in key characteristics (e.g. pre-intervention education achievement and demographics) a study has the potential to yield the correct overall conclusion about an intervention's effect.

   Note: Although experimental and quasi-experimental methods are considered to be the most rigorous of study and evaluation designs, it is important in either case that the study be well designed and that the evaluation methodology be considered at the earliest stages of program or project design. It is also important to accurately estimate the size of an intervention's effect based on the limits of the study design. Policy and implementation decisions should similarly be based on accurate estimates of an intervention's effect and should not be extrapolated beyond the limits and confidence of the study.
3. **Other designs, such as Pre- and Post-Test Studies, and Comparison Group Studies without careful matching**: New ideas are appropriately tested using non-rigorous study designs in order to develop and refine hypotheses or activities that will later be subjected to more rigorous evaluation. Results from this method should be used to direct future studies and should not be interpreted as conclusive indicators of program effects. Although regression and other statistical techniques may be used in these designs, the study results can-not be held to the same standard as those done using either RCTs or well-matched comparison groups for program evaluation. These designs provide indications of potential program effects rather than conclusive findings.

The hierarchy does not include study designs appropriate for education research in areas other than measuring the impact of an educational activity on student outcomes. For example, the hierarchy does not describe methods appropriate for qualitative and quantitative studies to determine *why* a particular curriculum or instructional practice works or does not work, nor does it describe appropriate methods for conducting basic research to uncover the cognitive processes through which children learn mathematics and science. Although such studies are not germane to the hierarchy, the ACC recognizes that they are a key part of the research agenda needed to improve U.S. STEM education, can be "rigorous" in their own context, and can serve as valuable precursors and-or complements to impact studies.

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8. *On Evaluating Curricular Effectiveness: Judging the Quality of K–12 Mathematics Evaluations*, National Research Council of the National Academies, Washington, D.C., 2004, pp. 2-3.

The hierarchy is a statement of general principles and does not address all contingencies that may affect a study's ability to produce valid estimates of a project's impact. (For a more complete discussion about randomized controlled trials, see the National Research Council report *Implementing Randomized Field Trials in Education: Report of a Workshop*, 2004). Its principles are based on the best scientific evidence regarding those study designs most likely to produce valid estimates of impact—evidence that spans a range of fields such as education, welfare and employment, criminology, psychology, and medicine. Its principles are also consistent with the standards of evidence used by federal agencies and other outside organizations in a number of different policy areas, including the Department of Education's Institute of Education Sciences, the Department of Justice's Office of Juvenile Justice and Delinquency Prevention, the Food and Drug Administration, the National Academy of Sciences' Institute of Medicine, and the American Psychological Association.

Applying the Evaluation Hierarchy to Federal STEM Education Programs

Once the framework was established, the ACC used this hierarchy as a tool to perform the requisite evaluation of program effectiveness. The broad nature of many programs makes a review at the program level uninformative in terms of education outcomes. Many agencies do conduct program-level management reviews to ensure that programs are administered properly and in accordance with federal guidelines and agency missions, but few of these evaluations provide information about the program's impact on student outcomes or how the program might advance the STEM education field. The evaluations can be extremely valuable in revealing important information about how to improve program design or operation. But for the purpose of evaluating educational impacts, evaluations at the level of an individual project, grant, or activity may actually yield more useful information. For that reason, the ACC decided to include evaluations of programs as well as projects, defined as the methods, incentives, support services, or other actions taken to directly or indirectly advance student learning, achievement, and related outcomes, in performing its STEM education evaluation.

It was not possible for the ACC to conduct a full-scale scientific evaluation of any single program or project, much less of the entire program inventory. For that reason, the ACC asked each participating federal agency to submit examples of program or project evaluations that had already been performed. The coalition assisted the ACC in reviewing these evaluations to determine the quality and estimate the impact of the submitted program or project studies on education outcomes. From the analysis of those evaluations, the ACC drew conclusions about the evidence of effectiveness of federally funded STEM education programs on student outcomes. The evaluations reviewed by the ACC were not selected randomly; rather, agencies were afforded the opportunity to provide their best efforts to the group for review, the results of which are reported in chapter VI.

Moving forward, the ACC recommends that agencies with STEM education programs refer to the hierarchy when choosing the appropriate evaluation methodology for measuring program or project impacts on education outcomes.

V. Common Goals and Metrics

To develop the STEM education program inventory, evaluate projects for effectiveness, and develop strategies for improving coordination across the federal government, it was necessary for the ACC to understand the primary goals served by each program and to articulate collective goals of the federally funded STEM education portfolio. Therefore, the ACC tasked each of its three working groups with developing a series of national and program goals and metrics relevant to their respective focus areas. The national goals are the broad outcomes that the ACC believes the federal government should seek to attain, collectively, through its STEM education programs. The metrics are a set of measures by which the nation can follow its progress in meeting these goals.

The ACC recognized that it would be difficult, if not impossible, to link an individual program or project with the overall progress of the nation in meeting a particular goal. For example, it is highly unlikely that the introduction and testing of a new science curriculum at a limited number of middle schools would influence overall NAEP science results because the scale of intervention would be so small. However, the collective federal investment in middle school science programs across the country would be expected to improve national NAEP scores.

A second set of program and project-level goals, and related metrics, were developed to enable high-quality evaluations of individual interventions to determine their effectiveness in meeting one or more goals. Projects and programs would be expected to demonstrate a link between their activities and one or more of the program or project goals. See appendix B for a full list of national and program goals and metrics.

The ACC also recognized that member agencies could establish additional goals, based on agency-specific expectations or mission requirements, that go beyond the shared goals and metrics adopted by the ACC. However, agencies should clearly articulate goals and metrics by which outcomes will be measured using methods similar to those by which progress toward the national and program goals will be measured. The ACC noted that while the hierarchy is useful in measuring the outcomes of individual projects, and in some cases can be useful in measuring the impact of narrowly focused programs, it may not be useful in evaluating our collective success in meeting the national goals identified by the ACC.

The goals and metrics developed by each working group are summarized below. Once adopted, agencies shared with OMB their plans for integrating these metrics into program operations and for developing rigorous evaluations to assess the impact of programs and projects. Due to time and resource constraints, the ACC encouraged agencies to target initial efforts to programs and projects with the largest potential impact.

K–12 Education

The K–12 Education working group adopted national goals that focus primarily on student achievement, teacher quality, and student engagement. (See appendix B for the complete list.) These goals are:

National Goal: *Student Learning*—Prepare all students with the science, technology, engineering, and math skills needed to succeed in the 21st-century technological economy, whether in postsecondary education or the workforce; and graduate students with the capability and motivation to become STEM professionals, educators, and leaders.

National Goal: *Teacher Quality*—Recruit and retain teachers with majors or minors in STEM fields and increase the content knowledge of current K–12 STEM teachers.

National Goal: *Engagement*—Increase students' engagement in STEM and their perception of its value to their lives.

NAEP and state assessments, the SAT and ACT tests, and international assessments of student achievement will measure student learning. In addition, the group determined that the percentage of college students who take remedial or developmental courses in mathematics and science should be a key K–12 metric (even though it is measured at the postsecondary level), because the effectiveness of the elementary and secondary education system determines whether students will be able to enter and succeed in postsecondary education without remediation.

Because of the importance of high-quality teaching (and the focus of many federal K–12 programs on teacher quality), the working group adopted a number of national metrics intended to gauge the quality and qualifications of the K–12 mathematics and science teaching force. These recommendations focus on the educational qualifications and experience of those teachers.

The third primary area of focus for federal K–12 programs is student engagement (that is, building student interest in STEM fields and encouraging them to pursue related careers). The working group adopted national metrics that attempt to gauge the level of student interest in STEM, through such proxy measures as number of courses completed and percentage of K–12 students who go on to complete STEM majors in college. The working group recommended that these measures be augmented with survey information on student interest and student participation in STEM-related extracurricular activities. However, no current national data in those areas are available.

The program-specific metrics developed by the group also focus on the areas of student learning, teacher quality, and student engagement. Indicators such as the percentage of students who participate in a program or project and demonstrate increased achievement (based on a rigorous evaluation design) and the number of projects that are determined to have been effective at raising achievement will be measures of student learning. The percentage of teachers demonstrating increased subject-matter competency and the percentage of the projects in which rigorous evaluations determine that students of participating teachers raise their performance will be measures of the effectiveness of teacher training programs. The success of student engagement programs will be assessed by looking, preferably through a rigorous evaluation mechanism, at such indicators as the percentage of student participants who increase their enjoyment of STEM fields and whose participation in STEM classes and STEM-related activities increases as a result of their participation in a program.

Postsecondary Education

The Postsecondary Education working group identified one national goal and three program goals to guide investments in undergraduate education. These goals are:

National Goal: *STEM Workforce*—Increase the number of undergraduates who enroll in and complete STEM degree programs and are prepared to enter STEM or STEM-related careers or advanced education.

Program Goal 1: *STEM Workforce*—Increase the number of undergraduates who enroll in and complete STEM degree programs and are prepared to enter STEM or STEM-related careers or advanced education.

Program Goal 2: *Collaborative Communities*—Encourage and support STEM professional collaborations, networks, communities, and alliances among educators, students, practitioners, government, professional organizations, and industry.

Program Goal 3: *Institutional Capacity*—Support advancement and development of STEM personnel, programs, and infrastructure in education institutions.

In general, undergraduate education programs seek to increase the number and diversity of students who enroll in and complete STEM courses and majors and who go on to pursue graduate studies or employment in a STEM or STEM-related field. Because the availability of STEM job opportunities is a function of the labor market at the time the student completes his or her undergraduate education, post-graduation employment in a STEM field may or may not be an indicator of the quality or efficacy of the undergraduate experience. Nonetheless, it is important to track career outcomes for students in order to understand how their education prepared them for the jobs they sought and the jobs they secured. In addition to general STEM education and training, several of the ACC agencies sponsor undergraduate education programs that are specifically intended to train the next generation of workers for mission-specific careers. In such cases, it is important for the agencies to monitor occupational demand to ensure that students are being properly trained for the opportunities that exist and that are realistically anticipated in the near future.

The ACC discussed at length the goals served by graduate and postgraduate traineeship and fellowship programs. Although the ACC recognized that the focus of graduate and postdoctoral training is on producing novel research results, the development of research-related goals for these programs was beyond the scope of the ACC. However, it was well recognized that graduate and postdoctoral programs do have clear education and training outcomes, the success of which should be measured using a series of metrics such as the percentage of fellowship recipients who complete their degree program, the time to degree completion, or the age at which the student establishes an independent career.

Informal Education and Outreach

Though informal education and outreach were combined into one working group based on similarities between the programs, the working group defined the terms separately:

> *Informal STEM Education Programs*. Informal learning can be defined as voluntary, self-directed, motivated by personal needs and interests, and often socially mediated; it engenders cognitive, affective, and other noncognitive outcomes. Federal agency programs fund activities that develop and deliver a wide array of informal learning experiences, as well as strengthen the infrastructure for advancing knowledge and practice of informal STEM education. Informal learning experiences are provided by a variety of organizations that offer children and adults learning opportunities outside of formal schooling through exhibits, media, programs, technology, and other means.
>
> *STEM Education Outreach Programs*. STEM outreach programs seek to raise awareness and provide learning experiences for target audiences (e.g., public, underserved groups, teachers and other professionals) outside of formal education. Federal agencies offer a wide variety of education outreach activities that can extend and complement their core missions.

The informal STEM education and outreach programs of federal agencies invest in education projects managed by non-school organizations, such as museums, broadcast media, and community-based service providers. The ACC's Informal Education and Outreach working group identified two national goals, which agency programs and projects collectively work toward in whole or in part:

> **National Goal 1**: *Public Awareness*—In the context of informal education and outreach, increase the awareness, interest, engagement, and understanding of STEM concepts, processes, and careers of the general public and other target populations.
>
> **National Goal 2**: *Professional Audiences*—Improve practice and build professional and institutional capacity by funding efforts that generate, develop, and apply innovative ideas and models for the informal science education field.

VI. Findings of the ACC and Its Working Groups

Total Program Inventory and STEM Education Investment

In its program inventory, the ACC identified 105 STEM education programs funded in FY 2006 at a total of $3.12 billion. Of that total, elementary and secondary programs received approximately $574 million (18.4 percent), postsecondary programs, more than $2.4 billion (77.2 percent) and informal education and outreach programs close to $137 million (4.4 percent). Within the postsecondary category, $943 million supported undergraduate programs and $1.46 billion supported graduate and postgraduate programs.

Three agencies—the NSF ($924 million), the Department of Health and Human Services ($855 million), and the Department of Education ($706 million)—account for nearly 80 percent of total FY 2006 federal STEM education spending. Those agencies also administer the five largest STEM education programs, which account for more than one-third of total ACC program funding:

1. The Ruth L. Kirschstein National Research Service Awards ($761 million, National Institutes of Health: graduate and postdoctoral support);

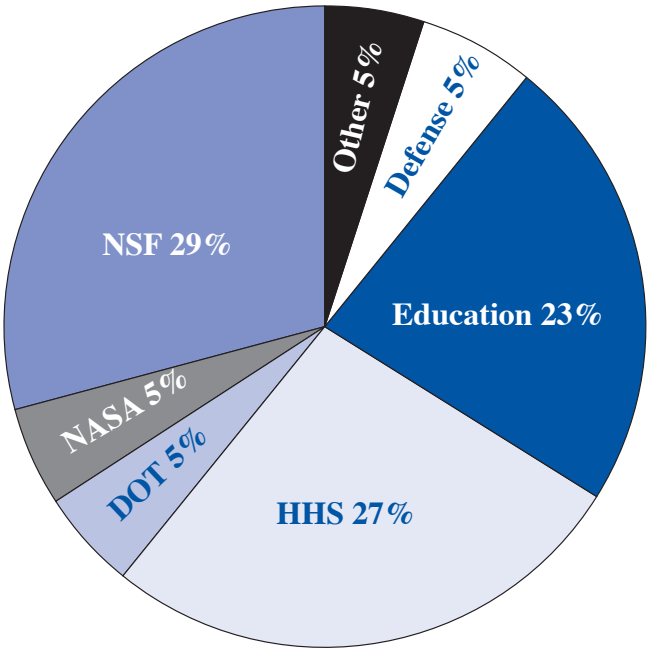
2. The National Science and Mathematics Access to Retain Talent (SMART) grants ($390 million, Department of Education: need-based undergraduate grant aid);

3. The Mathematics and Science Partnerships program ($182 million, Department of Education: elementary and secondary education, including teacher training and professional development);

4. Discovery Research K–12 ($93 million, NSF: elementary and secondary education, including teacher preparation and professional development); and

5. The Graduate Research Fellowships program ($93 million, NSF: graduate education).

Figure 3—FY 2006 ACC Program Funding, by Agency



Source: ACC program inventory, 2007

Over 62 percent of the funds support programs that cover all STEM disciplines. In contrast, approximately 37 percent of the federal funds support programs specifically focused on science and engineering education, with only 1 percent targeted solely to mathematics education. (Federal support for math education may well exceed 1 percent, given that math education is often funded through science and engineering education and research programs, particularly at the postsecondary level.)

K–12 Education

The ACC identified a total of 24 STEM programs primarily focused on elementary and secondary education outcomes, administered by eight federal agencies, with total fiscal year 2006 funding of approximately $574 million. NSF administers the greatest number of programs and provides the largest amount of funding, with six programs and $242 million. Second to NSF is the Department of Education at $239 million in program funding. Together, those two agencies account for nearly 85 percent of the total K–12 education STEM program funding.

The first key finding from the K–12 Education working group is that many agencies have judged their funded programs on the basis of inputs (such as number of teachers participating) or on surveys of attitudinal changes, or have concluded that certain programs were effective based on their management processes (e.g., a competitive grantee selection process that relies on expert peer reviewers). However, a more appropriate method to measure educational impacts is to assess outcomes, the most direct indicators of effectiveness, and require programs to adopt consistently high standards for determining and comparing their impact. Many of the K–12 goals and measures adopted by the ACC align with the expectations now set for the nation's K–12 education system under *NCLB*.

The second key finding relates to *NCLB*. The school accountability framework in *NCLB* presents an important opportunity for enhancing our understanding of the impact of federal science and math education programs in a manner not thought possible a decade ago. The central goal of the 2002 statute is for all students to succeed in reading and math at or above grade level by 2014. In exchange for federal funds, schools must test students annually in reading and math in grades 3 through 8, and once in high school. Beginning in the 2007-08 school year, schools must also test students in science. Under *NCLB*, schools have to publicly display assessment results. The testing infrastructure in place to carry out these requirements has transformed the way schools assess their performance. Potentially, the federal government can learn whether many of the science and math education activities it supports yield measurable student achievement gains through existing assessment activities in local school systems. Even more significantly, schools and school districts are held accountable for ensuring that an increasing percentage of their students test at the "proficient" level on these assessments, towards a national goal that 100 percent of students will achieve grade-level proficiency in math (as well as reading/language arts) by 2014.

The ACC considered the potential high costs associated with conducting RCTs. Where federal efforts to improve STEM education are aligned with state standards, state assessments can be used to measure the impact of federally supported activities on student learning. In these cases, scientifically rigorous impact evaluations involving randomized controlled trials or well-matched comparison groups can be carried out at reasonable cost, providing valuable information to determine whether federally supported projects are having a causal effect on student achievement. In programs where federal efforts have not been aligned with state standards, a choice must be made whether to align them or whether to adopt customized assessments to measure student learning, which may be more costly.

Finally, both project directors and federal program managers can use the results of student assessments to refine activities and enhance their impact on student learning. A continuing dialogue between the Department of Education, which oversees implementation of the *NCLB*, and other agencies administering science and math education programs can help all federal K–12 STEM education programs take advantage of the data tools now available because of *NCLB*.

Undergraduate Education

The ACC identified 43 STEM programs primarily focused on improving undergraduate education and administered by nine federal agencies, totaling $943 million in 2006. NSF administers 20 of these programs, the most of any single agency. The largest amounts of funding are from the Department of Education ($437 million) and NSF ($351 million). Together, those two agencies account for nearly 85 percent of the total funding for undergraduate STEM education programs. Generally, these programs focus on increasing student recruitment and retention in STEM fields, including increasing diversity within the STEM workforce, improving the infrastructure and content of undergraduate education, and improving the teaching of undergraduate STEM courses for both those majoring and not majoring in a STEM field.

Perhaps the most striking finding in undergraduate education is the lack of rigorous evaluation of federal investments due to inadequate mechanisms for the collection of data on long-term student outcomes. For example, a federal grant program may support the improvement of a freshman chemistry course, the direct outcomes of which may be measurable by a national exam. However, beyond the direct impact on student achievement in that one course, data on long-term student impacts—such as success in higher-level courses, retention in a STEM major, or enrollment in a STEM graduate program—are not currently available. The ACC and its working groups recognize it is important to understand lasting impacts that may be more difficult or more expensive to measure because they require longitudinal or repeated measures.

There are currently no national mechanisms through which data on a student's education experiences can be collected. Students who transfer from community colleges to four-year institutions or between two- and four-year institutions are particularly difficult to track using available national data collections. This gap in student-level data must be filled so agencies can do the type of high-quality longitudinal evaluations necessary to understand what works in improving long-term undergraduate outcomes.

Similarly, we do not have any mechanism to collect information on the long-term career outcomes of undergraduate degree recipients. While the Bureau of Labor Statistics (BLS) and the Census Bureau collect information about the career outcomes of the general population, these tools do not provide information on the field in which an individual earned his or her degree. Additionally, the career classifications currently used in the surveys conducted by BLS and Census do not capture relevant STEM-related career placements, such as scientists who work in policy or managerial positions.

It is noteworthy that while students who are enrolled in allied health majors complete a number of STEM courses and account for significant undergraduate STEM enrollments, they are not included in current federal surveys of STEM majors, nor is their placement into allied health careers considered to be a STEM-related placement. In addition, students who have expressed intent to major in a STEM field but then transfer to an allied health major or to STEM education are counted as a loss to the STEM field. Yet many would argue that an increase in allied health majors is a positive outcome, even if not credited to STEM education under current survey designs.

Graduate and Postgraduate Education

The ACC identified 27 federally funded STEM graduate and postdoctoral fellowship and traineeship programs with total funding of $1.46 billion in 2006. These programs account for nearly one-half of federal STEM education funding. The largest programs within this category are the Ruth L. Kirschstein National Research Service Award program at the NIH ($761 million in FY 2006) and the Graduate Research Fellowships Program at the National Science Foundation ($93 million in FY 2006).

In the American higher education system, research and education are inextricably linked. Graduate and postdoctoral students produce important original research findings and make major contributions to the U.S. scientific enterprise while gaining the training and skills they need to become independent scientists and professionals in STEM-related fields. Although coursework and qualifying exams are generally required of all graduate students, the majority of students' time is spent conducting independent research rather than attending classes.

The specialized and individualized nature of graduate and postdoctoral education in the sciences, and its interrelationship with the day-to-day conduct of research requires that it be assessed differently than K–12 and undergraduate education. In particular, many of the outcomes of interest identified by the Postsecondary Education working group, as well as by past evaluations of graduate and postdoctoral education, focus on research outcomes such as publications, presentations, and the extent to which findings are subsequently cited by other scientists. Developing outcome measures for graduate and postdoctoral education involves gauging research productivity, a topic that extends beyond the scope of the ACC effort, but is at the core of the work of the National Science and Technology Council's Science of Science Policy Task Group.

The ACC group did, however, consider how the conditions of graduate and postdoctoral support might affect non-research outcomes such as recruitment, retention, graduation, and long-term career outcomes of graduate and postdoctoral students. There is a high degree of variability among federally funded graduate and postdoctoral programs, including significant differences in how recipients are selected, in the level and duration of stipend support recipients receive, and in the timing of support during the graduate or postdoctoral career. It is unclear, however, which conditions are most effective in meeting goals such as increasing graduation rates among this population, reducing the number of years required to complete a doctoral degree (the national average is now over seven years), or reducing the time it takes for a student to establish an independent STEM or STEM-related career.

The National Science and Technology Council's (NSTC) Subcommittee on Education and Workforce Development (SEWD) recognized the limitation of current data collection tools for assessing graduate and postdoctoral federal STEM programs well over a year ago. Since that time, the NSTC has been working to develop a new survey tool to enable a more accurate assessment of graduate and postdoctoral education programs and outcomes. The ACC Postsecondary Education working group offered strong support for the NSTC's proposed pilot survey, but encouraged its expansion to include a random sample of all graduate students, and not just those who receive federal support. The working group also recommended that the survey include individuals who earn master's degrees as well doctoral degrees, and students who began but did not complete graduate programs. NSTC anticipates that the data needs identified by the ACC and its participating agencies will inform its effort in designing and implementing the pilot survey.

Informal Education and Outreach

The ACC identified a total of 11 STEM programs that primarily support informal education and outreach with a total FY 2006 funding level of about $137 million. Excluding the Smithsonian, five agencies have informal education and outreach programs, with most of the programs and funding concentrated in NSF ($71 million for three programs). The Department of Commerce and the Department of Defense also administer three informal education and outreach STEM programs. The Smithsonian, which participated in the ACC, has an extensive array of activities that support informal education and outreach, but because these programs are privately funded they are not included in the ACC program inventory.

There were several key findings from the Informal Education and Outreach working group. First, the variety in types of programs is expansive. Informal education and outreach activities can take place in schools, museums, the community, the media, and various other locations where people gather information and experience the world. Almost all ACC agencies had some type of program that was designed to generate awareness and engage the public in the agency's work. Further, the types of activities varied considerably across programs.

Second, the nature of these programs makes it difficult to conduct rigorous evaluation because, among other reasons: (1) the audience for these programs is diffuse and difficult to identify; (2) the multiple factors affecting and affected by these activities cannot be isolated for assessment; and (3) the modest scale of these efforts does not warrant a costly assessment approach. There are examples of pre- and post- quasi-experimental evaluations of these programs, but it is extremely challenging to carry out rigorous studies to identify causality in these programs.

Third, despite all of these complexities many programs share the same or similar goals. Though the programs are varied, the Informal Education and Outreach group agreed on the importance of better interagency coordination and information sharing. Sharing best practices across agencies could offer significant benefits as these programs often bear a closer relationship to outreach and informal education programs in other agencies than they do to K–12 or postsecondary education programs in the same agency.

Limited Evaluation of Program Effectiveness

Given the limitations of time and resources, the ACC could neither conduct nor contract for thorough reviews of federally funded STEM education programs, projects or interventions. However, the ACC working groups, with support from the coalition, solicited examples of program and project evaluations from each agency. Responses to this broad request for evaluations were reviewed for scientific rigor regarding measurement of impact on student outcomes. Collectively, the agencies submitted 115 program, project, and intervention evaluations, which the ACC reviewed using the hierarchy framework to determine the level of scientific rigor. Of the 115 evaluations submitted:

- 10 evaluations were scientifically rigorous evaluations that produced preliminary findings about a program or project's impact on education outcomes;
- 15 were scientifically rigorous impact evaluations that are currently under way and have yet to report results;

- 65 fell into the third level of the -hierarchy, that is, they were less rigorous evaluations of program or project impact, such as pre-post studies, comparison group studies without careful matching, or randomized controlled trials with important design flaws; and
- 25 were not impact evaluations, that is, they did not seek to measure a program or project's impact on education outcomes and so fell outside the hierarchy.

Of the 10 impact evaluations found to be sufficiently rigorous, four found the activity had a meaningful positive impact. Three of these four evaluations, as follows, have been fully completed and their results published in academic journals:

- *Undergraduate Research Opportunity Program* (UROP)[9]

The University of Michigan's Undergraduate Research Opportunity Program created one-year research partnerships between faculty members and first- and second-year undergraduate students. Using a well-designed, randomized controlled trial, the investigators found that UROP produced a 25 percent decrease in the number of students leaving the university prior to graduation, as compared to the control group. Additional research is needed to understand which elements of the UROP program were responsible for the observed outcome, i.e. being part of a group, having ready access to student and faculty mentors, or the research experience itself. NSF and the Department of Education sponsored the work (Recognition Award for the Integration of Research and Education, RAIRE and Fund for the Improvement of Postsecondary Education, respectively).

- *Direct Instruction in teaching 3rd and 4th graders how to design a simple, scientific experiment*[10]

Researchers at Carnegie Mellon University compared the efficacy of using Direct Instruction versus Discovery Learning to teach young students how to design simple, unconfounded scientific experiments. Through the use of randomized controlled trials, the investigators found that 77 percent of students in the Direct Instruction group became highly proficient at designing unconfounded experiments, compared to 23 percent of students in the Discovery Learning group. NIH/NICHD and NSF (Division of Behavioral and Cognitive Science) supported this research.

- *Incorporating peer-guided, small group sessions into an undergraduate general chemistry course typically taught in large lecture classes*[11]

A chemistry professor at the University of South Florida replaced one of three weekly, large general chemistry lecture classes with peer-guided, small-group sessions made up of 10 students each. Through the use of well-matched comparison groups, the professor found that the average score achieved by the intervention group on the American Chemical Society's national chemistry exam was modestly higher than those achieved by students who did not participate in the intervention. This small-scale study (Course, Curriculum and Laboratory Improvement Program), which NSF supported, indicates a promising practice worthy of additional exploration.

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9. Nagda, Biren A. and Sandra R. Gregerman, John Jonides, William von Hippel, Jennifer S. Lerner. "Undergraduate Student Faculty Research Partnerships Affect Student Retention." *The Review of Higher Education*. Vol. 22, No. 1, Fall 1998, pp. 55-72.
10. Klahr, David and Milena Nigam. "The Equivalence of Learning Paths in Early Science Instruction." *Psychological Science*. Vol. 15, No. 10, October 2004, pp. 661-667.
11. Lewis, Scott E. and Jennifer E. Lewis. "Departing from Lectures: An Evaluation of a Peer-Led Guided Inquiry Alternative." *Journal of Chemical Education*. Vol. 82, No.1, January 2005, pp. 135-139.

These are the best examples ACC found during its evaluation review that utilized sound methodology to test and evaluate the impact of particular education activities. However, even these well-designed studies with seemingly positive impacts would require additional replication and validation before they could be useful in driving decisions about education policy or recommended classroom practice. The working group highlighted these studies to demonstrate the promise that well-designed studies hold for producing positive outcomes and advancing the field of education, and to draw attention to the relative dearth of evidence regarding effective educational practices and activities.

Overlap and Lack of Coordination

As noted earlier, Congress assigned the ACC the task of identifying areas of overlap and duplication among federal STEM education programs and of recommending ways to improve the coordination of those programs. Appendix C shows which programs support the same target populations. Notable areas of overlap include but are not limited to:

- **K–12 Teacher Quality**: 45 programs have a goal to recruit and retain teachers with majors or minors in STEM fields or to increase the content knowledge of current K–12 STEM teachers. Pre-service teachers are a target population in 22 programs and in-service teachers are a target population in 39 programs.
- **Underserved Populations**: 57 programs, approximately half of the programs in the ACC program inventory, have a goal to support activities that ensure underserved populations are better represented in STEM fields and study.

Given the extent of the STEM challenge and the unique contributions that each agency is positioned to make, such overlap may not be inherently bad or wasteful. However, the ACC found that coordination among agencies could be improved to avoid, for example, grants to numerous projects that support the same sorts of interventions. Also, at times, there appears to be a lack of communication among the agencies about the work they are funding and the results that are being generated by the various grants and projects within their portfolios. For example, agencies are often uninformed by the results of earlier projects. Congress authorized the ACC as a temporary body and President Bush implemented it to remedy this lack of coordination and cooperation. Alternatively, NSTC is an established entity that coordinates activities of federal science agencies and, going forward, has the potential to strengthen cooperation and coordination among STEM programs and agencies.

Additionally, the design of the current programs tends to provide short-term support for the development phase of a particular intervention or program, such as the development of a curricular module, but few programs include a mechanism to identify promising practices and to test them on a larger scale using more rigorous methods. It appears that an education intervention developed by one agency is rarely used by another. ACC found no instances where ideas developed through the support of one agency have been handed off to another for implementation on a larger scale.

Finally, the ACC agencies and the education research community as a whole have very limited experience in structuring scientifically rigorous and cost-effective studies to estimate a project's impact on education outcomes. Many studies are small in scale, involve only the developers of interventions as the evaluators of their efficacy, and generate results that are anecdotal in nature. In the future, agencies will have to stimulate the research community to develop new research methodologies. Further, they will have to work together to develop more rigorous study designs of this type and to share examples of education activities, projects, and programs in which scientifically rigorous methods and evaluations of project impact were successfully employed.

VII. Recommendations of the ACC

As noted earlier, the Congress, in authorizing the ACC, directed it to recommend ways to improve, integrate and coordinate federal STEM education programs. The ACC has taken that charge seriously and, throughout its work, has sought ideas and information on improving not only program coordination, but also program results. On the basis of its deliberations, the ACC makes the following recommendations. Perhaps more importantly, the administration pledges to take steps to implement these recommendations immediately.

Recommendation 1: The ACC program inventory, goals and metrics should be living resources, updated regularly and used to facilitate stronger interagency coordination.

An important first step toward improving coordination is a regularly updated STEM education program inventory that provides agencies with readily available data about other agencies or programs that seek to address similar goals or fund similar activities. The initial program inventory, developed early in summer 2006, has already proven useful to agencies in reviewing their STEM portfolios and in identifying opportunities for interagency collaboration. To continue to be useful, however, the inventory must be kept current, reflecting changes in funding levels, statutory authorizations, agency responsibilities and priorities, and other factors. The administration will work to develop a Web-based inventory tool that can be easily updated by agencies on an annual basis.

Recommendation 2: Agencies and the federal government at large should foster knowledge of effective practices through improved evaluation and-or implementation of proven-effective, research-based instructional materials and methods.

To improve outcomes, agencies will focus their attention on:

- Measuring the impact of STEM education programs using the ACC goals and metrics;
- Implementing more rigorous evaluations, consistent with the hierarchy of evaluation designs presented in this report, to assess whether programs or activities are having the intended, positive impact;
- Implementing proven practices that have shown success through scientifically evaluated evidence; and
- Disseminating widely, within the federal government and to the public, consistent information on the effectiveness of federal programs.

Agencies will take immediate steps to embed the new metrics (see appendix B) into the design and operations of their programs, ensuring that project-level data on these metrics will be collected and analyzed wherever possible. Further, agencies should emphasize to all stakeholders that these metrics will be the basis for assessing programs.

To assist agencies in data collection for program evaluation, the federal government should improve and develop new mechanisms through which data on student-level outcomes can be collected and analyzed for research and evaluation purposes in a manner that safeguards individual privacy. Collecting such data will take time, but the Department of Education can facilitate this effort by helping agencies understand the types of data K–12 schools routinely collect and report, and by making school-level performance data from its new EDFacts reporting system available to other agencies. At the postsecondary level, all federal agencies would benefit from the development of a privacy-protected unit-record system that provides information on the long-term education pathway and outcomes of individual students. The administration has proposed a pilot initiative, to be administered by the National Center for Education Statistics in the Department of Education, which would develop with a consortium of states a prototype system for collecting and analyzing student data. The pilot would assess the feasibility of implementing a nationwide system with strong privacy protections.

In the past, many STEM education evaluations have been based on inputs (such as number of teachers trained) rather than outcomes (such as performance of students who were taught by teachers engaged in a STEM intervention). Similarly, evaluations have been based largely on attitudinal changes and customer satisfaction surveys rather than on education outcomes, or have relied on studies that lacked adequate experimental controls or sample size. Agencies will now use the hierarchy where appropriate to develop evaluation standards for estimating a program or project's impact on education outcomes, to provide support to investigators on the design of appropriate evaluations, and to create funding mechanisms that comprise both the strategy and support for increasingly rigorous evaluation of promising practices.

It is important to provide information to researchers, teachers, and the general public on the outcomes of well-designed studies. This includes the dissemination of interventions that were proven to be effective as well as those that were not. Negative results should not be seen as a failure so long as the agency used a carefully designed study and rigorous evaluation. Similarly, claims of effectiveness or causality should not be made unless the study design is of a level of scientific rigor that substantiates causal claims.

Recommendation 3: Federal agencies should improve the coordination of their K–12 STEM education programs with states and local school systems.

It is important for agencies to work with teachers and school officials to ensure that the research projects they fund address the challenges that teachers and school administrators face, and that the results of research projects are presented in ways that reach and are useful to classroom teachers.

Toward that end, the Department of Education and the NSF will host an annual meeting with the Council of Chief State School Officers to exchange ideas for enhancing program effectiveness. In addition, the NSTC will look for opportunities to achieve better "on the ground" coordination of related programs in some pilot communities.

Recommendation 4: Federal agencies should adjust program designs and operations so that programs can be assessed and measurable results can be achieved, consistent with STEM education program goals.

The value of the federal government's significant investment in math and science education programs can be substantially improved if program operations are modified to enable program managers and program participants to learn from these activities. With more knowledge about what works, and what doesn't, policymakers, program managers, and practitioners in the field can make better use of future investments to achieve results. The following are design and operational changes that agencies will consider:

- Programs that are overly broad will be either refocused on specific education problems, questions, or objectives, or divided into tracks so that the findings of individual projects can be aggregated; efforts will be made to synthesize and consolidate the findings of field-initiated programs.
- Agencies will establish common metrics and collect common data elements among all projects to enable comparative assessments that will yield information about best practices.
- Agencies and programs will seek the flexibility to target funding to the most effective activities. Often, program funding is directed in statute or policy to unproven activities. This practice diverts funds from activities that are more successful in achieving the nation's goals to improve STEM education in America.
- Agencies will adopt the most rigorous evaluation methodology appropriate to the activity they support. If projects are not mature enough to be assessed using randomized controlled trials or quasi-experimental designs, other rigorous methods can be used that will generate hypotheses about what is effective, and will enrich understanding of why certain approaches are effective or are not effective under particular conditions. In such cases, agencies will have a plan for identifying promising practices, and for collaborating with other federal or non-federal programs that can assist in development of better evaluations and further testing using scientifically rigorous approaches.
- Agencies will be certain that the duration of education research and intervention grants is appropriate to the scope of the work. A common complaint from investigators is that a typical three-year grant does not provide ample time to develop, test, implement, and improve an education intervention. Given the complications inherent in doing research involving human subjects, education research and intervention grants may need to be of a longer duration to promote the use of rigorous study designs and evaluation methodologies.

During the next year, the NSTC and its member agencies will identify and make recommendations for refining program activities in order to bring about a more cohesive and targeted portfolio of federal programs.

Recommendation 5: Funding for federal STEM education programs designed to improve STEM education outcomes should not increase unless a plan for rigorous, independent evaluation is in place, appropriate to the types of activities funded.

The hierarchy describes a pathway by which successful education interventions should be subjected to increasingly rigorous evaluation and validated for effect—potentially in meeting one or more national goals—before being recommended for broad use. Agencies should design appropriately rigorous evaluations early in the process of designing funding programs. This may include engaging professional evaluators early in the design process for funding programs, in conducting peer review, and in awarding and managing grants to ensure the use of appropriate and rigorous techniques to evaluate the impact of activities funded by the program. If evaluations find that specific activities are ineffective, they should be fixed or not be funded.

The ACC urges Congress to give careful consideration to the results of program and project impact, and to hold support for funding increases in abeyance until it is determined that programs have the capacity to rigorously evaluate the effectiveness of their activities. Similarly, the Congress should not create new STEM programs unless it is clear that there are gaps in the current portfolio that the new programs will fill.

Conducting a well-designed study of a project's impact on education outcomes requires a great deal of planning. It involves the selection of participants, the establishment of an experimental control group, and the collection of baseline and experimental data. All too often, evaluators are hired once the experiment has already begun. It is important that agencies include knowledgeable evaluation professionals in the design of federal programs and projects and on peer review panels to ensure the appropriateness and rigor of the methodologies used. Moreover, it is imperative that agencies provide technical support to investigators who may lack expertise in project evaluation.

Additionally, as the National Academies of Sciences pointed out in the study *On Evaluating Curricular Effectiveness*[12], all too often evaluations are conducted by the investigators themselves or by a firm solicited by the investigator. Early on in the evolution of an education activity, it may not be possible or even worthwhile to solicit an independent evaluation of its efficacy. But agencies need to understand that as activities mature to the point where they may be recommended to others as effective practice, the collective evidence supporting this recommendation must be validated either by scientific replication or review by a qualified, independent entity. Agencies need to develop new models for evaluating the most promising and mature projects so that a truly independent assessment of efficacy can be conducted.

Recommendation 6: Agencies with STEM education programs should collaborate on implementation of ACC recommendations under the auspices of the NSTC. Specifically, NSTC member agencies should identify high-leverage programs and collaborate on how to structure evaluations, embed metrics into their programs, and coordinate their activities. Under the auspices of the NSTC, member agencies will present a report to the president on agency progress and additional detailed recommendations at an ACC principals meeting chaired by the secretary of education by Oct. 1, 2007.

The ACC has made significant progress by developing a comprehensive inventory of STEM education programs, establishing a set of common goals and metrics for measuring success in meeting those goals, establishing a hierarchy for improving the scientific rigor of studies designed to measure a program or project's impact on education outcomes, and creating new opportunities to share information and coordinate programs. In addition, the ACC working group meetings provided an opportunity for representatives from different agencies to meet each other and to share information about studies that were particularly well designed or that had particularly compelling outcomes. The NSTC should conduct a more in-depth review of programs and activities that achieve measurable results and that have the greatest potential to enhance student learning, strengthen teacher quality, and increase the number of postsecondary students who complete STEM degree programs. This effort will examine agency progress in modifying program operations and initiating rigorous evaluations to measure their impact, and will identify additional opportunities for multi-agency coordination that would enhance program effectiveness.

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12. National Academy of Sciences, *On Evaluating Curricular Effectiveness: Judging the Quality of K-12 Mathematics Evaluations*, Committee for a Review of the Evaluation Data on the Effectiveness of NSF-Supported and Commercially Generated Mathematics Curriculum Materials, Jere Confrey and Vicki Stohl, Editors, National Research Council, 2004.

Appendix A: Academic Competitiveness Council Statutory Authority

S. 1932—152

TITLE VIII—EDUCATION AND PENSION BENEFIT PROVISIONS

Subtitle A—Higher Education Provisions

SEC. 8001. SHORT TITLE; REFERENCE; EFFECTIVE DATE.

(a) SHORT TITLE.—This subtitle may be cited as the ''Higher Education Reconciliation Act of 2005''.

(b) REFERENCES.—Except as otherwise expressly provided, whenever in this subtitle an amendment or repeal is expressed in terms of an amendment to, or repeal of, a section or other provision, the reference shall be considered to be made to a section or other provision of the Higher Education Act of 1965 (20 U.S.C. 1001 et seq.).

(c) EFFECTIVE DATE.—Except as otherwise provided in this subtitle or the amendments made by this subtitle, the amendments made by this subtitle shall be effective July 1, 2006.

SEC. 8002. MODIFICATION OF 50/50 RULE.

Section 102(a)(3) (20 U.S.C. 1002(a)(3)) is amended—

(1) in subparagraph (A), by inserting ''(excluding courses offered by telecommunications as defined in section 484(l)(4))'' after ''courses by correspondence''; and

(2) in subparagraph (B), by inserting ''(excluding courses offered by telecommunications as defined in section 484(l)(4))'' after ''correspondence courses''.

SEC. 8003. ACADEMIC COMPETITIVENESS GRANTS.

Subpart 1 of part A of title IV (20 U.S.C. 1070a) is amended by adding after section 401 the following new section:

''SEC. 401A. ACADEMIC COMPETITIVENESS GRANTS.

''(a) ACADEMIC COMPETITIVENESS GRANT PROGRAM.—

''(1) ACADEMIC COMPETITIVENESS GRANTS AUTHORIZED.— The Secretary shall award grants, in the amounts specified in subsection (d)(1), to eligible students to assist the eligible students in paying their college education expenses.

''(2) ACADEMIC COMPETITIVENESS COUNCIL.—

''(A) ESTABLISHMENT.—There is established an Aca-demic Competitiveness Council (referred to in this para-graph as the 'Council'). From the funds made available under subsection (e) for fiscal year 2006, $50,000 shall be available to the Council to carry out the duties described in subpara-graph (B). The Council shall be chaired by the Secretary of Education, and the membership of the Coun-cil S. 1932—153 shall consist of officials from Federal agencies with respon-sibilities for managing existing Federal programs that pro-mote mathematics and science (or designees of such officials with significant decision-making authority).

''(B) DUTIES.—The Council shall—

''(i) identify all Federal programs with a mathematics or science focus;

''(ii) identify the target populations being served by such programs;

''(iii) determine the effectiveness of such programs;

''(iv) identify areas of overlap or duplication in such programs; and

''(v) recommend ways to efficiently integrate and coordinate such programs.

''(C) REPORT.—Not later than one year after the date of enactment of the Higher Education Rec-onciliation Act of 2005, the Council shall transmit a report to each com-mittee of Congress with jurisdic-tion over a Federal program identified under subparagraph (B)(i), detailing the findings and recommenda-tions under subparagraph (B), including recommendations for legislative or administrative action.

Appendix B: Federal STEM Education Goals and Metrics

K-12 Education

K-12 National Metrics

Goal 1. Student Learning: Prepare all students with the science, technology, engineering, and math skills needed to succeed in the 21st-century technological economy, whether in postsecondary education or the workforce; and graduate students with the capability and motivation to become STEM professionals, educators, and leaders

	Metric	**Source and Supplemental Information**
1	NAEP Long-term Trend Mathematics scores for 9, 13, and 17 year olds	IES/NCES: National Assessment of Educational Progress (NAEP) • Data available for 1973 – 2004; future assessments every 4 years • Data available for key subgroups (gender, major ethnic categories, parental education)
2	NAEP National Mathematics and Science data for grades 4, 8, and 12—percent of students at or above proficient	IES/NCES: National Assessment of Educational Progress (NAEP) • Math data are collected every 2 years for grades 4 and 8 and every 4 years for grade 12. Science data available for 1996, 2000, and 2005; next assessment in 2009. • Data available for key subgroups (gender, major ethnic categories, poverty)
3	Percentage of students scoring at proficient or advanced levels on State mathematics and science assessments	Department of Education • Annual • Data available for key subgroups • State science assessments are required starting in 2007-08
4	SAT mathematics and ACT mathematics and science scores; SAT subject tests	College Board and ACT • Annual data • Data available for key subgroups • Comparability issues across time
5	Number of AP exams with scores of 3, 4, or 5 in particular subjects Number of students taking AP exams	ETS • Annual data • Data available for key subgroups • Keep in mind change in number of high school students
6	Trends in International Mathematics and Science Study (TIMSS) scores and ranking	IES/NCES • Allows international comparisons. • 4th grade data available for 1995, 1999, and 2003; 8th grade data available for 1995 and 2003
7	Program for International Student Assessment (PISA) scores and U.S. ranking	IES/NCES • Allows international comparisons of 15 year old students. • Data every 3 years (with math focus in 2003 and science focus in 2006)
8	Percentage of college students who took remedial or developmental courses in mathematics during their freshman or sophomore years	National Postsecondary Student Aid Study (NPSAS) • Periodic data since the 1986-87 school year

Goal 2. Teacher Quality: Recruit and retain teachers with majors or minors in STEM fields and increasing the content knowledge of current K-12 STEM teachers.

	Metric	**Source and Supplemental Information**
1	Percentage of middle and secondary school students whose mathematics and science classes are taught by teachers with (a) a major and (b) a minor in the subject being taught	IES/NCES: Schools and Staffing Survey (SASS) • SASS is collected approximately every 4 years, with data for 1987-88, 1990-91, 1993-94, 1999-2000, and 2003-04. • Data available for different types of schools (e.g., high poverty) • Percentage of students rather than percent of teachers wording is used to keep the focus on students and to help get around the issue of out-of-field teaching.
2	Percentage of mathematics and science teachers who are highly qualified under No Child Left Behind*	U.S. Department of Education
3	Average number of years of teaching experience for mathematics and science teachers	IES/NCES: Schools and Staffing Survey (SASS)
4	Percentage of mathematics and science teachers with a master's degree or higher in their primary teaching field	IES/NCES/Schools and Staffing Survey (SASS)
5	Percentage of mathematics and science teachers who meet criteria for being "effective" teachers	No current measures

Goal 3. Engagement: Increase student engagement in STEM and their perception of its value to their lives.

	Metric	**Source and Supplemental Information**
1	Average number of Carnegie units earned by HS students in math and science	NCES transcript studies (data now available for 1982, 1990, 1994, 1998, and 2000.)
2	Number of students who major in STEM fields in college	National Postsecondary Student Aid Study (NPSAS) • Periodic data since the 1986-87 school year
3	Percentage of 8th graders taking algebra	The 2005 Grade 8 Math Student Background Questionnaire asks students what math class they were taking.
4	Percentage of students who express an interest in mathematics and science	No current measures identified for math. The 2005 NAEP Science assessment asked students if they liked science
5	Percentage of students participating in extracurricular activities in mathematics and science	No current measures identified.

K-12 Program and Project Metrics

Goal 1. Student Learning: Prepare all students with the science, technology, engineering and math skills needed to succeed in the global economy, whether in postsecondary education or the workforce; and graduate students with the capability and motivation to become STEM professionals, educators, and leaders.

	Metric	**Suitable for:**	**Supplemental information**
1	Percentage of projects that demonstrate significant improvement in student achievement in a given subject, based on rigorous evaluation designs	Program	Individual projects would assess the effect of the projects on student achievement, using, whenever possible, experimental or quasi-experimental designs. Program effectiveness would be based on the percentage of projects that were effective. Suitable for programs that fund demonstration and service projects.
2	Percentage of students who meet or exceed proficient and advanced levels on State assessments of a given subject	Project or program	Suitable for programs that fund applied research, demonstration, and service projects.
3	Percentage of basic research projects judged by independent experts to make a significant contribution to our understanding of student learning in a given subject	Program	Suitable for programs that fund basic research projects
4	Percentage of funded projects that are using multi-site, controlled trials of interventions and programs to assess project effectiveness	Program	Suitable for initial assessment of programs that fund applied research and demonstration projects
5	The number of new approaches and interventions developed with program funds that have been found to be effective and that subsequently have been adopted at scale	Program	Suitable for long-term assessment of programs that fund applied research and demonstration projects

Goal 2. Teacher Quality: Recruit and retain teachers with majors or minors in STEM fields and increasing the content knowledge of current K-12 STEM teachers.

	Metric	**Suitable for:**	**Supplemental information**
1	Percentage of projects, based on rigorous evaluations, where the students of participating teachers demonstrate increased competency in a given subject or area	Program	Experimental or quasi-experimental designs would be preferred
2	Percentage of teachers, based on rigorous evaluations, demonstrating increased competency in a given subject or area	Project or program	Experimental or quasi-experimental designs would be preferred
3	Percentage of teachers, based on rigorous evaluations, who improve classroom instruction in a given subject or area	Project or program	Experimental or quasi-experimental designs would be preferred
4	Percentage of participants who become teachers in high poverty schools	Project or program	Experimental or quasi-experimental designs would be preferred
5	Percentage of participating teachers who are still teaching in 5 years	Project or program	Experimental or quasi-experimental designs would be preferred

Goal 3. Engagement: Increase student engagement in STEM and their perception of its value to their lives.

	Metric	**Suitable for:**	**Supplemental information**
1	Percentage of students whose enjoyment of a given subject increased after participation in project activities	Project or program	Experimental or quasi-experimental designs would be preferred
2	Number of mathematics and sciences courses taken by participants, compared to nonparticipants, in high school	Project or program	Experimental or quasi-experimental designs would be preferred
3	Percentage of participants, compared to nonparticipants, who major in STEM fields in college	Project or program	Experimental or quasi-experimental designs would be preferred
4	Percent of participants, compared to nonparticipants, who participate in sustained extracurricular activities	Project or program	Experimental or quasi-experimental designs would be preferred

Undergraduate Education

Undergraduate National Goals and Metrics/Program, Project and Intervention Metrics

Goal 1. STEM Workforce: Increase the number of undergraduates who enroll in and complete STEM degree programs, and are thus prepared to enter STEM or STEM-related careers or advanced education.

	Metric		Source and Supplemental Information
1	The number and/or percentage of students who declare and complete a STEM major or program of study (this includes students who transfer from 2- year colleges and go on to complete 4- year STEM degrees, even if they transferred prior to completing an associate's degree)		Institutions of higher education or IPEDS can provide the basic information on number of STEM graduates. • Persistence from freshman year (% of STEM-oriented freshmen getting B.S. degrees in STEM 5 or 6 years later); Data on freshman plans available from the Higher Education Research Institute (HERI) covering a large sample of institutions ("The American Freshman: National Norms"); similar data are available from ACT and SAT • National Center for Education Statistics • Unit Record System
2	The number and/or percentage of STEM graduates who stay in STEM by attending a STEM or STEM-related graduate program		Department of Education & NSF/ SRS recent graduates surveys (available biennially) provide aggregated data on total number of students who are enrolled in graduate programs. • Unit Record System
3	The number and/or percentage of STEM graduates who take a job in a STEM or STEM-related field		Department of Education & NSF/ SRS recent graduates surveys (available biennially); however, new definitions are required for STEM-related fields.
4	Employer satisfaction with student preparation and readiness to enter the STEM job market		American Customer Satisfaction Survey
5	Where appropriate, student achievement on national STEM exams, standardized tests within disciplines, and licensure exams		Professional societies • Testing services organizations

Program Goal 1. STEM Workforce: Increase the number of undergraduates who enroll in and complete STEM degree programs, and are thus prepared to enter STEM or STEM-related careers or advanced education.

	Metric		Source and Supplemental Information
1	The number and/or percentage of students who declare and complete a STEM major or program of study (which includes students who transfer from 2-year colleges and complete 4-year STEM degrees even if they transfer prior to completing the 2-year degree first)		Institutions of higher education or IPEDS can provide the basic information on number of STEM graduates. • Persistence from freshman year (% of STEM-oriented freshmen getting B.S. degrees in STEM 5 or 6 years later); Data on freshman plans available from the Higher Education Research Institute (HERI) covering a large sample of institutions ("The American Freshman: National Norms"); similar data are available from ACT and SAT • National Center for Education Statistics • Unit Record System
2	The number and/or percentage of STEM graduates who stay in STEM by attending a STEM or STEM-related graduate program		Department of Education & NSF/ SRS recent graduates surveys (available biennially) provide aggregated data on total number of students who are enrolled in graduate programs. • Unit Record System
3	The number and/or percentage of STEM graduates who take a job in a STEM or STEM-related field		Department of Education & NSF/ SRS recent graduates surveys (available biennially); however, new definitions are required for STEM-related fields.
4	The number/percentage of students who are not STEM majors, but who successfully complete STEM courses		
5	Where appropriate, student scores on relevant licensure, national disciplinary exams, graduate/professional entrance exams and the like		Professional societies • Testing services organizations.
6	Employer satisfaction with student preparation and readiness to enter the STEM job market		American Customer Satisfaction Survey

Goal 2. Collaborative Communities: Encourage and support STEM professional collaborations, networks, communities and alliances among educators, students, practitioners, government, professional organizations and industry.

	Metric		Source and Supplemental Information
1	The number and/or percentage of students who participate in scientific activities or research experiences in industry, government or the non-profit sector		Project reports
2	The number and/or percentage of students who present research findings at scientific meetings or student science exchange events		Project reports
3	The number of students who participate in interdisciplinary research or educational experiences		Project reports
4	The number of students who earn minors in a second STEM field		Project reports
5	The number of STEM courses successfully completed by non-STEM majors		Project reports

Goal 3. Institutional Capacity: Support advancement and development of STEM personnel, programs, and infrastructure in institutions that educate.

	Metric		Source and Supplemental Information
1	The number of students who engage in research experiences in an academic, industry, government, or nonprofit laboratory		Program and project data
2	Number of courses that integrate the use of instruments, methods, and procedures that are commonly used in an academic, industry, or government laboratory		Program and project reports

Note: An overarching goal of all STEM undergraduate programs is to increase the diversity of STEM majors and workers. Data should be collected in such a way that it can be disaggregated by gender and ethnicity.

Graduate and Postgraduate Education

Graduate and Postgraduate National Goals and Metrics

	Metric		Source/Supplemental information
1	The number and/or percentage of graduate/postdoctoral fellowship or traineeship recipients who complete a STEM graduate or postdoctoral program; the number and/or percentage of program completers who are employed in a STEM or STEM-related field		Survey of Earned Doctorates • Survey of Doctorate Recipients
2	Average time to degree completion for STEM doctoral students.		Survey of Earned Doctorates • Survey of Doctorate Recipients
3	Average age at which graduate and/or post-doctoral fellows established an independent scientific career.		Source not yet known
4	Contributions to the research enterprise		Metrics to be developed

Graduate and Postgraduate Program Metrics

	Metric		Source/Supplemental information
1	The number and/or percentage of graduate/postdoctoral fellowship or traineeship recipients who complete a STEM graduate or postdoctoral program; the number and/or percentage of program completers who are employed in a STEM or STEM-related field		Survey of Earned Doctorates • Survey of Doctorate Recipients
2	Average time to degree completion for STEM doctoral students.		Survey of Earned Doctorates • Survey of Doctorate Recipients
3	Career induction and retention in academia (independent funding, tenure), industry, government and in STEM or STEM-related fields.		Survey of Earned Doctorates • Survey of Doctorate Recipients • Professional society data
4	Career satisfaction – actual career pathway versus desired pathway.		Survey of Earned Doctorates • Professional society data
5	Research quality and productivity.		Metrics to be developed

**Metrics to evaluate the research quality and contributions of graduate and post-doctoral programs have not been developed as part of this effort. The ACC recommends a follow-up effort to examine the state of graduate and post-doctoral education at large and to develop appropriate metrics to evaluate the quality of research and professional productivity of graduate students and post-doctoral fellows

Note: An overarching goal of all STEM undergraduate programs is to increase the diversity of STEM majors and workers. Data should be collected in such a way that it can be disaggregated by gender and ethnicity.

Informal Education and Outreach

Informal Education and Outreach--National and Program Metrics

Goal 1. Public Audiences: Increase awareness, interest, engagement, and understanding of STEM concepts, processes, and careers by the general public and other targeted populations in the context of informal education and outreach.

Metric	Type	Source/Supplemental information
Awareness, knowledge, or understanding of STEM concepts, processes, or careers via informal STEM education and outreach deliverable	number, percent; trend; gain	Project: in target audience Program: across portfolio National: public survey data
Engagement or interest in STEM concepts, processes, or careers via informal STEM education and outreach deliverable	number, percent; trend; gain	Project: in target audience Program: across portfolio National: public survey data; ASTC, Nielsen, Arbitron, web site data
Attitude towards STEM-related topic or capabilities via informal STEM education and outreach deliverable	number, percent; trend; gain	Project: in target audience National: public survey data
Behavior in target audience resulting from engagement with informal STEM education and outreach deliverable.	number, percent; trend; gain	Project: in target audience.
New skills in target audience based on engagement with informal STEM education and outreach deliverable.	number, percent; trend; gain	Project: in target audience

Goal 2. **Professional Audiences.** Improve practice and build professional and institutional capacity through efforts that seek to generate, develop, and apply effective ideas and models for the informal STEM education field.

Metric	Type	Source/Supplemental information
Awareness, knowledge, or understanding of informal STEM education/outreach research or practice.	number, percent; trend; gain	Project: in target audience Program: in informal STEM education and outreach field
Engagement or interest in advancing the informal STEM education and outreach field.	number, percent; trend; gain	Project: in target audience Program: in informal STEM education and outreach field
Attitude towards informal STEM education/outreach research or practice.	number, percent; trend; gain	Project: in target audience Program: in informal STEM education and outreach field
Behavior in target audience related to informal STEM education/outreach research or practice.	number, percent; trend; gain	Project: in target audience Program: in informal STEM education and outreach field
New skills in target audience based on informal STEM education/outreach research or practice.	number, percent; trend; gain	Project: in target audience Program: in informal STEM education and outreach field

Appendix C: Federal STEM Programs--by Agency and Populations Served

Agency and Program	Mathematics	Science/Tech/Engineering	FY 2006 Appropriation	Underrepresented Populations	K-12 Proficiency	K-12 High Achievement	K-12 Students General Instruction	Preservice Teachers	Inservice Teachers	Future STEM Practitioners	Current STEM Practitioners	Undergraduate Students (Majors)	Undergraduate Students (Nonmajors)	Graduate Students	Postdoctoral Fellows	College Faculty	General Public	Other
Department of Agriculture																		
1890 Institution Teaching and Research Capacity Building Grants Program		X	$12,189,000	X						X	X	X		X		X		
Agriculture in the Classroom (AITC)		X	$856,350				X		X									
Alaska Native- and Native Hawaiian-Serving Institutions Education Grants		X	$3,218,000	X						X	X	X				X		
Food and Agricultural Sciences National Needs Graduate and Postdoctoral Fellowships Grants Program		X	$3,701,000							X				X	X			
Higher Education Challenge Grants Program		X	$5,423,000							X	X	X		X		X		
Higher Education Multicultural Scholars Program		X	$988,000	X						X		X						
Hispanic-Serving Institutions Education Grants Program		X	$5,940,000	X						X	X	X		X		X		
International Science and Education Competitive Grants Program		X	$990,000							X	X			X		X	X	
Resident Instruction Grants for Institutions of Higher Education in Insular Areas		X	$495,000	X						X	X	X		X		X		
Secondary and Two-Year Postsecondary Agriculture Education Challenge Grants Program		X	$990,000		X				X	X		X				X		
Tribal Colleges Education Equity Grants Program		X	$2,228,000	X						X	X	X						
Tribal Colleges Fund		X	$2,577,000	X						X	X	X		X		X		
Department of Commerce																		
Bay Watershed Education and Training Program (B-WET)		X	$6,904,000	X	X		X		X								X	
Chesapeake Bay Interpretive Buoys		X	$493,000				X		X								X	
Educational Partnership Program with Minority Serving Institutions		X	$14,201,000	X						X		X		X	X	X		
Ernest F. Hollings Scholarship Program		X	$3,962,000					X		X		X	X					
Gulf Coast Explorium		X	$986,000														X	
Hawaii Humpback Whale Education Program		X	$1,726,000				X											
JASON Education and Outreach	X	X	$2,466,000				X		X									
Nancy Foster Scholarship Program		X	$448,000	X						X				X				
Narragansett Bay Marine Education		X	$493,000				X		X									
National Institutes of Health(NIH)/NIST National Research Council (NRC) Joint Postdoctoral Research Associateships Program	X	X	$338,250							X	X					X		
NOAA Education Initiative		X	$6,284,000	X		X	X		X								X	

NOTE: Designations made by administering agency

	Mathematics	Science/Tech/Engineering	FY 2006 Appropriation	Underrepresented Populations	K-12 Proficiency	K-12 High Achievement	K-12 Students General Instruction	Preservice Teachers	Inservice Teachers	Future STEM Practitioners	Current STEM Practitioners	Undergraduate Students (Majors)	Undergraduate Students (Nonmajors)	Graduate Students	Postdoctoral Fellows	College Faculty	General Public	Other
Summer Undergraduate Research Fellowship (SURF) Program	X	X	$416,000	X						X		X						
Department of Defense																		
DoD STARBASE Program	X	X	$16,472,000	X													X	X
Dr. John Hopps Defense Research Scholars Program	X	X	$1,700,000	X		X				X		X	X	X	X			
Gains in the Education of Mathematics and Science (GEMS)	X	X	$415,000	X			X		X									
Mathematics Summer Employment Program (MSEP)	X	X	$146,672									X						
National Defense Science and Engineering Graduate (NDSEG) Fellowship	X	X	$31,600,000	X						X				X				
National Science Center (NSC)	X	X	$1,958,000	X	X		X	X	X								X	
Science, Mathematics and Research for Transformation (SMART)	X	X	$9,200,000							X	X	X		X				
Uniformed Services University of the Health Sciences (USUHS)		X	$115,225,000											X	X			
University Nanosatellite Program		X	$1,400,000									X		X				
Department of Education																		
Adjunct Teacher Corps	X	X	$0	X	X			X			X							
Advanced Placement	X	X	$32,175,000	X	X	X			X									
Evaluation of Mathematics and Science Programs	X	X	$0		X	X	X	X	X									
Fund for the Improvement of Education (FIE)	X	X	$0	X	X	X	X	X	X									
Fund for the Improvement of Postsecondary Education (FIPSE)	X	X	$5,834,000	X				X	X	X		X	X	X		X		
Graduate Assistance in Areas of National Need	X	X	$30,067,290	X						X				X				
Math Now for Elementary School Students	X		$0		X		X		X									
Math Now for Middle School Students	X		$0		X				X									
Mathematics and Science Partnerships	X	X	$182,160,000		X		X		X									
Minority Science and Engineering Improvement Program	X	X	$8,729,820	X						X		X				X		
National Mathematics Panel	X		$0		X	X	X	X	X									
Research in Special Education	X	X	$257,000		X	X	X	X	X									
Research, Development, and Dissemination	X	X	TBD		X	X	X	X	X									
Science and Mathematics Access to Retain Talent (SMART) Grants	X	X	$390,000,000	X				X		X								
Teacher Loan Forgiveness	X	X	$24,000,000	X		X				X								
Upward Bound Math and Science Program	X	X	$32,300,000															
Department of Energy																		
Department of Energy Academies Creating Teacher Scientists (DOE Acts)	X	X	$1,840,000						X									

NOTE: Designations made by administering agency

	Mathematics	Science/Tech/Engineering	FY 2006 Appropriation	Underrepresented Populations	K-12 Proficiency	K-12 High Achievement	K-12 Students General Instruction	Preservice Teachers	Inservice Teachers	Future STEM Practitioners	Current STEM Practitioners	Undergraduate Students (Majors)	Undergraduate Students (Nonmajors)	Graduate Students	Postdoctoral Fellows	College Faculty	General Public	Other
Science Undergraduate Laboratory Internship	X	X	$2,257,000									X	X					
U.S. Department of Energy Computational Science Graduate Fellowship (CSGF) Program	X	X	$5,500,000								X	X	X	X	X			
WERC: a Consortium for Environmental Education and Technology Development		X	$2,500,000	X			X	X	X			X	X	X				
Department of Health and Human Services																		
NIH K-12 STEM Education Activities	X	X	$35,915,464	X	X	X	X	X	X	X	X							
NIH STEM Outreach Activities		X	$5,183,000														X	
Nurse Education, Practice and Retention (NEPR) Program		X	$37,291,000									X						X
Nursing Workforce Diversity (NWD) Program	X	X	$16,107,000	X	X							X						X
Ruth L. Kirschstein National Research Service Award (NRSA) Program		X	$761,000,000	X								X		X	X			
Department of Homeland Security																		
Cooperative Research Units Program		X	$14,664,000							X	X			X		X		
Scholarship and Fellowship Program	X	X	$13,300,000							X		X		X				
Department of the Interior																		
EDMAP Component of the National Cooperative Geologic Mapping Program		X	$473,651							X	X	X		X		X		
Student Educational Employment Program (SEEP)	X	X	$1,221,202	X								X		X	X			
Water Resources Research Act Program		X	$6,404,369							X		X	X	X			X	
Department of Transportation																		
Dwight David Eisenhower Transportation Fellowship Program		X	$1,829,000									X	X	X				
Garrett A. Morgan Technology and Transportation Education Program		X	$1,040,000	X	X	X												
National Summer Transportation Institute Program		X	$312,500															
State Maritime Schools	X	X	$11,099,000							X		X						
The U.S. Merchant Marine Academy (USMMA)	X	X	$61,236,000							X		X						
University Transportation Centers (UTC) Program		X	$76,700,000	X						X		X	X	X				
Environmental Protection Agency																		
Green Chemistry Program		X	$0				X					X		X	X	X		
Green Engineering Program		X	$55,000							X	X	X	X	X	X	X		
Science to Achieve Results (STAR) Graduate Fellowship Program	X	X	$9,500,000							X		X		X				
The Greater Research Opportunities (GRO) Fellowship Program	X	X	$1,500,000							X		X		X				

NOTE: Designations made by administering agency

	Mathematics	Science/Tech/Engineering	FY 2006 Appropriation	Underrepresented Populations	K-12 Proficiency	K-12 High Achievement	K-12 Students General Instruction	Preservice Teachers	Inservice Teachers	Future STEM Practitioners	Current STEM Practitioners	Undergraduate Students (Majors)	Undergraduate Students (Nonmajors)	Graduate Students	Postdoctoral Fellows	College Faculty	General Public	Other
National Aeronautics and Space Administration																		
e-Education Program	X	X	$8,100,000	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Elementary & Secondary Education Program	X	X	$14,900,000	X	X	X	X	X	X									
Higher Education Program	X	X	$69,200,000									X	X	X	X	X		
Informal Education Program	X	X	$34,000,000	X	X				X								X	
Minority University Research and Education Program	X	X	$36,200,000	X								X	X	X	X	X		
National Science Foundation																		
Advanced Technological Education (ATE)	X	X	$44,930,000				X	X		X		X				X		
Alliances for Graduate Education and the Professoriate (AGEP)	X	X	$14,500,000	X						X				X			X	
Broadening Participation in Computing (BPC)		X	$14,000,000	X								X	X	X		X		
Centers for Ocean Science Education Excellence (COSEE)		X	$4,530,000	X			X		X		X						X	
CISE Pathways to Revitalized Undergraduate Computing Education (CPATH)		X	$3,000,000	X								X				X		
Course, Curriculum and Laboratory Improvement (CCLI)	X	X	$35,930,000					X		X		X	X			X		X
Cyberinfrastructure Training, Education, Advancement, and Mentoring for Our 21st Century Workforce (CI-TEAM)	X	X	$10,000,000	X		X	X	X	X			X	X	X	X		X	
Discovery Research K-12 (DR-K12)	X	X	$93,360,000		X	X	X	X	X	X		X		X			X	
Engineering Education Reform (EER)		X	$14,950,000									X	X	X	X	X		
Excellence Awards in Science and Engineering (EASE)	X	X	$4,370,000	X					X							X		X
Federal Cyber Service: Scholarship for Service/Cybercorps (SFS)	X	X	$10,300,000									X		X		X		
Geoscience Teacher Training (GEO-Teach)		X	$3,000,000					X	X		X							
Graduate Research Fellowships (GRF)	X	X	$93,360,000	X						X				X				
Graduate Teaching Fellows in K-12 Education (GK-12)	X	X	$50,650,000	X			X		X	X				X				
Historically Black Colleges and Universities Undergraduate Program (HBCU-UP)	X	X	$25,180,000	X						X		X				X		
Informal Science Education (ISE)	X	X	$62,700,000	X			X			X							X	
Information Technology Experiences for Students and Teachers (ITEST)	X	X	$20,000,000	X			X		X	X								
Integrative Graduate Education and Research Traineeship Program (IGERT)	X	X	$65,420,000	X						X				X		X		
Interdisciplinary Training for Undergraduates in Biological and Mathematical Sciences (UBM)	X	X	$3,500,000							X		X						

NOTE: Designations made by administering agency

	Mathematics	Science/Tech/Engineering	FY 2006 Appropriation	Underrepresented Populations	K-12 Proficiency	K-12 High Achievement	K-12 Students General Instruction	Preservice Teachers	Inservice Teachers	Future STEM Practitioners	Current STEM Practitioners	Undergraduate Students (Majors)	Undergraduate Students (Nonmajors)	Graduate Students	Postdoctoral Fellows	College Faculty	General Public	Other
Louis Stokes Alliances for Minority Participation (LSAMP)	X	X	$35,000,000	X						X		X		X				
Math and Science Partnership (MSP)	X	X	$63,180,000	X	X	X	X	X	X							X		X
NSF Academies for Young Scientists (NSFAYS)	X	X	$14,000,000		X		X		X								X	
Opportunities for Enhancement of Diversity in the Geosciences (OEDG)		X	$4,600,000	X			X			X	X	X	X	X				
Post-Doctoral Fellowship Programs (PFP)	X	X	$17,720,000	X						X				X	X			
Research and Evaluation on Education in Science and Engineering (REESE)	X	X	$48,060,000		X	X			X			X		X				
Research Experiences for Undergraduates (REU) Sites		X	$34,730,000						X	X		X	X			X		
Research in Disabilities Education (RDE)	X	X	$5,110,000	X	X		X		X	X		X		X		X	X	
Research on Gender in Science and Engineering (GSE)	X	X	$9,680,000	X			X		X	X		X		X		X	X	
Robert Noyce Scholarship Program (NOYCE)	X	X	$8,770,000					X		X		X		X				
Scholarships in Science, Technology, Engineering and Mathematics (S-STEM)	X	X	$50,000,000							X		X		X				
STEM Talent Expansion Program (STEP)	X	X	$25,570,000							X		X						
Tribal Colleges and Universities Program (TCUP)	X	X	$9,270,000	X			X	X	X	X		X	X			X	X	
Undergraduate Mentoring in Environmental Biology (UMEB)		X	$3,000,000	X								X						
Undergraduate Research Collaborative (URC)		X	$3,860,000	X						X		X						
Vertical Integration of Research and Education in the Mathematical Sciences (VIGRE)	X		$17,530,000							X			X	X		X		
Summary	**69**	**110**	**$3,115,040,568**	**57**	**24**	**17**	**34**	**22**	**39**	**59**	**20**	**61**	**21**	**51**	**16**	**34**	**20**	**6**

Source: Academic Competitiveness Council, 2006

NOTE: Programs with no FY2006 appropriation were included for the purpose of including all STEM education programs subject to ACC review. As such, totals referenced in the report for programs with FY 2006 funding are lower than the totals in this Appendix.

NOTE: Designations made by administering agency

Appendix D: Federal STEM Education Program Funding and Count, by Agency: FY 2005-2007 PB

Agency Name	FY 2005		FY 2006		FY 2007	
	Funding	Number of programs	Funding	Number of programs	Request	Number of programs
Department of Agriculture	38,429,000	12	39,595,350	12	40,362,000	12
Department of Commerce	36,028,049	9	38,717,250	12	19,974,250	6
Department of Defense	179,046,312	8	178,116,672	9	170,153,068	8
Department of Education	461,157,189	9	705,523,110	9	1,065,028,820	12
Department of Energy	12,004,000	4	12,097,000	4	14,290,000	3
Department of Health and Human Services	850,112,378	5	855,496,464	5	851,314,808	5
Department of Homeland Security	10,600,000	1	13,300,000	1	12,500,000	1
Department of the Interior	23,318,491	4	22,763,222	4	16,923,202	3
Department of Transportation	135,573,000	3	152,216,500	6	151,990,500	6
Environmental Protection Agency	11,100,000	2	11,055,000	3	7,400,000	2
National Aeronautics and Space Administration	178,800,000	5	162,400,000	5	153,300,000	5
National Science Foundation	878,250,000	31	923,760,000	35	970,650,000	34
Total	**2,814,418,419**	**93**	**3,115,040,568**	**105**	**3,473,886,648**	**97**

NOTE: Funding amounts are estimated and may not be final. Due to delayed final 2007 appropriations (see Page 10 of this report for more detailed discussion), 2007 enacted and 2008 President's Budget funding levels could not be included.

Appendix E: Federal STEM Education Program Funding and Count by Primary Subgroup and Agency, FY 2005–2007 PB

Agency name	2005 funding/count		2006 funding/count		2007 request/count	
Graduate/Postgraduate Programs						
Department of Agriculture	2,976,000	1	3,701,000	1	4,455,000	1
Department of Commerce	17,521,049	3	14,987,250	3	14,950,250	3
Department of Defense	160,193,000	3	156,025,000	3	150,354,000	3
Department of Education	30,371,072	1	30,067,290	1	30,067,000	1
Department of Energy	5,500,000	1	5,500,000	1	6,000,000	1
Department of Health and Human Services	756,000,000	1	761,000,000	1	760,000,000	1
Department of Homeland Security	10,600,000	1	13,300,000	1	12,500,000	1
Department of the Interior	21,459,028	3	21,542,020	3	15,508,000	2
Department of Transportation	69,700,000	1	78,529,000	2	78,824,000	2
Environmental Protection Agency	11,100,000	2	11,055,000	3	7,400,000	2
National Aeronautics and Space Administration	133,100,000	2	105,400,000	2	94,600,000	2
National Science Foundation	268,150,000	6	259,180,000	6	272,970,000	6
Total, Graduate/Postgraduate Programs	**1,486,670,149**	**25**	**1,460,286,560**	**27**	**1,447,628,250**	**25**
K-12 Programs						
Department of Agriculture	1,722,000	2	1,846,350	2	1,732,000	2
Department of Commerce	7,917,000	3	11,589,000	4	1,000,000	1
Department of Education	340,617,984	5	238,592,000	4	619,335,000	8
Department of Energy	3,944,000	2	4,340,000	2	5,645,000	1
Department of Health and Human Services	52,258,378	2	52,022,464	2	48,930,808	2
Department of Transportation	0	0	1,352,500	2	1,519,500	2
National Aeronautics and Space Administration	35,500,000	2	23,000,000	2	56,200,000	2
National Science Foundation	252,110,000	3	241,600,000	6	223,000,000	5
Total, K-12 Programs	**694,069,362**	**19**	**574,342,314**	**24**	**957,362,308**	**23**
Outreach and Informal Education Programs						
Department of Commerce	6,473,000	1	7,763,000	3	0	0
Department of Defense	17,507,000	3	18,845,000	3	18,252,000	3
Department of Health and Human Services	5,386,000	1	5,183,000	1	5,093,000	1
National Aeronautics and Space Administration	10,200,000	1	34,000,000	1	2,500,000	1
National Science Foundation	72,760,000	3	71,600,000	3	76,800,000	3
Total, Outreach and Informal Education	**112,326,000**	**9**	**137,391,000**	**11**	**102,645,000**	**8**

NOTE: Funding amounts are estimated and may not be final. Due to delayed final 2007 appropriations (see page 10 of this report for more detailed discussion), 2007 enacted and 2008 President's Budget funding levels could not be included.

Agency name	2005 funding/count		2006 funding/count		2007 request/count	
Undergraduate Programs						
Department of Agriculture	33,731,000	9	34,048,000	9	34,175,000	9
Department of Commerce	4,117,000	2	4,378,000	2	4,024,000	2
Department of Defense	1,346,312	2	3,246,672	3	1,547,068	2
Department of Education	90,168,133	3	436,863,820	4	415,626,820	3
Department of Energy	2,560,000	1	2,257,000	1	2,645,000	1
Department of Health and Human Services	36,468,000	1	37,291,000	1	37,291,000	1
Department of the Interior	1,859,463	1	1,221,202	1	1,415,202	1
Department of Transportation	65,873,000	2	72,335,000	2	71,647,000	2
National Science Foundation	285,230,000	19	351,380,000	20	397,880,000	20
Total, Undergraduate Programs	**521,352,908**	**40**	**943,020,694**	**43**	**966,251,090**	**41**
Grand Total	**2,814,418,419**	**93**	**3,115,040,568**	**105**	**3,473,886,648**	**97**

NOTE: Funding amounts are estimated and may not be final. Due to delayed final 2007 appropriations (see page 10 of this report for more detailed discussion), 2007 enacted and 2008 President's Budget funding levels could not be included.

Appendix F: Federal STEM Education Program Funding and Description by Agency: FY 2005-2007 PB

Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.

Department of Agriculture

K-12 Programs:

Agriculture in the Classroom (AITC) — **$730,000** | **$856,350** | **$742,000**

AITC is a nationally-coordinated, but locally executed, science education program. The program is carried out in each state, according to state needs and interests, by individuals representing farm organizations, agribusiness, education and government. USDA supports the state groups by: helping to develop Ag in the Classroom programs, acting as a central clearinghouse for materials and information, encouraging USDA agencies to assist in the state programs, and coordinating with national organizations to promote the goal of an increased awareness of agriculture among the nation's students.

The AITC program operates independently in each state using various funding mechanisms, including some Federal support. The National Office provides coordination and funding to State projects, sponsors the National Conference, provides web-based resources, and staffs the National Consortium of AITC State Contacts. AITC serves nearly 5 million students and 60,000 teachers annually through workshops, conferences, field trips, farm tours, and other educational activities. Animal sciences, natural resources, environmental issues, nutrition, and agricultural careers are the subjects taught most often.

Secondary and Two-Year Postsecondary Agriculture Education Challenge Grants Program — **$992,000** | **$990,000** | **$990,000**

This competitive program awards grants through a peer review process. Eligible applicants include: independent school districts, public secondary schools (limited to grades 9-12), and public or private, nonprofit junior or community colleges. Educational institutions receiving grants are required to match USDA funds on a dollar-for-dollar basis from non-Federal sources. Awards are based on review of proposals by panels of experts from academic institutions; Federal, state, and local governments; and private sector organizations.

Undergraduate Programs:

1890 Institution Teaching and Research Capacity Building Grants Program — **$12,312,000** | **$12,189,000** | **$12,375,000**

This competitive program awards grants through a peer review process. Awards are based on review of proposals by panels of experts from academic institutions; Federal, state, and local governments; and private sector organizations. Eligible applicants are Historically Black Colleges and Universities (HBCUs), but limited specifically to those institutions designated as 1890 Land-Grant Institutions, which means those institutions eligible to receive funds under the Act of August 30, 1890, (26 Stat. 417-419, as amended; 7 U.S.C. 321-326 and 328), including Tuskegee University and West Virginia State University. Authority for this program is contained in section 1417 (b)(4) of the National Agricultural Research, Extension, and Teaching Policy Act of 1977, as amended (7 U.S.C. 3152 (b)(4)).

Competitive grants are made for designing and implementing programs that build institutional teaching and research capacity in the food and agricultural sciences, including: basic, applied, and developmental research; extension and teaching activities in food and fiber; agriculture; renewable natural resources; forestry; physical and social sciences; rural economic, community, or business development; and other related disciplines.

NOTE: Funding amounts are estimated and may not be final. Due to delayed final 2007 appropriations (see Page 10 of Report for more detailed discussion), 2007 enacted and 2008 President's Budget funding levels could not be included.

Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.

Department of Agriculture

Alaska Native- and Native Hawaiian-Serving Institutions Education Grants Program — **$3,472,000** | **$3,218,000** | **$2,967,000**

This program awards grants through a process of merit review to eligible institutions or to a consortia of eligible institutions. Appropriated funds are divided equally between the States of Alaska and Hawaii for postsecondary institutions to carry out education, applied research, and related community development programs in the food and agricultural sciences.

Higher Education Challenge Grants Program — **$5,456,000** | **$5,423,000** | **$5,445,000**

This is a competitive grants program that awards teaching enhancement grants to U.S. public or private, nonprofit colleges and universities through a review process by panels of experts from academic institutions; Federal, state, and local governments; and private sector organizations. Eligible applicants include U.S. public or private, nonprofit colleges and universities offering a baccalaureate or first professional degree in at least one discipline or area of the food and agricultural sciences. Educational institutions receiving grants are required to match USDA funds on a dollar-for-dollar basis from non-Federal sources.

Higher Education Multicultural Scholars Program — **$990,000** | **$988,000** | **$988,000**

This competitive program awards grants to 4-year colleges and universities through a peer review process. Funds provide for a limited number of undergraduate scholarships and experiential learning opportunities in support of students in the food and agricultural sciences. Eligible applicants include: U.S. public or private, nonprofit colleges and universities. Educational institutions receiving grants are required to match USDA funds with 25% from non-Federal sources. Awards are based on review of proposals by panels of experts from academic institutions; Federal, state, and local governments; and private sector organizations.

Hispanic-Serving Institutions Education Grants Program — **$5,600,000** | **$5,940,000** | **$5,588,000**

This competitive grants program is intended to promote and strengthen the ability of Hispanic-Serving Institutions (HSIs) to carry out higher education programs in the food and agricultural sciences. Accredited 2-year and 4-year public or nonprofit HSIs are eligible to apply for awards. Projects involve individual institutions, consortia of HSIs, or cooperative initiatives between an HSI and two or more other entities (including educational institutions, units of government, or private sector corporations). Awards are based on review of proposals by panels of experts from academic institutions; Federal, state, and local governments; and private sector organizations.

International Science and Education Competitive Grants Program — **$992,000** | **$990,000** | **$990,000**

This competitive program awards grants through a peer review process. Awards are based on review of proposals by panels of experts from academic institutions; Federal, state, and local governments; and private sector organizations. Eligible applicants include public and private, nonprofit colleges and universities offering a program of study at the bachelors or higher degree level. The program supports innovative campus-based activities that enhance the capabilities of American colleges and universities to conduct international collaborative teaching, research, and extension in agriculture and related fields.

Resident Instruction Grants for Institutions of Higher Education in Insular Areas — **$496,000** | **$495,000** | **$495,000**

This is a competitive grants program that awards teaching enhancement grants to public or private nonprofit colleges and universities located in Insular Areas, and to consortia of such eligible institutions. Applications are evaluated through a merit review process by panels of experts from academic institutions; Federal, state, and local governments; and private sector organizations. Eligible applicants must offer at least a 2-year program of study with a demonstrable capacity to conduct teaching and extension activities in the food and agricultural sciences, and must be located in an Insular Area. Insular Areas are defined by law as: (1) the Commonwealth of Puerto Rico, (2) Guam, (3) American Samoa, (4) the Commonwealth of the Northern Mariana Islands, (5) the Federated States of Micronesia, (6) the Republic of the Marshall Islands, (7) the Republic of Palau, and (8) the Virgin Islands of the United States.

NOTE: Funding amounts are estimated and may not be final. Due to delayed final 2007 appropriations (see Page 10 of Report for more detailed discussion), 2007 enacted and 2008 President's Budget funding levels could not be included.

Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.
Department of Agriculture			
Tribal Colleges Education Equity Grants Program	**$2,232,000**	**$2,228,000**	**$2,227,000**
This is a non-competitive grants program for the 33 Tribal Colleges and Universities designated as 1994 Land-Grant Institutions under the authority of the Equity in Educational Land-Grant Status Act of 1994 (7 U.S.C. 301 note), and as amended by the Agricultural Research, Extension, and Education Reform Act of 1998 (7 U.S.C. 7601 note).			
Tribal Colleges Fund	**$2,181,000**	**$2,577,000**	**$3,100,000**
This is a non-competitive grants program for the 33 Tribal Colleges and Universities designated as 1994 Land-Grant Institutions under the authority of the Equity in Educational Land-Grant Status Act of 1994 (7 U.S.C. 301 note), and as amended by the Agricultural Research, Extension, and Education Reform Act of 1998 (7 U.S.C. 7601 note).			
Graduate/Postgraduate Programs:			
Food and Agricultural Sciences National Needs Graduate and Postdoctoral Fellowships Grants Program	**$2,976,000**	**$3,701,000**	**$4,455,000**
This is a competitive graduate traineeship program that awards grants to 4-year colleges and universities through a peer review process. Funds provide for a limited number of graduate fellowships and international dissertation research opportunities in support of students in the food and agricultural sciences. Additional postdoctoral training may also be provided for Fellows who have completed their doctoral degrees. Eligible applicants include U.S. nonprofit colleges and universities, both public and private. Awards are based on review of proposals by panels of experts from academic institutions; Federal, state, and local governments; and private sector organizations. Grants are not made directly to students, but rather to institutions, which select individuals for fellowship awards.			
Total, Department of Agriculture	**$38,429,000**	**$39,595,350**	**$40,362,000**

NOTE: Funding amounts are estimated and may not be final. Due to delayed final 2007 appropriations (see Page 10 of Report for more detailed discussion), 2007 enacted and 2008 President's Budget funding levels could not be included.

Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.

Department of Commerce

K-12 Programs:

Bay Watershed Education and Training Program (B-WET)	**$4,962,000**	**$6,904,000**	**$0**

This program offers competitive grants aimed at providing a meaningful watershed experience for K-12 students in three locations - Chesapeake Bay, California, and Hawaii.

Hawaii Humpback Whale Education Program	**$0**	**$1,726,000**	**$0**

Develop a K-12 marine science curriculum for the State of Hawaii

JASON Education and Outreach	**$2,463,000**	**$2,466,000**	**$1,000,000**

This program supports the development of marine science curricula and content for after-school programs that highlight NOAA sciences.

Narragansett Bay Marine Education	**$492,000**	**$493,000**	**$0**

This program supports competitive grants aimed at providing a meaningful watershed experience for K-12 students in the Narragansett Bay area.

Undergraduate Programs:

Ernest F. Hollings Scholarship Program	**$3,919,000**	**$3,962,000**	**$3,700,000**

This program is designed to provide financial assistance through undergraduate scholarships for students matriculating in STEM and NOAA related fields. The goal is to increase the number of students graduating in academic fields that support NOAA's mission.

Summer Undergraduate Research Fellowship (SURF) Program	**$198,000**	**$416,000**	**$324,000**

SURF is a 12-week summer honor-academy program, which awards fellowships to undergraduate students interested in pursuing graduate degrees in science and engineering, or related areas.

Graduate/Postgraduate Programs:

Educational Partnership Program with Minority Serving Institutions	**$16,700,000**	**$14,201,000**	**$14,212,000**

The Educational Partnership Program (EPP) is designed to provide financial assistance, through competitive processes, to Minority Serving Institutions (MSI) that support education and training in NOAA related sciences. EPP's goal is to enhance NOAA's capacity to increase environmental literacy by establishing partnerships with MSIs, the private sector, and other Federal, State, Tribal, and local agencies. There are 4 program components: Cooperative Science Centers; Environmental Entrepreneurship Program; Graduate Sciences Program; and, Undergraduate Scholarship Program.

NOTE: Funding amounts are estimated and may not be final. Due to delayed final 2007 appropriations (see Page 10 of Report for more detailed discussion), 2007 enacted and 2008 President's Budget funding levels could not be included.

Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.
Department of Commerce			
Nancy Foster Scholarship Program	**$482,799**	**$448,000**	**$400,000**
This graduate research scholarship program is designed to recognize outstanding academic accomplishments in oceanography, marine biology, and maritime archeology, particularly by women and members of minority groups who would not be able to pursue an advanced degree due to financial constraints.			
National Institutes of Health(NIH)/NIST National Research Council (NRC) Joint Postdoctoral Research Associateships Program	**$338,250**	**$338,250**	**$338,250**
This program provides two-year awards for postdoctoral researchers emphasizing interdisciplinary research at the interface of the biological and physical sciences. Postdoctoral work is done both at NIST and at NIH, and NIH and NIST jointly provide the funds for this program, furnishing all necessary support services, facilities, and equipment for the approved research program of each Associate. The program is administered by NRC, and is jointly funded by NIH and NIST.			
Outreach and Informal Education Programs:			
Chesapeake Bay Interpretive Buoys	**$0**	**$493,000**	**$0**
This program develops and deploys interpretive buoys in the Chesapeake Bay, and provides opportunities for distance learning, real time data, curricular materials, and interaction and connection between classrooms.			
Gulf Coast Explorium	**$0**	**$986,000**	**$0**
This program is focused on developing a Gulf Coast informal education program.			
NOAA Education Initiative	**$6,473,000**	**$6,284,000**	**$0**
This program supports formal and informal education opportunities related to NOAA's mission. The majority of funds are awarded through completive mechanisms.			
Total, Department of Commerce	**$36,028,049**	**$38,717,250**	**$19,974,250**

NOTE: Funding amounts are estimated and may not be final. Due to delayed final 2007 appropriations (see Page 10 of Report for more detailed discussion), 2007 enacted and 2008 President's Budget funding levels could not be included.

Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.

Department of Defense

Undergraduate Programs:

Dr. John Hopps Defense Research Scholars Program — **$0** | **$1,700,000** | **$0**

This research scholars program is designed to advance core federal missions and DoD goals to increase the participation of minority students in emerging science and technology fields. The program identifies top tier high school students and places them in a rigorous program in the Division of Science and Mathematics that includes one-on-one mentoring, a summer educational and research program, and challenging internships at top research institutions, with the goal of placing them in doctoral programs on a track to work in the national laboratories.

Overall, this research scholars program is designed to extend Dr. Hopps' legacy into the 21st Century by providing meaningful opportunities to young African American researchers, and thereby increasing the number of minority scientists entering into advanced research positions. The funds will provide the needed infrastructure and increased research capacity to establish student mentor relationships within active research laboratories both in Atlanta and around the country, which will further the stated Federal and Department of Defense goals of encouraging minority participation in the sciences and advanced research. The ultimate goal of the program is to engender doctorate track student researchers focused on research careers leading to the national laboratories, and further aiding federal research and innovation missions, as is consistent with the Administration's recently announced Innovation Initiative, and the Science, Technology, Engineering and Mathematics (STEM) education initiative.

Mathematics Summer Employment Program (MSEP) — **$146,312** | **$146,672** | **$147,068**

This program is open to students who are U.S. citizens majoring in mathematics. The intense 12-week program gives talented U.S. undergraduate math students the chance to put their problem-solving skills to the test and receive valuable work experience at the same time. Students participating in the program have the opportunity to learn and develop cryptomathematical theory and to apply the theory to operational problems. MSEP is geared towards students following their junior year who are majoring in mathematics.

University Nanosatellite Program — **$1,200,000** | **$1,400,000** | **$1,400,000**

This program is a continuing effort which provides undergraduates and graduates with hands-on experience in design, fabrication, and testing of spacecraft.

Graduate/Postgraduate Programs:

National Defense Science and Engineering Graduate (NDSEG) Fellowship — **$30,500,000** | **$31,600,000** | **$32,700,000**

The NDSEG Program is a joint program of the United States Army, Navy and Air Force within the University Research Initiative (URI), designed to increase the number of U.S. citizens trained in disciplines of science and engineering important to defense goals. DoD awards approximately 100-150 new three-year graduate fellowships each year to individuals for study and research leading to doctoral degrees in, or closely related to, the disciplines of aeronautical and astronautical engineering; biosciences; chemical engineering; chemistry; cognitive, neural, and behavioral sciences; electrical engineering; geosciences; civil engineering; computer and computational sciences; materials science and engineering; mathematics; mechanical engineering; naval architecture and ocean engineering; oceanography; and physics.

Science, Mathematics and Research for Transformation (SMART) — **$2,406,000** | **$9,200,000** | **$14,000,000**

SMART is a DoD-wide scholarship/fellowship program open to US Citizens that are competitively selected to pursue undergraduate and graduate degrees in disciplines considered to be critical to the national defense mission of the DoD.

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Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.
Department of Defense			
Uniformed Services University of the Health Sciences (USUHS)	**$127,287,000**	**$115,225,000**	**$103,654,000**

USUHS is the Nation's Federal health sciences university and is committed to excellence in military medicine and public health during peace and war. It provides the Nation with health professionals dedicated to career service in the Department of Defense and the United States Public Health Service and with scientists who serve the common good.

Outreach and Informal Education Programs:

DoD STARBASE Program	**$15,070,000**	**$16,472,000**	**$15,797,000**

The DoD STARBASE Program is authorized under 10 USC 2193b. The program design emphasizes experiential "hands-on" applications, student interaction, and problem solving experiments. Students are transported to the military base for DoD STARBASE instruction that covers 13 core curriculum topics. The program provides 20 or 25 hours of classroom instruction which focuses on students learning facts, applying the facts in team inquiry, and then adding reasoning process to build a depth of understanding of applied science, math, and technology. In addition to written materials, facilities, simulators, and trainers are made available to the students. Also, teachers from the public schools attend the program with their students and use STARBASE-generated material to reinforce learning during regular school days. Although authorized to serve K-12 students, the program primarily works with the fifth grade students that are historically under-represented in math, science, and technology; living in inner cities or rural locations; disabled; socio-economically disadvantaged; and low in academic performance. The program is based on partnerships between military installations, school districts, and communities to ensure the instruction provided can integrate with state and local science and math objectives.

Gains in the Education of Mathematics and Science (GEMS)	**$415,000**	**$415,000**	**$450,000**

The "Gains in the Education of Mathematics and Science" (GEMS) seeks to engage Washington, DC, junior high and high schools in a one-, two-, or four-week summer program. These students spend the time working in a DoD or University lab performing lab experiments under the direct supervision of a college-aged near-peer mentor.

Three GEMS Levels for the varying levels of previous science experience:
GEMS 1
Simple biology, chemistry and physics experiments, interactive lectures on the, caring for insects, snakes and other creatures, explorations in engineering, etc. all lead to an increased interest in science and the overall process of learning. These students enjoy activities that are both educational and fun.

GEMS 2
The experiments are more complex than in GEMS 1 and build on techniques previously introduced. Students study toxicity in neuronal cultures and possible neuroprotection by various agents.

GEMS 3
This group is offered a 4-week internship to learn advanced techniques, such as high-throughput cloning and gene analysis. Students who have shown significant initiative and have succeeded in previous years of the GEMS program as well as selected students from the SEAP applicant pool are offered this intensive course. Participants are required to complete a five-page research paper and a poster detailing their summer work.

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Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.
Department of Defense			
National Science Center (NSC)	**$2,022,000**	**$1,958,000**	**$2,005,000**
The National Science Center is a unique public-private partnership between the U.S. Army and a not-for-profit corporation, the National Science Center Inc. [While no funding is exchanged, the U.S. Army and the NSC promote one another science programs to the public.] The NSC was created under Congressional authority via Public Law 99-145 in 1985 and further amended by the 1996 Defense Authorization Act. The mission of the NSC is to stimulate and increase interest in math, science, and technology by our nation's elementary, middle and high school students. The NSC carries out this mission through the design, development, and delivery of a series of educational outreach programs ranging from mobile discovery centers that travel to schools across the country to distance learning programs that are delivered live to classrooms in 26 different states.			
Total, Department of Defense	**$179,046,312**	**$178,116,672**	**$170,153,068**

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Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.

Department of Education

K-12 Programs:

Adjunct Teacher Corps — $0 | $0 | $25,000,000

This proposed program would create opportunities for professionals and other individuals with subject-matter expertise to teach courses in the core academic subjects, particularly math, science, and critical foreign languages, on an adjunct basis. Grantees would be required to provide student achievement data on those students instructed by adjunct teachers.

Advanced Placement — $29,760,000 | $32,175,000 | $122,175,000

This program supports two components: Advanced Placement Test Fees and Advance Placement Incentives. Eligible activities under the Incentives program include teacher training, development of pre-advanced placement courses, coordination and articulation between grade levels to prepare students for AP or IB courses, books and supplies, and participation in online AP or IB courses. The program does not currently focus on STEM, but the FY 2007 budget request would focus on mathematics, science, and critical foreign languages.

In FY 2007, the President set the goal of training 70,000 teachers to teach advanced placement mathematics, science, and critical foreign language courses to increase to 700,000 the number of students who annually pass advanced placement tests in those subjects. The amended program would give incentives to teachers and students that pass advanced placement exams, and the Federal investment would be matched 2:1 by private sector and State contributions.

Evaluation of Mathematics and Science Programs — $0 | $0 | $5,000,000

This proposed program would conduct activities to improve the quality of evaluations of programs designed to improve elementary and secondary mathematics and science education.

Fund for the Improvement of Education (FIE) — $25,297,984 | $0 | $0

FIE provides the authority to support nationally significant programs to improve the quality of elementary and secondary education.

Math Now for Elementary School Students — $0 | $0 | $125,000,000

The purpose of this program is to improve instruction in mathematics for K-7 students by implementing mathematics programs that reflect the best available evidence on early mathematics instruction, including the essential principles, practices, and components of mathematics instruction as recommended by the National Mathematics Panel. The goal of the program is to enable all students to reach grade-level achievement standards and prepare them to enroll in and pass algebra courses.

Math Now for Middle School Students — $0 | $0 | $125,000,000

Through this proposed program, grantees would use funds to diagnose the deficiencies of middle-school students who are not proficient in math, implement appropriate interventions, monitor students' progress, and provide professional development in accordance with the principles, practices, and components defined by the National Mathematics Panel.

Mathematics and Science Partnerships — $178,560,000 | $182,160,000 | $182,160,000

This is a formula grant program to States, and requires States to make competitive awards to projects that support professional development in mathematics and science. The projects support partnerships of arts and science and/or engineering faculty of institutions of higher education, and high need school districts with the goal of developing the content knowledge and teaching skills of participating teachers. Projects are required to report to ED annually on (1) increases in teachers' participation and content knowledge; and (2) impact on student learning.

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Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.
Department of Education			
National Mathematics Panel	**$0**	**$0**	**$10,000,000**
As created by Executive Order, the President has established a National Mathematics Advisory Panel to distill the key principles, components, and practices of effective math, with the goal of preparing all students to take and pass algebra.			
Research in Special Education	**$0**	**$257,000**	
This program supports research to address gaps in scientific knowledge in order to improve special education and early intervention services and results for infants, toddlers, and children with disabilities. The program enhances mathematics and science education for students with disabilities through research competitions on the development of mathematics and science curricula which address the needs of students with disabilities, as well as methods to improve assessment and teacher quality for these students.			
Research, Development, and Dissemination	**$32,000,000**		
This program promotes excellence and equity in education by providing the information needed to ensure that all students meet or exceed challenging academic standards and master the skills they will need throughout their lives through sustained programs of research, evaluation, and data collection. The program specifically addresses mathematics and science through research competitions on the development and evaluation of mathematics and science curricula, and methods to improve assessment and teacher quality.			
Teacher Loan Forgiveness	**$75,000,000**	**$24,000,000**	**$25,000,000**
Highly qualified math, science, and special education teachers serving low-income communities may receive loan forgiveness of up to $17,500 for loans made between October 1, 1998, and September 30, 2005. Schools in these communities often are forced to hire uncertified teachers or assign teachers who are teaching "out of field." In FY 2007, the President proposes to make this expansion permanent, allowing schools to recruit and retain highly qualified math, science, and special education teachers.			
Undergraduate Programs:			
Fund for the Improvement of Postsecondary Education (FIPSE)	**$48,758,245**	**$5,834,000**	**$6,897,000**
FIPSE supports projects that are models for innovative reform and improvement in postsecondary education.			
Minority Science and Engineering Improvement Program	**$8,817,888**	**$8,729,820**	**$8,729,820**
This program provides grants to effect long-range improvement in science education at predominantly minority institutions to increase the flow of underrepresented ethnic minorities, particularly minority women, into science and engineering careers.			
Science and Mathematics Access to Retain Talent (SMART) Grants	**$0**	**$390,000,000**	**$400,000,000**
A National SMART Grant will provide up to $4,000 for each of the third and fourth years of undergraduate study to full-time students who are eligible for a Federal Pell Grant and who are majoring in physical, life, or computer sciences, mathematics, technology, engineering, or a foreign language determined to be critical to national security. Students must also have at least a 3.0 GPA and meet a number of other statutorily defined criteria.			

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Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.
Department of Education			
Upward Bound Math and Science Program	**$32,592,000**	**$32,300,000**	**$0**
Upward Bound provides intensive academic instruction to high school students to generate the skills and motivation needed to pursue and complete a postsecondary education. The Upward Bound Math/Science program establishes mathematics and science centers which encourage students to pursue postsecondary degrees in those specific fields.			
Graduate/Postgraduate Programs:			
Graduate Assistance in Areas of National Need	**$30,371,072**	**$30,067,290**	**$30,067,000**
The Graduate Assistance in Areas of National Need program awards grants to postsecondary institutions to provide scholarships to graduate students who demonstrate superior academic ability and a high degree of financial need. The program is designed to support graduate students pursuing specific high-need fields of study. Currently, the designated area of national need are biology, chemistry, computer and information sciences, engineering, geological and related sciences, mathematics, physics, and nursing.			
Total, Department of Education	**$461,157,189**	**$705,523,110**	**$1,065,028,820**

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Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.

Department of Energy

K-12 Programs:

Department of Energy Academies Creating Teacher Scientists (DOE Acts) — **$1,494,000** | **$1,840,000** | **$5,645,000**

The Laboratory Science Teacher Professional Development (LSTPD) program is designed by the Office of Science to create a cadre of outstanding science and math teachers with the proper content knowledge and scientific research experience to serve as leaders and agents of positive change in their local and regional teaching communities. This three-year program will use the unmatched wealth of mentoring talent at the DOE National Laboratories to guide and enrich the teachers' understanding of the scientific and technological world. Through this program, teachers will establish long-term relationships with their mentor scientists and teaching colleagues who will continue to support the educational efforts of the teachers when they have returned to their classrooms.

WERC: a Consortium for Environmental Education and Technology Development — **$2,450,000** | **$2,500,000** | **$0**

The mission of WERC: has been, and continues to be, to develop human resources and technologies that assist various levels of government and other stakeholders in environmental and health related issues. This includes environmental restoration, waste minimization, pollution prevention, food safety, potable water, and contaminants of concern.

Undergraduate Programs:

Science Undergraduate Laboratory Internship — **$2,560,000** | **$2,257,000** | **$2,645,000**

This program places students in paid internships in Science and Engineering at any of several Department of Energy facilities. Many of the participants in the program have decided on a career in science and engineering because of the nature of the experience. Students work with scientists or engineers on projects related to the laboratories' research programs.

Graduate/Postgraduate Programs:

U.S. Department of Energy Computational Science Graduate Fellowship (CSGF) Program — **$5,500,000** | **$5,500,000** | **$6,000,000**

The DOE CSGF program directs talented graduate students into a course of study and research in academic disciplines that support computational science research and development applicable to DOE programs. The program provides incentives for well-qualified students to continue their studies in graduate school and to prepare for careers in the computational sciences. The combination of graduate study and research at academic institutions and practical research experience at DOE facilities ensures that the program produces individuals capable of making significant contributions to research and development in computational science relevant to DOE missions.

Total, Department of Energy — **$12,004,000** | **$12,097,000** | **$14,290,000**

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Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.

Department of Health and Human Services

K-12 Programs:

NIH K-12 STEM Education Activities — **$35,988,378** | **$35,915,464** | **$32,823,808**

NIH research impacts the health and well being of every person in the United States, and all science, technology, engineering and mathematics (STEM) disciplines contribute towards the advancement of this research. NIH requires a steady supply of talented STEM professionals in order to continue its history of medical discoveries. NIH supports more than 200,000 researchers and other personnel through approximately 50,000 biomedical research grants annually and its intramural program.

The NIH K-12 program seeks to develop, maintain, and renew the scientific human resources that will assure the Nation's capability to prevent disease. One way that NIH works towards this mission is by translating complex biomedical research knowledge into unique K-12 resources that teach state-of-the art scientific concepts through the use of rigorous content and application of research-based teaching strategies. NIH also funds cognitive research that seeks to extend our fundamental understanding of how students learn mathematics and science.

The strategy of the NIH K-12 program is to foster collaborations between STEM professionals and the K-12 community. Nearly 90% of this $35.9 million FY 2006 effort is driven by NIH grants to STEM professionals at universities, research institutions and medical schools across the country. Various NIH Institutes and Centers have K-12 related grants that support numerous collaborative projects nationwide. NIH also directly partners with the K-12 community. In many cases, these efforts are targeted at minority institutions and underserved populations. These collaborations result in:

- Instructional materials and teacher professional development focused on STEM content
- STEM work experiences for teachers and students
- Career resources that promote interest in STEM fields
- Basic and applied research in all aspects of mathematical thinking and problem solving, as well as in scientific reasoning, learning, and discovery

Nursing Workforce Diversity (NWD) Program — **$16,270,000** | **$16,107,000** | **$16,107,000**

The NWD program’s purpose is to provide grant support to increase nursing education opportunities for individuals from disadvantaged backgrounds (including racial and ethnic minorities underrepresented among registered nurses) through retention activities, pre-entry preparation, and by providing student scholarships or stipends.

- Retention activities are designed to assist nursing students from disadvantaged backgrounds to continue their pursuit of a nursing education. Project activities may include mentoring, tutoring, coaching or advanced technical (nursing skills), academic (science and math) and social enrichment strategies.

- Pre-entry activities are designed to enhance the academic abilities and preparation of students from disadvantaged backgrounds to increase their competitiveness for entry into, and graduation from a professional nursing program. Programs are targeted at improving communication, reading, math science and writing skills.

- Stipends and Scholarships are award by the grantee to disadvantaged students participating full-time in grant project activities.

Undergraduate Programs:

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Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.

Department of Health and Human Services

Nurse Education, Practice and Retention (NEPR) Program **$36,468,000** **$37,291,000** **$37,291,000**

The NEPR program's purpose is to provide grant support for academic and continuing education projects designed to strengthen the nursing workforce and improve nurse retention and quality of care. The program is a broad authority with targeted purposes under education, practice and retention priority areas. There are nine purposes associated with the three priority areas:

I. Education (E) Priority Area:
Purpose E1: Expanding enrollment in baccalaureate nursing programs;
Purpose E2: Developing and implementing internship and residency programs to encourage mentoring and the development of specialties; or
Purpose E3: Providing education in the area of new technologies, including distance learning methodologies.

II.Practice (P) Priority Area:
Purpose P1: Establishing or expanding nursing practice arrangements in non-institutional settings (Nurse Managed Centers) to demonstrate methods to improve access to primary health care in medically underserved communities;
Purpose P2: Providing care for underserved populations and other high-risk groups such as the elderly, individuals with HIV/AIDS, substance abusers, the homeless, and victims of domestic violence;
Purpose P3: Providing managed care, quality improvement, and other skills needed to practice in existing and emerging organized health care systems; or
Purpose P4: Developing cultural competencies among nurses.

III. Retention (R) Priority Area:
Purpose R1: Career ladder programs which promote career advancement for registered nurses and nursing personnel; or
Purpose R2: Enhancing patient care delivery systems through improving the retention of nurses and enhancing patient care.

Graduate/Postgraduate Programs:

Ruth L. Kirschstein National Research Service Award (NRSA) Program **$756,000,000** **$761,000,000** **$760,000,000**

The purpose of this program is to build and maintain research capacity to help ensure that diverse pools of highly trained scientists are available in adequate numbers and in appropriate research areas to address the Nation's biomedical, behavioral, and clinical research needs.

The NRSA program was established by the National Research Act (P.L. 93-348) enacted by Congress in 1974. In 2002, Public Law 107-206, renamed the NRSA Program the Ruth L. Kirschstein National Research Service Award program, in acknowledgement of Dr. Kirschstein's contributions to the research training of new investigators, the NIH and the Nation. The NRSA program supports individual research fellowships and institutional research training grants primarily targeted at predoctoral and postdoctoral investigators. NRSA awards set the level of quality for the biomedical research training enterprise by establishing standards for biomedical research training and utilizing a rigorous process of peer review. NRSA institutional research training grants are awarded to research intensive institutions for up to five years that in turn select students to be supported for research training. NRSA individual research fellowships are awarded up to five years for individual predoctoral candidates and up to 3 years for postdoctoral fellows who apply to the NIH in order to obtain research experience under the guidance of a mentor at a sponsoring institution. To provide postdoctoral NRSA participants an added incentive to continue to pursue research careers, the NRSA program requires them to "pay back" the benefits they receive at critical junctures by conducting health-related research. Eligible program participants annually report on their activities to the NIH until the service obligation has been met. NRSA participants who fail to fulfill the service obligation are required to pay back the cost of the research training received, with interest.

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Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.
Department of Health and Human Services			
Outreach and Informal Education Programs:			
NIH STEM Outreach Activities	**$5,386,000**	**$5,183,000**	**$5,093,000**

NIH research impacts the health and well being of every person in the United States, and all science, technology, engineering and mathematics (STEM) disciplines contribute towards the advancement of this research. It is thus imperative that NIH informs the public about the results of the research that they support.

The NIH Outreach program serves to bring the science content behind NIH-supported medical discoveries to the public in a meaningful way. This is distinct from the health and disease information that NIH provides to patients, their families and healthcare providers. The strategy of the NIH Outreach program is to enable dialogues between STEM professionals, informal science educators and the public. About 90% of this program is facilitated through grants to science museums and other informal education centers across the country. NIH also directly coordinates outreach efforts. In many cases, these efforts are targeted at minority institutions and underserved populations.

The NIH Outreach program includes activities that:

- Generate innovative, topical and interactive science exhibits for the general public
- Provide forums for public education and discussion on current medical research and health topics
- Highlight the relevance of basic scientific research to our health and well being

Total, Department of Health and Human Services	**$850,112,378**	**$855,496,464**	**$851,314,808**

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Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.
Department of Homeland Security			
Graduate/Postgraduate Programs:			
Scholarship and Fellowship Program	**$10,600,000**	**$13,300,000**	**$12,500,000**

In September 2003, DHS established the Scholarship and Fellowship Program. This evidence-based STEM education program is focused on developing a highly talented and diverse cadre of homeland security scientific personnel in six major disciplines from the social sciences to engineering. DHS achieved the planned level of approximately 300 participants in September 2005. The DHS science and engineering undergraduate and graduate students attend over 110 institutions of higher education, including Historically Black Colleges and Universities and other Minority Serving Institutions in over 40 states and the District of Columbia.

The Scholarship and Fellowship Program provides scholarships for undergraduate and fellowships for graduate students pursuing degrees in mission-relevant fields. The purpose of the program is to provide educational support and relevant experiential learning opportunities to diverse and highly talented individuals in order to enhance the scientific leadership in areas of importance to DHS. The chosen scholars are provided opportunities to:
1) Continue their education and research training in areas that support the DHS mission;
2) Become more familiar with the research and technology areas of DHS; and
3) Conduct research in fields that support the DHS mission.

Total, Department of Homeland Security	**$10,600,000**	**$13,300,000**	**$12,500,000**

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Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.
Department of the Interior			
Undergraduate Programs:			
Student Educational Employment Program (SEEP)	**$1,859,463**	**$1,221,202**	**$1,415,202**
The SEEP program was created to attract students from secondary education to post secondary educational institutions in the fields of Science, Technology, Engineering and Mathematics.			
Graduate/Postgraduate Programs:			
Cooperative Research Units Program	**$14,570,000**	**$14,664,000**	**$14,938,000**
This program links state agencies and universities with the federal government to meet a defined mission of research, education, and technical assistance. The Program operates 40 Cooperative Fish and Wildlife Research Units across 38 states, all located on university campuses where Federal scientists are appointed as graduate faculty, teaching and mentoring graduate students in a variety of natural resource fields. (Established in 1936, this program was authorized officially by the Cooperative Units Act of 1960 (Public Law 86-686, Sec.1, Sept. 2, 1960, 74 Stat. 733, as amended by the Fish and Wildlife Improvement Act of 1978, Public Law 95-616, Sec. 2, Nov. 8, 1978, 92 Stat.3110).			
EDMAP Component of the National Cooperative Geologic Mapping Program	**$479,329**	**$473,651**	**$570,000**
EDMAP is a grant program designed to train tomorrow's geologic mappers. It was established by the National Mapping Act of 1992 (reauthorized in 1999), which recognizes the importance of geologic mapping for our Nation's well-being, and stipulates that a portion of the funding for the Program should be directed to training a new generation of geologic mappers.			
Water Resources Research Act Program	**$6,409,699**	**$6,404,369**	**$0**
This program provides support to State Water Resources Research Institutes that conduct research to foster (1) the entry of new research scientists into the water resources fields, (2) the training and education of future water scientists, engineers, and technicians, (3) the preliminary exploration of new ideas that address water problems or expand understanding of water and water-related phenomena, and (4) the dissemination of research results to water managers and the public.			
Total, Department of the Interior	**$23,318,491**	**$22,763,222**	**$16,923,202**

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Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.

Department of Transportation

K-12 Programs:

Garrett A. Morgan Technology and Transportation Education Program — **$0** | **$1,040,000** | **$1,207,000**

The program seeks to improve the preparation of students, particularly women and minorities, in science, technology, engineering, and mathematics (STEM) through curriculum development and other activities related to transportation. Funded at $1,250,000 per fiscal years 2006-2007, the program awards grants to "local and state educational agencies, which may enter into partnership agreement with institutions of higher education, businesses, or other entities" to enhance STEM at elementary and secondary school levels.

National Summer Transportation Institute Program — **$0** | **$312,500** | **$312,500**

The National Summer Transportation Institute (NSTI) is funded by the U. S. Department of Transportation Federal Highway Administration (FHWA). The NSTI provides career orientation and educational experiences to motivate secondary school students toward professions in the field of transportation. Participants spend four weeks on some of the most prestigious college/university campuses in the country.

Undergraduate Programs:

State Maritime Schools — **$10,406,000** | **$11,099,000** | **$9,900,000**

This program is a Federal and State Partnership to support the Federal purpose of educating and graduating U.S. licensed officers for the American merchant marine.

The U.S. Merchant Marine Academy (USMMA) — **$55,467,000** | **$61,236,000** | **$61,747,000**

USMMA educates U.S. citizens in marine transportation and marine engineering disciplines who serve as well qualified U.S. maritime labor to support DOD mobilization requirements while sustaining commerce.

Graduate/Postgraduate Programs:

Dwight David Eisenhower Transportation Fellowship Program — **$0** | **$1,829,000** | **$2,124,000**

This program seeks to attract highly qualified students to the fields of transportation education and research and advance transportation workforce development. Full-time graduate and undergraduate students (juniors/seniors at MIHEs) are eligible to apply for fellowships. Funded at $2.2 million.

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Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.
Department of Transportation			
University Transportation Centers (UTC) Program	**$69,700,000**	**$76,700,000**	**$76,700,000**
The UTC Program is designed to advance significantly the state-of-the-art in transportation research and expand the workforce of transportation professionals through the following programs and activities: Research -- Basic and applied research, the products of which are judged by peers or other experts in the field of transportation to advance the body of knowledge in transportation. Education -- An education program relating to transportation that includes multidisciplinary course work and participation in research. Technology Transfer -- An ongoing program of technology transfer that makes transportation research results available to potential users in a form that can be implemented, utilized, or otherwise applied.			
Total, Department of Transportation	**$135,573,000**	**$152,216,500**	**$151,990,500**

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Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.
Environmental Protection Agency			
Graduate/Postgraduate Programs:			
Green Engineering Program	**$0**	**$55,000**	**$0**
The Green Engineering program works with universities and professional societies to incorporate Green Engineering into Chemical Engineering curricula with the aim to develop future chemical engineers with Green Engineering training. The program offers workshops to educators where attendees also receive hands-on training and education on a number of selected EPA risk-based tools and other risk-based/green engineering design tools. A Green Engineering textbook was also created and provided to more than 50 engineering schools in the U.S. and internationally.			
Science to Achieve Results (STAR) Graduate Fellowship Program	**$9,500,000**	**$9,500,000**	**$5,900,000**
The purpose of the STAR Fellowship program is to encourage promising students to obtain advanced degrees and pursue careers in an environmental field. This goal is consistent with the immediate and long-term mission of EPA, to protect public health and the environment. This program has proven to be beneficial to both the public and private sectors by providing a steady stream of well-trained specialists to meet environmental challenges in our society. It has also provided new environmental research in physical, biological, health and social sciences, and engineering.			
The Greater Research Opportunities (GRO) Fellowship Program	**$1,600,000**	**$1,500,000**	**$1,500,000**
The GRO Fellowship program awards graduate and undergraduate fellowships with the intentions of strengthening the environmental research capacity of institutions of higher education that receive limited funding to build such capacity. This population includes, but is not limited to, institutions with substantial minority enrollment. Additionally, the undergraduate portion of the program intends to support quality environmental education to undergraduate students, thereby encouraging them to pursue careers in environmentally related fields and to continue their education beyond the baccalaureate level.			
Total, Environmental Protection Agency	**$11,100,000**	**$11,055,000**	**$7,400,000**

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Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.

National Aeronautics and Space Administration

K-12 Programs:

e-Education Program **$9,500,000** **$8,100,000** **$9,000,000**

This program sustains the research and development of technology applications, products, services and implementation of technology-enriched infrastructure in facilitating the appropriate and effective technology-based applications to enhance the educational process for formal and informal education. In addition, e-Education identifies projects that will meet the President's Management Agenda of providing citizen-centric services related to NASA Education efforts.

Specific efforts include: Learning Technologies Project (LTP), NASA Educational Technologies Services, Classroom of the Future, e-Education Small Programs.

Elementary & Secondary Education Program **$26,000,000** **$14,900,000** **$47,200,000**

This program provides K-12 educators with tools, experiences, and opportunities to further their education and participate in unique NASA learning experiences to enhance their knowledge of STEM and inspire pursuit of STEM careers. The program supports the role of educational institutions, which provide the framework to unite students, families, and educators for educational improvement.

Specific efforts include: Educator Astronaut Program, Aerospace Education Services Program (AESP), NASA Explorer Schools (NES), Interdisciplinary National Science Program Incorporating Research and Education Experience (INSPIRE), Science Engineering Mathematics and Aerospace Academy Program (SEMAA), Education Flight Projects.

Graduate/Postgraduate Programs:

Higher Education Program **$62,400,000** **$69,200,000** **$54,000,000**

This program focuses on supporting institutions of higher education in strengthening their research capabilities and providing opportunities that attract and prepare increasing numbers of students for NASA-related careers. The research conducted by the institutions will contribute to the research needs of NASA's Mission Directorates. The student projects serve as a major link in the student pipeline for addressing NASA's Human Capital Strategies and the President's Management Agenda by helping through hands-on experiences to build, sustain, and effectively deploy the skilled, knowledgeable, diverse, and high performing workforce needed to meet the current and emerging needs of government and its citizens.

Specific efforts include: Space Grant, Experimental Program to Stimulate Competitive Research (EPSCoR), Graduate Student Research Program (GSRP), Undergraduate Student Research Program (USRP).

Minority University Research and Education Program **$70,700,000** **$36,200,000** **$40,600,000**

This program engages under-represented populations through a wide variety of initiatives. Multi-year grants are awarded to engage minority institutions, faculty and students in research pertinent to NASA missions. The program focuses on retaining underrepresented and underserved students in a STEM discipline through completion of undergraduate or graduate degrees and entry into the scientific and technical workforce.

Specific Efforts include University Research Centers (URC), Faculty Awards for Research (FAR), Curriculum Improvement Partnership Award (CIPA), Research Academy, Jenkins Graduate Fellowship Program, Tribal College and University Program, NASA Administrator’s Fellowship Program, MUREP Small Programs, and Motivating Undergraduates in Science & Technology (MUST).

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Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.
National Aeronautics and Space Administration			
Outreach and Informal Education Programs:			
Informal Education Program	**$10,200,000**	**$34,000,000**	**$2,500,000**
This program is designed to increase learning, to educate students, educators and the general public on specific science, technology, engineering or math (STEM) content areas, and to expand the nation's future STEM workforce. Projects within the program produce supplemental educational materials/handouts that are standards based, support staff/facilitators, trained or qualified in STEM/education fields, actively working with participants to further enhance their understanding, and develop content based on educational standards and/or learning objectives to supplement and enrich an experience, visual, or activity.			
Specific Efforts include the NASA Explorer Institutes.			
Total, National Aeronautics and Space Administration	**$178,800,000**	**$162,400,000**	**$153,300,000**

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Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.

National Science Foundation

K-12 Programs:

Discovery Research K-12 (DR-K12) — **$113,690,000** | **$93,360,000** | **$107,000,000**

The DR-K12 program is designed to build on the programmatic strengths of three existing programs: Instructional Materials Development (IMD), Teacher Professional Continuum (TPC), and Centers for Learning (CLT) programs. The DR-K12 program comprises research, development and evaluation activities through which knowledge is generated and applied with some immediacy to improve STEM learning and teaching.

Geoscience Teacher Training (GEO-Teach) — **$0** | **$3,000,000** | **$3,000,000**

The GEO-Teach program is designed to implement, at a national scale, effective teacher professional development and teacher training activities that will have transformative impact on the quality, scientific accuracy, and rigor of geoscience instruction.

Information Technology Experiences for Students and Teachers (ITEST) — **$0** | **$20,000,000** | **$25,000,000**

Initiated in response to the American Competitiveness in the 21st Century Act of 2000, the ITEST program provides opportunities for students and teachers (grades 7-12) to learn about, experience, and use information technology (IT) in the context of STEM education. To achieve its goals, this K-12 pathways program forges collaborations among higher education, museums, science centers, industry, and middle and secondary schools.

Youth-Based Projects provide students with intensive summer and academic year follow-up opportunities, allowing participants to meet and work with scientists and STEM professionals, gain in-depth exploration of content, and obtain guidance on college preparation. Comprehensive Projects provide STEM teachers with year-round professional development in IT concepts, skills, applications, and strategies that promote inquiry and practice skills while providing summer laboratory experiences for students.

Math and Science Partnership (MSP) — **$79,060,000** | **$63,180,000** | **$46,000,000**

The MSP program at NSF has integrated the work of higher education with that of K-12 to strengthen and reform science and mathematics education. The MSP seeks to improve student outcomes in mathematics and science for all students, at all grade levels. As overall student achievement rises, MSP projects are expected to reduce achievement gaps in the mathematics and science performance of diverse student populations. The program emphasizes promising partnerships between institutions of higher education – especially their disciplinary faculty in mathematics, science and/or engineering – and local school districts, with other important stakeholders as supporting partners. NSF's MSP program is being consolidated with the MSP program at the Department of Education.

NSF Academies for Young Scientists (NSFAYS) — **$0** | **$14,000,000** | **$0**

The NSFAYS program supports highly innovative projects that expose students to innovative out-of-school time (OST) learning experiences that demonstrate effective synergies with in-school curricula, and take full advantage of the special attributes of each educational setting in synergistic ways. Projects structure highly motivational experiences for students while providing essential STEM preparation. Professional development for classroom teachers and OST education providers are critical to the success of NSFAYS Projects. The portfolio of NSFAYS Projects is intended to explore a variety of implementation models in urban, rural and suburban settings representing diverse student populations. This portfolio of projects, taken as a whole, informs NSF and the broader educational community of what works and what does not, for whom, in what settings. One NSFAYS Research and Evaluation Center will be funded to provide research and evaluation support for the NSFAYS program. It is anticipated that the Center will synthesize research emerging from the funded NSFAYS Projects and have responsibility for national dissemination of program models, findings, and best practices for attracting K-8 students to, prepare them for, and retain them in science, technology, engineering, and mathematics (STEM) disciplines, leading to an increase in the pool of students continuing in STEM coursework in high school and considering careers in STEM fields.

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National Science Foundation

Research and Evaluation on Education in Science and Engineering (REESE) — **$59,360,000** | **$48,060,000** | **$42,000,000**

The REESE program supports basic and applied research and evaluation that enhances STEM learning and teaching. It supports two types of research – synthesis studies and empirical proposals. Synthesis studies identify areas where the knowledge base in either evaluation or research is sufficiently robust to support strong scientific claims, identify areas important to education research and practice, and propose rigorous methods for synthesizing findings and drawing conclusions. Empirical proposals identify areas that have the potential for advancing discovery and innovation at the frontiers of STEM learning.

Undergraduate Programs:

Advanced Technological Education (ATE) — **$44,480,000** | **$44,930,000** | **$46,500,000**

With an emphasis on two-year colleges, the ATE program focuses on the education of technicians for the high-technology fields that drive our nation's economy. The program involves partnerships between academic institutions and employers to promote improvement in the education of science and engineering technicians at the undergraduate and secondary levels.

Broadening Participation in Computing (BPC) — **$3,700,000** | **$14,000,000** | **$14,000,000**

The BPC program aims to significantly increase the number of U.S. citizens and permanent residents receiving post secondary degrees in the computing disciplines. Initially, its emphasis will be on students from communities with longstanding underrepresentation in computing: women, persons with disabilities, and minorities. Included minority groups are African Americans, Hispanics, American Indians, Alaska Natives, Native Hawaiians, and Pacific Islanders. While these efforts focus on underrepresented groups, it is expected that the resulting types of interventions will improve research and education opportunities for all students in computing.

CISE Pathways to Revitalized Undergraduate Computing Education (CPATH) — **$0** | **$3,000,000** | **$6,000,000**

Initial projects funded through IWEI program will focus on planning activities, small group pilot activities and large team or multi-institutional curricular and organizational models addressing campus-wide integration of IT education and research and the design of computing curricula that reflect the integrative nature of IT. Later program activities will promote the best of the pilot models resulting from 2007 funding.

Course, Curriculum and Laboratory Improvement (CCLI) — **$41,080,000** | **$35,930,000** | **$34,000,000**

The CCLI program seeks to improve the quality of science, technology, engineering, and mathematics (STEM) education for all undergraduate students. It does this by supporting individual projects at a full range of institutions of higher education, in a full range of STEM disciplines. The program seeks to stimulate, disseminate, and institutionalize innovative and effective developments in undergraduate STEM education through the introduction of new content reflecting cutting edge developments in STEM fields, the production of knowledge about learning, and the improvement of educational practice. The program supports three types of projects representing three different phases of development, ranging from small exploratory investigations to large comprehensive projects.

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National Science Foundation

Cyberinfrastructure Training, Education, Advancement, and Mentoring for Our 21st Century Workforce (CI-TEAM) — $5,510,000 | $10,000,000 | $10,000,000

The CI-TEAM program supports Demonstration and Implementation Projects aimed at positioning the national science and engineering community to more effectively engage in national and global research and education activities that promote and leverage cyberinfrastructure. CI-TEAM awards will:

- Prepare current and future generations of scientists, engineers, and educators to use, support, deploy, develop, and design cyberinfrastructure; and
- Foster inclusion in cyberinfrastructure activities, of diverse groups of people and organizations, with particular emphasis on traditionally underrepresented groups.

Engineering Education Reform (EER) — $12,080,000 | $14,950,000 | $13,020,000

The EER program supports research that contributes to our basic understanding of how students learn engineering and promotes significant breakthroughs in understanding so that our undergraduate and graduate engineering education can be transformed to meet the needs of the changing economy and society.

Federal Cyber Service: Scholarship for Service/Cybercorps (SFS) — $13,660,000 | $10,300,000 | $11,000,000

The SFS program supports scholarships and capacity building activities designed to recruit, retain and graduate increased numbers of students at the undergraduate and graduate levels in the field of cyber security.

Historically Black Colleges and Universities Undergraduate Program (HBCU-UP) — $25,280,000 | $25,180,000 | $30,000,000

HBCU-UP supports a wide range of activities that will increase the quality of STEM education, increase participation and success in undergraduate STEM programs, and increase access to undergraduate STEM research opportunities. The overall efforts address the HBCU's institutional STEM needs, long-term goals, and mission. Activities may include course and curriculum development, revision, and enhancement; undergraduate student support servicies, academic success, and educational enrichment; and faculty development.

Interdisciplinary Training for Undergraduates in Biological and Mathematical Sciences (UBM) — $3,850,000 | $3,500,000 | $3,300,000

The UBM program aims to broaden undergraduate research experiences and enhance capacity for, infrastructure in support of, and commitment to excellence in undergraduate education.

Louis Stokes Alliances for Minority Participation (LSAMP) — $35,610,000 | $35,000,000 | $40,000,000

The LSAMP program is a multi-disciplinary comprehensive program designed to increase substantially the quality and quantity of students receiving baccalaureate degrees in STEM fields and well prepared for either doctoral study or professional practice in STEM fields normally supported by NSF. LSAMP encourages the formation of alliances among leaders throughout academia, government, industry, and other organizations. The LSAMP program supports comprehensive attention to those processes and factors that promote baccalaureate attainment, preparation for graduate study, and preparation for successful careers by students within alliances. These alliances may include partners drawn from among two- and four-year higher education institutions, businesses and industries, national research laboratories, local, state, and Federal agencies. LSAMP provides financial assistance to many of its participants. Distinguishing it from traditional scholarship programs, LSAMP takes a multidisciplinary approach to student development and retention, creating partnerships among colleges, universities, national research laboratories, business and industry, and other federal agencies in order to accomplish its goals. Hands-on research experiences and mentoring to build student interest in STEM are LSAMP's other key characteristics.

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Agency/Program Name	FY 2005 Funding	FY 2006 Funding	FY 2007 Pres. Bud.

National Science Foundation

Opportunities for Enhancement of Diversity in the Geosciences (OEDG) — **$4,890,000** | **$4,600,000** | **$4,600,000**

The OEDG program provides targeted education, research, and mentoring activities that will increase the number of members of underrepresented groups involved in formal pre-college and informal geoscience education programs, pursuing undergraduate and advanced degrees in the geosciences, and entering geoscience careers.

Research Experiences for Undergraduates (REU) Sites — **$35,870,000** | **$34,730,000** | **$35,640,000**

The REU program supports active research participation by undergraduate students in any of the areas of research funded by the National Science Foundation. REU projects involve students in meaningful ways in ongoing research programs or in research projects designed especially for the purpose. REU Sites initiate and conduct projects that engage a number of students in research. REU Sites may be based in a single discipline or academic department, or on interdisciplinary or multi-department research opportunities with a coherent intellectual theme. Some REU Sites also have an international dimension. (A partnership with the Department of Defense supports REU Sites in DoD-relevant research areas.)

Research in Disabilities Education (RDE) — **$5,040,000** | **$5,110,000** | **$6,000,000**

The RDE program supports efforts to increase the participation and achievement of persons with disabilities in science, technology, engineering, and mathematics (STEM) education and careers. Meritorious projects from a diversity of institutions are supported via the RDE Demonstration, Enrichment, and Information Dissemination (RDE-DEI) program track. Promising research efforts are also further developed via awards under the Focused-Research Initiatives (RDE-FRI) program track. In the third program track, broadly applicable methods and products are disseminated for widespread use, commercialization, or inclusion in the activities of program-sponsored Regional Alliances for persons with disabilities in STEM education (RDE-RAD). RDE Alliances serve to inform the public, government, and industry about proven-good practices in the classroom, promote broader awareness of disabilities issues, and define specific areas of accessibility and human learning in need of further attention by educators and the research community.

Research on Gender in Science and Engineering (GSE) — **$9,900,000** | **$9,680,000** | **$11,000,000**

The GSE program seeks to broaden the participation of girls and women in all fields of science, technology, engineering, and mathematics (STEM) education by supporting research, dissemination of research, and integration of proven good practices in education that will lead to a larger and more diverse domestic science and engineering workforce. Typical projects will contribute to the knowledge base addressing gender-related differences in learning and in the educational experiences that affect student interest, performance, and choice of careers; and how pedagogical approaches and teaching styles, curriculum, student services, and institutional culture contribute to causing or closing gender gaps that persist in certain fields. Projects will disseminate and apply findings, evaluation results, and proven good practices. The Research on Gender in Science and Engineering program has been funding these objectives since 1993, under the prior names "Program for Women and Girls" (PWG), "Program for Gender Equity in Science, Mathematics, Engineering and Technology" (PGE), and "Gender Diversity in STEM Education" (GDSE).

Robert Noyce Scholarship Program (NOYCE) — **$7,570,000** | **$8,770,000** | **$10,000,000**

This program seeks to encourage talented science, technology, engineering, and mathematics majors and professionals to become K-12 mathematics and science teachers. It provides funds to institutions of higher education to support scholarships, stipends, and programs for students who commit to teaching in high need K-12 school districts.

Scholarships in Science, Technology, Engineering and Mathematics (S-STEM) — **$540,000** | **$50,000,000** | **$75,000,000**

Building upon the successes of its predecessor program, the H-1B visa fee-funded Computer Science, Engineering, and Mathematics Scholarships (CSEMS) program, the S-STEM program -- renamed in FY 2006 to account for its expanded disciplinary eligibility -- makes grants to institutions of higher education to support scholarships for academically talented, financially needy students, enabling them to enter the workforce following completion of an associate, baccalaureate, or graduate level degree in science and engineering disciplines. Grantee institutions are responsible for selecting scholarship recipients, reporting demographic information about student scholars, and managing the S-STEM project at the institution.

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National Science Foundation

STEM Talent Expansion Program (STEP) **$24,530,000** **$25,570,000** **$26,500,000**

This program provides funding to institutions for projects at eligible institutions of higher education for a diverse set of activities including funding initiatives for undergraduate students. STEP has supported two types of projects – those aimed at implementing strategies that will lead to an increase in the number of students obtaining STEM degrees (Type 1) and those that conduct educational research on degree attainment in STEM (Type 2).

Tribal Colleges and Universities Program (TCUP) **$9,180,000** **$9,270,000** **$12,850,000**

TCUP promotes sustainable improvement of undergraduate science, technology, engineering and mathematics (STEM) instructional and outreach programs, with an emphasis on the expansion of course and degree offerings, undergraduate research opportunities, and the use of information technologies at Tribal Colleges and Universities, Alaskan Native-serving institutions and Native Hawaiian-serving institutions. Support is available for the implementation of comprehensive institutional approaches to strengthen STEM teaching and learning in ways that improve access to, retention within, and graduation from STEM disciplines, and bridge the digital divide.

Undergraduate Mentoring in Environmental Biology (UMEB) **$500,000** **$3,000,000** **$5,000,000**

The UMEB program is designed to enable institutions to create programs that will encourage undergraduate students, especially those from underrepresented groups, to pursue a career in environmental biology.

Undergraduate Research Collaboratives (URC) **$1,960,000** **$3,860,000** **$3,470,000**

The URC program develops new models and partnerships between research universities, 4-year colleges and 2-year colleges with the potential to expand the reach of undergraduate research to include first- and second-year college students, to broaden participation, and increase diversity in the student talent pool from which the nations's future technical workforce will be drawn and to enhance the research capacity, infrastructure and culture of participating institutions.

Graduate/Postgraduate Programs:

Alliances for Graduate Education and the Professoriate (AGEP) **$15,000,000** **$14,500,000** **$19,000,000**

The AGEP program supports the establishment of alliances of colleges and universities to develop and implement innovative models for recruiting, mentoring, and retaining minority students in STEM doctoral programs. Alliances participating in this program are expected to engage in comprehensive institutional cultural changes that will lead to sustained increases in the conferral of STEM doctoral degrees, significantly exceeding historic levels of performance.

Graduate Research Fellowships (GRF) **$95,940,000** **$93,360,000** **$96,630,000**

The GRF program is one of the nation’s pre-eminent predoctoral fellowship programs in STEM fields. It is the oldest and largest STEM graduate program in the U.S. The program awards fellowships for graduate study leading to research-based masters or doctoral degrees. GRF provides fellows with three years of support within a five-year period, which may be used at an institution in the United States or abroad. The fellowships are intended for individuals in the early stages of their graduate study. All applicants are expected to have adequate preparation to begin graduate level study and research by summer or fall of the following year. Applicants must provide detailed profiles of individual interests, relevant educational and research experiences, and plans for graduate education.

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National Science Foundation

Graduate Teaching Fellows in K-12 Education (GK-12) — **$49,430,000** | **$50,650,000** | **$55,860,000**

The GK-12 program provides funding to graduate students in NSF-supported science, technology, engineering, and mathematics (STEM) disciplines to acquire additional skills that will broadly prepare them for professional and scientific careers in the 21st century. Through interactions with teachers in K-12 schools, graduate students can improve communication and teaching skills while enriching STEM instruction in K-12 schools. Through this experience graduate students can gain a deeper understanding of their own scientific research. In addition, the GK-12 program provides institutions of higher education with an opportunity to make a permanent change in their graduate programs by incorporating GK-12 like activities in the training of their STEM graduate students.

Integrative Graduate Education and Research Traineeship Program (IGERT) — **$67,590,000** | **$65,420,000** | **$67,400,000**

The IGERT program has been developed to meet the challenges of educating U.S. Ph.D. scientists and engineers who will pursue careers in research and education, with the interdisciplinary backgrounds, deep knowledge in chosen disciplines, and technical, professional, and personal skills to become, in their own careers, leaders and creative agents for change.

Post-Doctoral Fellowship Programs (PFP) — **$16,630,000** | **$17,720,000** | **$16,050,000**

Post-doctoral Fellowship Programs (PFP) are comprised of eight efforts across five directorates that provide individual postdoctoral fellowships to support training and research in areas supported by NSF. PFPs provide an opportunity for highly qualified investigators to carry out an integrated program of independent study. Their projects enhance research capacity and infrastructure, contribute to workforce development and job creation, thereby furthering NSF's goal of creating a diverse, competitive, and globally-engaged U.S. workforce of scientists, engineers, technologists and well-prepared citizens. PFPs recognize young investigators of significant potential, and provide them with experience in research and education that will establish them in positions of distinction and leadership in the community.

Vertical Integration of Research and Education in the Mathematical Sciences (VIGRE) — **$23,560,000** | **$17,530,000** | **$18,030,000**

The long-range goal of the EMSW21 program is to increase the number of well-prepared U.S. citizens, nationals, and permanent residents who pursue careers in the mathematical sciences and in other NSF-supported disciplines. EMSW21 attempts to accomplish this goal through three separate components: The Vertical Integration of Research and Education (VIGRE) program supports activities that involve the entire department and span the entire spectrum of educational levels from undergraduates through postdoctoral associates; Research Training Groups (RTG) support the training activities of a group of faculty who have a common research interest; Mentoring through Critical Transition Points (MCTP) involves a larger group of faculty but focuses on specified stages in the professional development of the trainees. The (VIGRE) component focuses on enhancing the educational experience of all students and postdoctoral associates in a department (or departments).

Outreach and Informal Education Programs:

Centers for Ocean Science Education Excellence (COSEE) — **$4,530,000** | **$4,530,000** | **$4,000,000**

The COSEE program supports a network of coordinated regional centers that facilitate collaborations and communications between ocean science researchers and educators, in both formal and informal settings.

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National Science Foundation			
Excellence Awards in Science and Engineering (EASE)	**$5,480,000**	**$4,370,000**	**$6,800,000**
EASE is a new program that is a combination of three existing programs designed to recognize excellence by teachers, scholars and organizations: • The Distinguished Teacher's Scholars (DTS) program was established in FY 2001. Awards are made to distinguished faculty for substantive research in their fields and the integration of research and education in their scholarly work at K-16 level. • The Presidential Awards for Excellence in Mathematics and Science Teaching (PAEMST) program was established in 1983 by the White House. Up to 108 awards are made available to individual teachers annually. • The Presidential Awards for Excellence in Science, Mathematics and Engineering Mentoring (PAESMEM) was established in 1996 by the White House for highlighting the importance of role models and mentors in the academic, professional and personal development of students from K-12 through graduate levels who are from groups underrepresented in STEM.			
Informal Science Education (ISE)	**$62,750,000**	**$62,700,000**	**$66,000,000**
The ISE program is a primary source of funding in the U.S. for promoting public interest, understanding, and engagement in science, technology, engineering, and mathematics (STEM) through voluntary, self-directed, and lifelong learning opportunities. The ISE program promotes public engagement with and understanding of STEM through such means as exhibitions, media projects, and educational programs, such as citizen science. ISE projects advance the frontiers of informal science education while reaching audiences of all ages and backgrounds across the nation in museums, theaters, community centers, the home (e.g., TV, radio, web), and other settings, including outdoor environments.			
Total, National Science Foundation	**$878,250,000**	**$923,760,000**	**$970,650,000**
Total, ACC Program Funding	**$2,814,418,419**	**$3,115,040,568**	**$3,473,886,648**

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